S. HRG. 103-976

COMMERCIAL IMAGERY

HEARING

BEFORE THE

SELECT COMMITTEE ON INTELLIGENCE

OF THE

UNITED STATES SENATE

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

ON

COMMERCIAL IMAGERY

NOVEMBER 17, 1993

Printed for the use of the Select Committee on Intelligence

U.S. GOVERNMENT PRINTING OFFICE

84-837 WASHINGTON : 1995

For sale by the U.S. Government Printing Office
Superintendent of Documents, Congressional Sales Office, Washington, DC 20402
ISBN 0-16-046800-0

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[Established by S. Res. 400, 94th Cong., 2d Sess.]

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COMMERCIAL IMAGERY

WEDNESDAY, NOVEMBER 17, 1993

U.S. SENATE,
SELECT COMMITTEE ON INTELLIGENCE,
Washington, DC.

The Select Committee met, pursuant to notice, at 11:25 o'clock a.m., in room SH–216, Hart Senate Office Building, the Honorable Dennis DeConcini, Chairman of the Committee, presiding.

Present: Senators DeConcini, Kerrey of Nebraska, and Warner.

Also Present: Norman Bradley, Staff Director; David Addington, Minority Staff Director/Counsel; Britt Snider, Chief Counsel; and Kathleen McGhee, Chief Clerk.

Chairman DECONCINI. The Select Committee on Intelligence will come to order.

Senator Warner is on the Floor with the Conference Report on the DOD Authorization bill and will be here later, as will other Members. I apologize to the witnesses for holding you up because of our schedule, but there is nothing I could do about it. We had six votes in a row.

The Committee this morning takes up a topic of great importance not only to the Intelligence Community, but also to the nation's future as a leader in high technology. Our goal today is to learn what the U.S. government can do to open up to U.S. corporations the global market for imagery and image systems while continuing to keep U.S. intelligence methods both secure and of the world's finest.

It is not easy holding a hearing on this topic in open session, but I felt it imperative because of the importance of the issue. What we discuss today will be nonclassified and will in no way get into intelligence sources and methods. I ask our witnesses and Members to remember that this is an opening hearing and to be extra careful to avoid straying into classified areas. If we need to move into closed session, we of course are prepared to do so.

Since our closed hearing in June several things have happened to keep our concerns high.

First, our government has issued no new licenses.

Second, we are informed that a major potential foreign customer is growing very weary of the lack of movement by our government and is entertaining offers from other competitive sources.

Third, LADSAT, 6, which had been the major new American entry in the market was lost in the launch process, and the French and Indians are reportedly scrambling to get that satellite's customers.

Fourth, we note press reports that the Administration is considering declassifying intelligence imagery and selling it commercially.

Fifth, we have heard reports which we hope to either confirm or put to rest today that the Administration is considering a French proposal to agree to a common commercial imagery standard.

Finally, we are told that the government may seek to sell imagery from its governmental owned intelligence satellites or even enter into government joint ventures.

Today I want to welcome the panelists and thank them for being with us today. The first panel will be composed of: Mr. Peter Teets, President of Martin Marietta Space Group; Mr. James Frey, President of Litton Itek; and Mr. Sam Araki, Executive Vice President of Lockheed Missile and Space Company; and Ms. Robin Armani, Director of Vitro-SAAS, an American owned firm doing imagery business in Europe.

Does Senator Kerrey have an opening statement?

Senator KERREY of Nebraska. Mr. Chairman, I could probably hold. I know that you have to leave and maybe it would be best to——

Chairman DECONCINI. Go ahead if you want to make a statement, Senator.

Senator KERREY of Nebraska. I do have a short statement I would like to make.

Chairman DECONCINI. Go ahead.

Senator KERREY of Nebraska. First of all, I appreciate you holding the first hearing, and I even more appreciate the fact that you and Senator Warner agreed to do an open hearing. I apologize to the witnesses, you probably already did. We're in a series of votes that has caused the attendance at this hearing to be less than certainly the interest on the Committee would reflect.

Let me say at the start, the principal concern we have is protecting our intelligence capacity, and that has to be our primary mission. So it seems to me that what we are trying to discover in the process of this hearing is how do we protect that capacity. We understand that we protect it with secrecy. There is a need to protect that capacity with secrecy from interests which could use that capacity against us. But we also protect that capacity with competition. That is, by permitting our technologically advanced industries to compete in the global marketplace and thereby to maintain the cash flow and the research and development base they need to stay at the forefront.

The companies who are represented here today and many others like them are really a service industry. They are accustomed to serving a very small number of government customers. This hearing indicates that they and we are conscious of a far larger potential customer base for their product and the other products that help businesses and individuals make decisions.

With the end of the Cold War and the growth of global commercial competition we are able to make this conceptual leap that is so much more difficult than the technology itself. And I can't emphasize that enough, that the difficult problem it seems to me that we have as policymakers is making a conceptual leap, not the technological one. The technology is a lot easier in some ways to under-

stand than the kind of new world of intelligence gathering that we are in.

There's a number of issues as I see it. First, we have the question of what imagery and systems our government should permit to be sold to foreign and commercial customers. The government has the right to regulate this process, first because of the national security concern and second because taxpayer dollars develop these capabilities. Let us bear in mind today that we are talking about new uses for a public investment.

Second, this hearing is an opportunity to consider the uses of open source information because commercially available imagery is, by definition, an open source.

I would say that on Monday this week I visited a commercial firm in New York City that is not in the business of imagery, but it is in the business of trading foreign currencies. And I was extremely impressed, first of all, with the technology they deployed to try to make decisions about those kinds of investments. And I was struck once again by the value of this open source material. That is one of the things that we, in our effort to try to make policy decisions, are increasingly discovering: that very often an open source is a very valuable source of information, as opposed to the traditional closed source methods of gathering intelligence.

So I find listening to a small group of business people in New York City discussing various currencies in the world, I discover, A, a tremendous amount of technology being deployed, and B, a tremendous resource in a relatively short period of time of intelligence information.

Third, we as a Committee have a responsibility to consider how America can maintain its technological superiority in the imagery field. Clearly we can't afford to stop improving the capabilities that support our national security decisions. That's a critical problem for us. With budget pressures, there's a lot of pressure to stop, to simply say we've won the Cold War, lets' stop—the technological investments tend to be extremely expensive and as you all know, the budget pressure is quite large and that causes us very often to make decisions that aren't necessarily in the best interests of the nation's security.

This is probably the principal reason, though the idea of our advanced industries competing in the commercial market has such an appeal because it allow us to maintain that technological edge. If it can discover a way to protect our security it allows us a means to maintain our technological edge without having to subsidize the entire process with public money.

Mr. Chairman, I believe we are at the beginning of a process that will someday bring imagery and other forms of information not just to government decisionmaking, but to business decisionmakers, scientists, and others. Far more important to me, however, is the possibility that we could make a conceptual leap, which is a very difficult thing to do, I understand, and consider the possibility of serving 120 million customers who are citizens of America in the household. One of the things that troubles me about this whole proposition is the possibility that citizens who are struggling to make decisions may find themselves having to purchase imagery that they had previously created. And I am painfully aware myself of the dif-

ficulty in making decisions around here and how very often, when I need to make a decision my staff understands that I haven't got the time to read 500 pages of text, and so they very often present me with some kind of image to make that decision.

So Mr. Chairman, one of the things that I am considering as a conceptual change is could we not, as both a private sector and a public sector effort, use the technologies that we are about to hear about to serve the information needs of 120 million American households. That's 120 million customers who have to make very difficult decisions about policies that this country faces. And my view is the better their information, the more informed they are as individual citizens, the more likely that we'll make good decisions here in Washington, D.C.

So again, I appreciate, Mr. Chairman, your having this open hearing. I look forward to the witnesses' testimony.

Chairman DECONCINI. Thank you.

Senator, I ask if you would Chair this for a few minutes while I vacate, but Mr. Teets, you may proceed.

STATEMENT OF PETER B. TEETS, PRESIDENT, MARTIN MARIETTA SPACE GROUP

Mr. TEETS. Thank you, Mr. Chairman.

Well, it is a pleasure to be here this morning and have this opportunity to speak to the Committee. I represent Martin Marietta Corporation. I am President of Martin Marietta Space Group. And of course, Martin Marietta has been in the space business since its inception more than 30 years ago. I have spent my entire career on the space side of the business, and so it is from that perspective that I would offer a few remarks to you today.

I have prepared some testimony that has been provided to the Committee and I would just give you some very brief thoughts from that testimony.

Senator KERREY of Nebraska. Your entire statement will be included in the record. Please proceed.

[The prepared statement of Mr. Teets follows:]

TESTIMONY BY PETER B. TEETS, PRESIDENT, MARTIN MARIETTA SPACE GROUP

Mr. Chairman and members of the Committee, I am Peter B. Teets, president of Martin Marietta Space Group, and I thank you for the opportunity to appear before you to share our views on the commercial sale of medium resolution imagery.

Martin Marietta is a major provider of spacecraft and space-related technologies for both U.S. government and commercial uses. We have been part of the space program virtually from its beginning more than 30 years ago. And I would like to draw upon some of that expertise in making my remarks today.

Broadly speaking, Martin Marietta strongly supports the commercialization of space-derived information. As the defense budget continues to decline, defense contractors have been motivated to develop dual-use technologies that can serve both military and commercial objectives. Data gathered from satellites in space is an excellent example of potential dual-use applications.

Obviously, greater utilization of space data would aid firms such as my own that already have a presence in the market. But commercialization of space products would also help to stabilize the employment environment for some of our most capable employees, reducing the number of layoffs of highly skilled technicians, engineers and scientists, who would be essential to respond to future space ventures. In other words, I believe we need to develop new business today in order to ensure the continued viability of our nation's space efforts tomorrow.

As we all know, the space-derived data and technology base we would draw upon for commercialization already exists and could be put to work almost immediately.

For year, vast amounts of data on earth resources—for example, geological formations and crop conditions—have been compiled from earth observation satellites such as LANDSAT, and is currently being sold and distributed worldwide. Other space-derived data, from U.S. government sensors, would be very valuable to U.S. commercial interests in order to maintain our competitiveness around the world.

Much work in this field is already under way, including growing competition from a number of foreign government-industry consortia. The fact that we are here today is partially related to the competitive pressures of a market that is already developing, with an increasing number of interested government and civilian buyers.

Despite the historical leadership of the U.S. in space, these consortia have been quick to capitalize on the commercial opportunities. We believe our systems are more capable, and therefore our information is more valuable. So we certainly have a built-in competitive edge in this emerging marketplace, if we, as a nation, decide to exploit it.

The question really is: Does the government wish to allow private interests to exploit this competitive edge? And if so, under what conditions or limitations?

This is a question of the utmost gravity, with many implications for the future security of our country and the ability of U.S. firms to be competitive in the world marketplace. I would like to commend Director Woolsey and Deputy Defense Security Perry for the efforts they have made in loosening the restrictions on commercialization of U.S. technological expertise. These efforts and the leadership of the Committee, Mr. Chairman, have helped focus everyone's attention on the issue of commercialization of space-based information. Speaking strictly for Martin Marietta, we could operate quite well within the policy framework that has been suggested.

As this Committee explores this question further, you may wish to consider the experiences of EOSAT, a joint venture between Martin Marietta and the Hughes Aircraft Company. EOSAT dates back to 1984, when it was created to commercially market and distribute data generated by LANDSAT satellites.

EOSAT has been quite successful in fulfilling its mandate of commercializing remote sensed satellite data. It has a track record of selling to the commercial world, meeting the needs of a varied customer base, delivering the types of information desired, with timeliness and within a competitive fee structure. I would add that, as with virtually any commercial venture, improving the quality of the product available for sale—which is what we are, in effect, discussing today—would certainly enhance the marketability of remote sensed satellite data.

The capability exists to provide customers information that's as simple as "photos from space" or as complex as fully operational "turn-key" satellite systems. We today have both the satellite manufacturing capability for medium resolution images and the data sales and distribution network to market, on a worldwide basis, products and services of great commercial interest.

The basic facts we have learned from EOSAT are that this market does exist, it is growing, and the U.S. needs to move with all deliberate speed for we will begin losing customers to more aggressive, if less capable and less accountable, foreign competitors.

In order to allow U.S. companies to compete, what we need from our government are precise, definitive policies and procedures about what is releasable technology and what is not. Space information can be restricted or tailored in many different ways; what private companies need are clearly defined guidelines as what information we will make available and in what form. If so desired, we would be pleased to offer our resources and our expertise to work with the government in an appropriate partnership to develop these policies and procedures.

For emphasis, I would offer the following points describing Martin Marietta's views on the subject of commercializing space:

Commercialization of space-derived information offers an excellent, proven opportunity for dual-use technologies that could create jobs and somewhat ameliorate the decline in defense-related business for many firms, plus provide core technical competence for future U.S. space needs.

The market does exist, worldwide, for proven U.S. space products, but the foreign competition in this market is intense.

National security concerns regarding technologies and capabilities need to be defined in advance, not on an ad-hoc, decide-as-you-go basis, so that private companies can be assured of what services are marketable and to whom.

A clear, concise, and timely process must be established to allow U.S. firms to gain U.S. approval for worldwide market entry of the array of space-based products we have available today—and tomorrow.

Thank you again for the opportunity to join this discussion. I'd be happy to answer any questions you have now—or in any future venue.

Mr. TEETS. First, I would say that Martin Marietta strongly supports and endorses the idea of commercially using data that is acquired from space assets. The fact is that the dissemination on a commercial basis of space based collected information is a perfect example of dual use technology. All of us who are in the defense business and have been associated with defense activities for many years are certainly strained right now by the severe cuts in defense spending. And one perfect example of dual use technology would be the commercial exploitation of information gathered from space.

On the other hand, we fully recognize the need for going forward with a strong partnership with the United States government. We too recognize the need for national security information to be protected. And what we would be looking for from the government is a clear set of policy guidelines and procedures under which the government can be comfortable with our continuing to engage in the business of commercially selling data gathered from space.

And, I would say that there is a market there. As a matter of fact, the LANDSAT satellite, originally developed by NASA and which is currently in use today is an example of a satellite that collects information. Martin Marietta is a 50% owner of a joint venture company with Hughes Aircraft Company, a company known as EOSAT. We indeed do distribute commercially information gathered from the LANDSAT satellite.

As an example of that information, I would offer to the Committee a comparative image taken by LANDSAT which shows the St. Louis area taken in 1988, compared with an image taken in July of 1993. It shows the dramatic impact of the floods along the Mississippi River. I offer this image to the Committee just for your perusal, and I think it is an interesting illustration of just how dramatic images from space can be. Of course, LANDSAT takes images with about 30 meter resolution.

Now, another fact that I would mention is that this marketplace is going to be impacted by foreign competition. The Russians and the French both have capability in this area. There is capability from India as well. And I would urge, in closing, simply to say that we in the United States do have a technological edge for both the data and the satellite technology that collects that data. Going forward in partnership with the United States government is what we would like to do. What we need then is concise, clear procedure, technique and method for achieving authorization to proceed to compete successfully against those foreign competitors which will offer these services into the marketplace.

I appreciate the opportunity to make a few remarks this morning and be happy to answer questions at the right time. Thank you very much.

Senator KERREY of Nebraska. Thank you, Mr. Teets.

Mr. Frey.

STATEMENT OF JAMES H. FREY, PRESIDENT ITEK OPTICAL SYSTEMS, LITTON SYSTEMS, INC.

Mr. FREY. Okay, thank you.

I would like to thank you, Mr. Chairman and the Committee in general for having me back. I last appeared here on June 10th when I believe this Committee first met on this subject. At that

time I told you that we had come up with an initiative in my company some three to four years ago to offset the really devastating effect of declining defense procurement on this particular part of the defense industry. I mentioned at that time that one group of industry people that advised the community had done a survey that showed their had been a 50% decline in jobs in this industry since the late 1980's. Given that environment it is important for us in the industry to find a way to use our technology and save our jobs in a way that is consistent with the national interest.

We have been pushing and developing a concept for bringing one meter class imagery to the private sector, and we discussed that at length at the last hearing. Today I would like to talk about three things to update you on that subject. Number one is to update you on events that have happened in the commercial side of the marketplace since that time. The second is to talk to you about what progress or lack of progress that's been made in resolving the export policy issues. And the third is to address a topic that got very little discussion in the last hearing, and that is government competition with this emerging commercial sector.

Let me first talk about recent events in the commercial sector. On the day of the last hearing, Lockheed announced their interest and filed a license to form a commercial venture in this area. Their venture was called CRSS and they, I believe, still have a pending license before the government.

Since that time, my company, Litton Itek Optical Systems has joined with GDE Systems in San Diego, California, and Orbital Sciences Corporation to form an alliance to evaluate forming a separate company to exploit this area in the global marketplace. We think we have an outstanding team. Orbital Sciences is probably the leader in low cost launch services and a major player in low cost satellite busses.

We at Itek are experts at optical systems at GDE out in California is probably a leader in the ground systems that support this kind of activity. The young people we have working this initiative are truly excited about it. They are looking forward to providing raw imagery, imagery products, three dimensional maps, serving such industries as the environmental people, construction industry, foreign intelligence services and hopefully a broader sector of the information highway of the future that we hear so much about.

But we're talking about investments in that area of several hundreds of millions of dollars to deploy a private satellite system to service this community. The excitement and efforts of these people is being somewhat frustrated by the very difficult job of resolving two government policy issues, one resolving the export issues and the other the competition issues, and I will talk about each of those.

At the time of the last hearing or about at that time, the DCI announced an initiative which he said would allow the export of these types of products evaluated on a case by case basis. After that hearing, he asked his people to work with industry to come up with an implementation directive for that policy. And that process has proceeded I think in a very effective way.

He has worked with an industry advisory group chaired by Mr. Araki of Lockheed. That group has come up with a very positive

and I think constructive implementation directive. That directive includes recognition, and I quote, "that the overall interests of the Intelligence Community and the country are best served by a policy that aggressively supports and facilitates U.S. industrial sales in this market place." Again, this is a draft policy that has not been fully approved in government.

That policy or implementation directive also goes on to say that they will establish reasonable constraints on resolution for imagery, both visible, IR, and radar imagery. The constraints that they have come up with are completely acceptable to the industry and I think consistent with what would be available in a commercial market-place at a reasonable cost today. That implementation directive also recognizes that in a competitive world, whatever role the government undertakes to regulate this area has to be done in a timely way. We can't debate each of these cases for many years as we're now doing.

And finally, the directive establishes some criteria which I won't discuss in detail here, which are intended to protect U.S. security interests in the event that a global event comes up that would make these systems that we are selling a threat to the United States. I think an effective protective mechanism has been established.

But despite this progress—and I think we in industry really congratulate the government on the way that activity has been conducted—I sense that as it is coming to a close and the policy has been pretty much agreed to, that I sense a slowing down in that process as people begin to have second thoughts and new concerns about the whole change.

At this time there is still no date announced for releasing that implementation directive, nor is there any date announced for acting on the several export license applications that have been filed.

Let me now just jump briefly to government competition. Government competition has been discussed in three broad forms. One is an area we sometimes call burden sharing. It is the most threatening to a commercial venture because under this concept the government would offer for sale in real time, images collected by current U.S. assets or duplicates of those assets. There are many forms of this and I don't think it is fully defined. But one form may be the negotiation of many bilateral agreements with foreign countries where they could task these systems and receive the imagery back in real time.

One of the arguments for this approach said it would provide some funds to support the current infrastructure. I would argue, however, that this is not in the best overall national interest. First of all, it is almost certainly going to be the death knell to any kind of a commercial venture, unless there is some way to very tightly constrain how broadly this really higher resolution and more capable imagery will be disseminated.

Secondly, I think it is more of a threat to the sources and methods of the United States in a commercial venture because you would be working directly with the true sources and methods of this country.

I guess the third thing I wanted to say on burden sharing is I really question whether there is a market out there for even the

marginal costs for imagery collected by current U.S. systems. I am afraid that what would happen is we would gradually add to the orbital assets, add to the ground assets, add to the general infrastructure, and that if even the marginal costs of that effort were charged, I am not sure how much of a market there would be. The result may be to shift that cost to the taxpayer.

The second class of competition that has been discussed is declassification of old intelligence imagery. Just how much of a threat that is to a commercial activity depends on how old and how good it is. And I think there is a way that imagery collected in the past could be released to the general public for no charge in a way that would not threaten this industry. But I think the criteria for governing that ought to be discussed with those in the industry that are interested in investing in this area.

And the third area is LANDSAT. LANDSAT in the past has not—has been in a different resolution range than we are discussing here. They are at 10 and 30 meters, SPOT is at 10 meters resolution; we're talking one meter—typically, one to two meter.

But future LANDSAT programs and future French programs are moving the resolution capability towards what we are talking about. So I think in the long run we have got to consider where this country is going with its LANDSAT system in the same context that we discuss the commercialization of the field.

In general there are these three broad types of government competition—burden sharing, declassification of old imagery and LANDSAT. Until the government clarifies their intent in these three basic areas, I think it will be impossible for most commercial companies to consider the hundreds of millions of dollars investment that would be required to enter this field. So it is imperative that we get all those issues resolved.

The recommendations I have made here and that appear in the written testimony that I have submitted to this Committee are essentially the same as we made in June. Let me just briefly summarize them.

First, we think that the government should allow the sale of full satellite systems or products which provide resolution equal to that that's available on the world market from other sources or about to become available. We think that we should be allowed to sell these systems and products to any country that is generally in good standing with the U.S. and the world community.

We suspect that it would be wise to allow—in establishing these commercial relationships, to develop parallel government relationships so that the government could benefit from this, too. And we in industry support that.

We think that the regulation of this activity ought to be removed from the Munitions Control list and moved to the Commerce Department for control and controlled on their Commodity Control list.

We think it is very important that a policy be established that clearly defines the realm in which the government will compete with us in this industry, and if we don't do that, there will be no commercial industry.

And then finally, whatever structure we set up in government to regulate this area, it is very important at its core that it be capable

of being exercised in a timely way. You can't sell in competition with the French and the Russians if it is taking us two and three and four years to consider each case. I assume that won't be the case after we get by the first one.

Most importantly of all, I think it is very important that we now, after several years of debate, get all these issues resolved and let us in industry know what kind of playing field we can play on. The people at Litton Itek and the people at GDE Systems and the people at Orbital Sciences Corporation are very excited about what we are doing here. We are all thankful that the legislative people, I think, bring a unique perspective to this. We in industry certainly have some parochial views. We're trying to save our jobs and our technology. I think some of our friends in government have their own point of view that is unique and perhaps the legislative people could help bring us together.

Thank you very much.

Senator KERREY of Nebraska. Mr. Araki, for your information and for all the witnesses, unless there is objection, we will include all of your statements in the record.

[The prepared statement of Mr. Araki follows:]

PREPARED STATEMENT OF MR. SAM ARAKI, EXECUTIVE VICE PRESIDENT, LOCKHEED MISSILES AND SPACE COMPANY

Mr. Chairman, Vice Chairman, and distinguished members of the Committee, I appreciate the opportunity to be here today to review the status of Lockheed Missiles and Space Company's efforts in commercial remote sensing. The work and attention that the Chairman and Vice Chairman of this Committee have given to the issue of commercial remote sensing and its future have been very helpful to U.S. industry. Lockheed in particular is appreciative of all your efforts.

At your request, I will provide an update on the governmental approval process for Commercial Remote Sensing Satellites (CRSS), review commercial market requirements for one-meter resolution, and discuss the use of existing assets, unfair competition, and their impact on commercial remote sensing.

REGULATORY APPROVAL PROCESS UPDATE

As you know, when the President of Lockheed Missiles and Space Company, Mr. John McMahon, last testified before this Committee on June 10, 1993, he announced the submittal of an application to the Department of Commerce for an operating license for CRSS—a private remote sensing space system with one-meter resolution. On July 8, 1993, LMSC received confirmation from Commerce that our application for CRSS was considered substantially complete. In August, LMSC participated in a Commerce Department-chaired inter-agency review of the CRSS operating license application, which included participants from the intelligence community, Joint Chiefs of Staff, and the Departments of State and Defense.

Unfortunately, we received a letter from the Commerce Department on October 15, 1993, informing LMSC that final action on our application to operate a private remote sensing space system would not occur within the 120 days stipulated. The delay was attributed to a lack of completion of the consultation process between Commerce and the Departments of State and Defense. Specifically, the Commerce Department indicated that "the Department of State had requested [Commerce] postpone issuance of the license until the subject be considered by a soon-to-be-scheduled National Security Council Deputies Committee meeting." Since this notification, we have learned that the Department of Defense has notified Commerce of its approval subject to some anticipated conditions. However, we do not believe the Deputies meeting has yet been held.

Government Policy on Commercial Imagery

Following the SSCI hearing on June 10, 1993, the Intelligence Community and the NRO's Industrial Advisory Council (as chartered by the Director of Central Intelligence) met numerous times to define, draft, coordinate, and finalize a policy document establishing the performance and operational characteristics acceptable to the Intelligence Community for U.S. commercial satellite imaging. The Industrial

Advisory Council (IAC) fully participated in the preparation of this policy document in support of the NRO. The performance and operational characteristics specified in this document provide U.S. industry the policy guidelines to build and operate a one-meter resolution satellite remote sensing system, while protecting U.S. national security interests.

Considerable effort and time has been spent over the last four months by the IAC and Government officials working policy issues relating to the future of private remote sensing systems like Lockheed's CRSS. During this time, the Intelligence Community, and particularly the NRO, have been very forthcoming and receptive in considering Industry views and should be commended. The national security community, in general, is making substantive efforts to anticipate and respond to the changing environment in this post-cold war period.

International Interest in CRSS

International interest in CRSS has risen substantially over the last six months following the submittal of our application for a Commerce Department operating license. Last August, an international entity signed a letter of intent with LMSC to jointly study the market potential in their region for CRSS products and services. Consequently, LMSC submitted and recently received U.S. State Department approval of a Technology Assistance Agreement (TAA) between LMSC and the overseas entity regarding the joint study on CRSS.

In addition, we have received signed letters of intent from six commercial overseas entities proposing the same type of joint study. We have applied to the U.S. State Department for approval of Technology Assistance Agreements with each of the entities and look forward to prompt action on our submissions.

Approval of our first TAA on CRSS with an international entity will be widely seen as a positive step. However, companies in the U.S. and overseas are carefully watching the Department of Commerce operating license process for CRSS. They view the eventual decision, and potential license conditions, as a signal determining whether or not U.S. industry will be allowed by the U.S. Government to compete in the largest segment of the worldwide commercial remote sensing market.

International Affiliations and Export Controls

From Lockheed's perspective, regional international business partners (or anchor tenants) are vital in facilitating the worldwide collection and distribution of data. Several international entities appear interested in sharing the financial risks in establishing a commercial one-meter satellite. In return, they desire the ability to utilize the data produced by a system in their own regions for commercial and governmental activities,

As you know, the French are developing HELIOS, designed for a one-meter resolution capability, and the Russians are already selling data from existing security assets defuzed to 2-meter resolution. Mr. McMahon noted correctly in his testimony to you last June, "the question for the future is not whether there will be one-meter satellite imagery available commercially—it will happen—but rather will it be provided by U.S. companies or other foreign sources." Attempts by the U.S. Government to introduce new controls on the export of remote sensing data, or to establish additional export licensing requirements as part of operating licenses for commercial remote sensing systems like CRSS, will only secure an advantage for others in international competition.

We believe the U.S. Government's overall interests are best served by letting U.S. companies compete in the global one-meter satellite remote sensing market. By granting a license unincumbered by inappropriate and burdensome conditions, the U.S. Government will enable U.S. industry to take advantage of its technological leadership and entrepreneurial spirit, and thereby capture most of the world market. In addition, satellite systems operated and controlled by U.S. industry will enable the U.S. Government to maintain control of critical satellite imagery technologies and their use during crises.

Handicapping U.S. companies as they attempt to enter this market ensures that the Europeans and others (as mentioned earlier) will have a better opportunity to enter and continue to dominate the commercial remote sensing market with systems they control.

MEETING COMMERCIAL MARKET REQUIREMENTS

One of the most important market sectors for CRSS data is to support Geographic Information Systems. CRSS' one-meter resolution was selected by LMSC because it meets the market demands of Geographical Information Systems and others for quality digital maps. GIS is a management tool used by industry and governments to organize, analyze, and communicate vast amounts of information. All geographic

systems are based on digital maps. But comparing a GIS digital map to a paper map is like comparing a spacecraft to a paper airplane.

Maps have existed for centuries to aid navigation and as a way of staking claim to territory and defining ownership. But as society has grown more complex, the amount of geographic information applicable to environmental studies, demographics, city planning, taxation, etc., has rendered the old paper map staggeringly inefficient. In a big organization, paper data is scattered in many locations. Gathering information needed for management decisions is often impossible. Valuable information is lost or ignored. With a GIS, up-to-date information from every office is instantly available all over the organization. More importantly, the GIS allows management to assemble information easily to make decisions and ask sophisticated "what if" questions.

A GIS database is built upon a digital map in a standard reference scheme, called a base map. On top of this base map information is organized in layers. Each layer presents a different theme, such as land use, utility lines, property values, habitats, population demographics, and other themes. Geographic datal, shown as lines, are Vector Data. Images from a satellite or an aerial camera are Raster Data.

Up to 90 percent of all the information used by the public and private sectors is related to physical locations in the real world. A GIS organizes information by indexing it to locations on the base map. By selecting a map feature such as a property parcel, a GIS can access all the information relating to that location, including site photos. In a construction project, for example, the city permitting clerk can call up the property records and flag any utility easements. The planning department can review the design and any changes are instantly directed to all other departments for comments. Construction crews receive updated work orders and schematics created by a GIS. Costs are tracked efficiently. Information about this project and others is easily brought together to analyze trends and increase efficiency.

In Zambia, scientists are managing wildlife populations with the help of a Geographic Information System. In Europe, government agencies at every level use GIS to manage infrastructure, land use, utility maintenance, and the environment. In Asia, industries use GIS to manage and maintain facilities and evaluate marketing demographics. Governments and industry the world over are investing hundreds of millions of dollars each year in GIS systems.

In the United States, one of the real strengths of GIS is not just data management, but the ability to perform sophisticated analysis. Some are using GIS in analyzing the environmental impact of proposed hazardous waste landfill sites. In Nevada, Sierra Pacific Power is using GIS to determine the best route for new power lines, examining terrain, environmental concerns, land use, and analyzing the costs of alternative routes. GIS is used in the U.S. by national, state and local governments, utilities, railroads, and many industries, including petroleum, mining, construction, *and* agriculture, to name a few.

According to *Fortune Magazine* (see October 18, 1993, article attached):

"GIS is now on the verge of becoming one of the hottest business information tools. Companies as diverse as Cigna, Sears, Super Value, The Gap, and Isuzu, have adopted mapping as a down-to-earth way to interpret data that were previously available only in the form of numbingly complex printouts, spreadsheets, and charts.

"At Cigna, the giant insurer, a GIS helps salesmen pitch managed care plans to brokers * * * A broker might ask, for instance, what percentage of his client's employees will find at least two Cigna-affiliated doctors within eight miles of their home. Whereas the salesman formerly would have presented many pages of tabular data in response, he now provides the broker with maps showing the distribution of physicians and employees.

"So-called personal navigation systems are gradually making their way into cars. In Japan, over 22,000 drivers already use them. The systems, which combine an antenna, a CD–ROM player, and a computer built into the dash, display full-color maps that are updated as the car travels. If the driver gets hungry, the computer will direct them to the nearest restaurant. Japanese electronics companies may offer U.S. versions by the end of next year.

"GIS can even help you buy a house. A Seattle realtor linked via modem to the Puget Sound multiple-listing service can type in criteria * * * and display maps showing available homes in the suburb, complete with price tags. Zooming in on a particular neighborhood, the realtor can show how close a house is to schools, parks, and shopping malls. Geographic Information digital maps and systems are quickly becoming an important element of the Information Age."

Our own analysis, to date, agrees with the Fortune 500 assessment.

Current Map Construction Limitations

GIS users need vast amounts of geographic data about the physical world, known as digital spatial data. But there are problems with current data acquisition methods.

Building and maintaining the database is the largest cost of a geographic information system. Data is often entered manually by digitizing from paper maps, a slow process. Survey workers can enter data in the field. Aerial photos are often used, but it's costly and slow. Shooting, correcting distortions, and aligning photos to a map grid yields an orthophoto base map, but the process takes an average of four months. To create a digital map complete with vector data averages 18 months.

The use of GIS is growing on average 35% per year worldwide. In 1990, the worldwide market for *Geographic Information* products and services totaled $2 billion. It was recently reported that by the year 2000, the market is expected to quadruple—to $8 billion.

Impressive as this is, market growth is actually being hindered by three factors: the high cost of images, the excessive time required to produce high resolution aerial maps, and the poor resolution of existing satellite images. This pent-up demand provides an unprecedented opportunity.

The CRSS Design Targets Commercial Market Needs

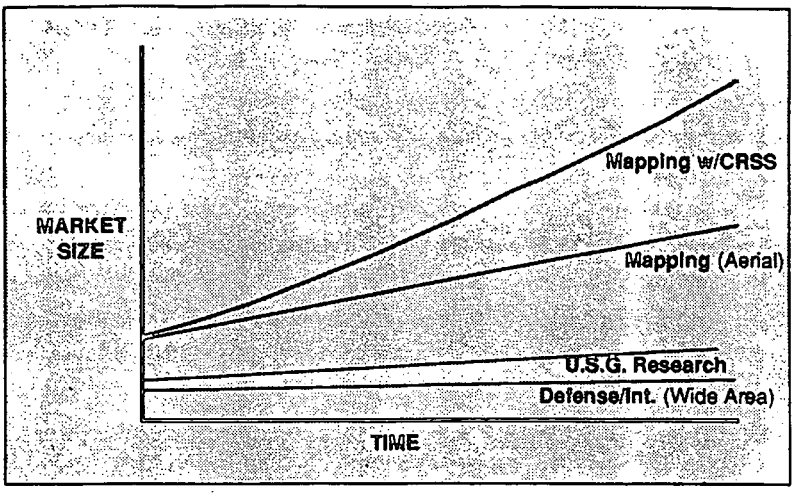
Today's commercially available satellite images can't precisely locate buildings, road boundaries, and cars for GIS users. Current satellites provide only 10-meter resolution, too coarse to be useful to many requiring precise geographic information. Many Geographic Information users require the clarity of one-meter resolution.

Consequently, LMSC has proposed a satellite with one-meter resolution that can fly 365 days a year, banking images and anticipating the market needs. CRSS has been structured to provide 24-hour turnaround—instead of the many months typical for aerial photography. With CRSS, Geographic Information markets can have easy, quick access to an enormous repository of data at lower cost. We believe that the current CRSS design provides LMSC with the best avenue to meet commercial market demands and ensure profitability.

The one-meter CRSS digital map increases the required data rate bandwidth several times over current Spot/Landsat imagery. The higher data rate distribution requirement integrates well with the fiber optics highway development data now underway.

The worldwide market for commercial Geographic Information data is growing, and will grow even faster when one-meter resolution satellite images and refined data are readily available at reasonable cost. Lockheed has realized this opportunity and moved to request Governmental approval for CRSS. We believe that CRSS can provide the critical imagery products and can be an important part of the Information Highway necessary for ensuring U.S. economic growth.

While we believe that a significant commercial market exists for CRSS and have designed the system to meet commercial market demands, we recognize that CRSS products (domestically and overseas) may also be sold and used for other than their intended purposes, e.g. support to foreign national security requirements. In the near term, this market for CRSS data may be significant. The conditions of the license require us to deny data to anyone if there is a risk to U.S. national security. However, CRSS' target market is commercial geographical information, because of its current size and potential for its unparalleled substantial growth.


MARKET
SIZE
Mapping w/CRSS
Mapping (Aerial)
U.S.G. Research
Defense/Int. (Wide Area)
TIME

UNFAIR COMPETITION

A recent news article indicated that the U.S. Government is considering the possibility of selling data from National Technical Means which would compete with aerospace companies involved in commercial remote sensing. If true, such a proposal would pose a serious impediment of CRSS and defense diversification in general. The proposals outlined in this news article ranged from concepts associated with burden-sharing to the actual selling of NTM data to commercial customers. While existing U.S. Government assets can provide the commercial market with imagery, it will not directly assist aerospace companies to retain key skills important to maintaining critical industrial base capabilities.

In general, the use of existing assets to support foreign governments should only occur in circumstances where mutual national security needs cannot be met in some other fashion from commercially available sources like CRSS. In addition, if data from existing assets are provided to foreign entities in return for monetary compensation, it should be priced based on recovering the full burden of the recurring costs associated with the assets, including operation and maintenance. This should avoid government competition and undermining of U.S. private sector efforts.

TRANSPARENCY

A bit of transparency (in openly publishing U.S. Government policies on commercial sales) can go a long way in eliminating uncertainties among potential customers, and provide a predictable and encouraging environment for commercial initiatives by U.S. companies.

DEFENSE DIVERSIFICATION

Over the last four years, due to defense cuts, LMSC has been forced to downsize from roughly 30,000 to 18,000 employees. We expect that with the federal government budget reductions we will be forced to reduce further. As we eliminate jobs, Lockheed (and the aerospace industry in general) is losing highly-skilled employees and a critical skill base, which the U.S. Government will need to meet future national security requirements.

In the case of Lockheed's commercial remote sensing efforts, if allowed to move forward, more than 700 jobs are estimated to be sustained (over a three-year period) at LMSC, and another 1,800 jobs distributed in the U.S. among all the team members working with us on the program. These jobs are not only important to Lockheed, but are also essential in maintaining the U.S. aerospace industrial base in general. In addition, our one-meter system holds the potential of expanding GIS market by at least $1 billion in annual sales. In terms of employment, these additional sales could generate roughly 30,000 new jobs for the U.S. economy.

SUMMARY

The growth of the Geographic Information market is an important untapped area in the new information age, we are now facing. CRSS digital maps can trigger a dramatic increase in GIS growth and use worldwide. It is a potential win/win situation for the United States where industry can move into new profitable commercial areas, while retaining those skills that will be helpful to U.S. Government needs in the future. We look forward to addressing this challenge through positive and constructive participation with the U.S. Government in charting a new course that will assist industry in diversifying into profitable commercial markets like GIS. This Administration, Congress, and industry can play key roles in fashioning policies and practices to foster these efforts.

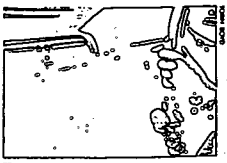
I welcome the opportunity to work with you in resolving any issues raised by Lockheed's efforts in commercial remote sensing and would be happy to answer any questions the Committee may have.

MAPPING FOR DOLLARS

Sick of staring at spreadsheets? Technology that lets you display and analyze data on computerized maps is becoming one of the hottest information tools on the business landscape. ☐ by Rick Tetzeli

SYLVANIA'S WAR ROOM
Sylvania marketer Frank St. Onge uses these lamps light up profits for retail-

WHEN Frank St. Onge, manager of marketing analysis for Osram/Sylvania, really wants to impress customers—the wholesalers who distribute his company's lamps, for instance—he brings them into the high-tech "War Room" at headquarters in Danvers, Massachusetts, dims the lights, and turns on the equipment. The room is designed for teleconferencing and state-of-the-art multimedia presentations, but what most lights up visitors are the maps—big computerized ones, rich with useful data, displayed on a six-foot color videoscreen. Says St. Onge: "We show them where are our competitors, where are the customers, and what areas of the country have the greatest sales potential, down to the block level. We show how many specialty lamps different hospitals in their region buy. Of course, we could give them the same data on reams of spreadsheets, but illustrating the information with a map is a much more powerful tool."

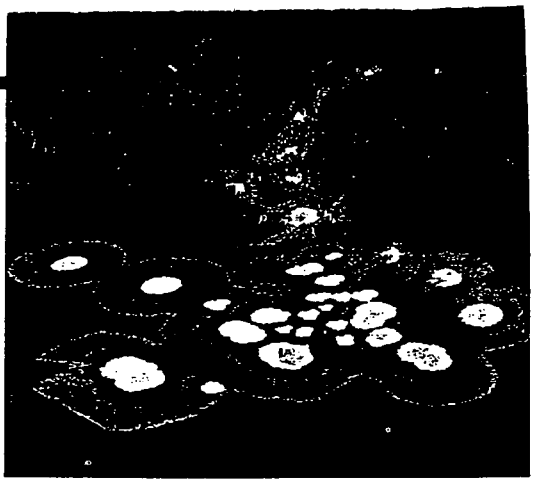


☐ Consumers in Japan now use electronic maps to navigate. For more, see box.

Behind this sensory approach to winning customers is a geographic information system (GIS), a computer setup that makes it possible to view and analyze data on digitized maps. GIS isn't new: Utilities, oil companies, and governments have long used such systems to plot transmission routes, manage natural resources, and track pollution; the technology already accounts for $2.1 billion a year in hardware, software, and consulting sales. But the cost of GIS has fallen so dramatically in recent years that GIS is now on the verge of becoming one of the hottest business information tools. Companies as diverse as Cigna, Sears, Super Valu, the Gap, and Isuzu have adopted mapping as a down-to-earth way to interpret data that were previously available only in the form of numbingly complex printouts, spreadsheets, and charts. Says Jack Dangermond, founder of ESRI, the Redlands, California, company that pioneered GIS technology using mainframe computers in the 1970s: "A map offers an intuitive way to organize things. People remember things about space that they don't about any other way of organizing information."

A GIS today typically consists of a demographic database, digitized maps, a computer, and software that enables the user to add corporate data to the mix. The cost of bringing together these elements has dropped from $125,000 per user in 1985 to around $35,000, according to John Antenucci, who heads a GIS consulting firm in Frankfort, Kentucky. That's largely because desktop computers have become powerful enough to manage and analyze the masses of data that mapping involves. A host of startup companies have emerged to offer low-cost, business-focused mapping data and software. Wessex of Winnetka, Illinois, sells a complete set of U.S. street maps and census information for $995; the old cost for similar data was over $50,000. Powerful GIS programs can be had for $2,500 or less from Strategic Mapping of Santa Clara, California; MapInfo of Troy, New York; and Tactics International of Andover, Massachusetts, which makes Tactician, the program Osram/Sylvania depends on.

For St. Onge, computer mapping is one of the best ways to take advantage of the



■ Up and out: PacTel's cellular signal fades as Interstate 80 climbs into the Sierra Nevada.

"source," as he calls the marketing database of the nation's No. 2 light-bulb maker (General Electric is No. 1). Like every corporate database, Sylvania's is loaded with geographic information, such as addresses of customers. St. Onge taps into the mainframe with a Hewlett-Packard 486 PC and two Apple Macintoshes equipped with a custom version of Tactician. He uses the system not just to woo distributors but also to support his sales staff. To persuade a store owner to allot shelf space to Sylvania lamps, for example, a sales rep will present a demographic map of the store's clientele within a ten-mile radius, along with information about their bulb-buying habits. Reps also get color-coded "hot-cold" maps of their territories, which highlight neighborhoods where lamp use is likely to be most intense.

While business programs account for only 6% of the $630-million-a-year market for GIS software, they are its hottest segment. Kathryn Hale, an analyst at Dataquest in San Jose, California, reports that purchases of marketing and sales mapping programs have more than tripled since 1990. She figures such spending will reach $200 million a year by 1997 as businesses increasingly turn to GIS to keep pace with competitors. How can you stay ahead of the trend? Here are some of the most successful and widespread uses of GIS:

■ **Site selection.** If your company is expanding, it is probably using GIS to plot new locations. Says Brady Foust, a consultant in Eau Claire, Wisconsin: "Stores succeed or fail because of location. Only GIS can tie together diverse locational information and make sense of it." Lately Foust has worked with an upscale clothing chain (he won't name it) that has stores in Eau Claire and Green Bay. Using Strategic Mapping's Atlas software, he analyzed sales data and showed on a map of central Wisconsin how each store drew most of its customers from within a 20-mile radius. Between the sites lay a wide swath where fewer than 15% of would-be customers visited either store. Foust's conclusion: A single new store in the town of Wausau would let the retailer sell effectively across the entire state.

Super Valu, the nation's largest supermarket wholesaler, bought Strategic Mapping software last April to help pick sites. Perry Harrison, director of market analysis, says his staff used to spread paper maps of prospective sites across a room and then painstakingly compare those with scrolls of demographic data. Now the information is concentrated on the screen of a Compaq 486. Says Harrison: "GIS frees up our analysts so they can actually analyze."

■ **Target marketing.** Western Auto, a Sears Roebuck subsidiary, uses Tactician on IBM PCs and Apple Macintoshes to choose store locations. But the real edge is gained in fine-tuning a new store's inventory. Integrating company data with information from market researchers like R.L. Polk, Western Auto creates a detailed demographic profile of the neighborhood. That lets the store tailor its offerings to, say, lower-middle-class do-it-yourselfers who prefer to fix their own brakes, or upscale types who mainly want polishes and accessories. Says Tom Swiontek, the Sears planning manager who helped develop the GIS: "We set up the right product mix right away and as a result build up the clientele much faster." It now takes six months for the average Western Auto outlet to break even on operating expenses, down from 18 months before the GIS.

American Isuzu runs a GIS from Strategic Mapping on AST Research 486 PCs to shape its marketing plans. This summer two Isuzu dealers in Yakima and Pasco, Washington, offered weekend-long test drives of Trooper, a luxury sport-utility vehicle. Director of strategic planning Mark Darling used the GIS to create a list of likely customers near the dealers. The response rate was 18%, high for a direct-mail campaign. Better yet, sales are up: The Pasco dealer, who had sold four Troopers in the first half of the year, sold four more in August alone.

■ **Sales support.** At Cigna, the giant insurer, a GIS helps salesmen pitch managed-care plans to brokers who buy health policies for corporations. A broker might ask, for instance, what percentage of his client's employees will find at least two Cigna-affiliated doctors within eight miles of their homes. Whereas the salesman formerly would have presented many pages of tabular data in response, he now provides the broker with maps showing the distribution of physicians and employees. The GIS, a $35,000 setup that includes Strategic Mapping software and a souped-up IBM PC, also performs statistical analysis, yielding such details as average distance from employee to provider. Marina Pye, a Cigna sales support supervisor until she left recently for another job, started offering the maps in early 1992. At first, she says, sales reps used maps only to embellish major presentations; now "they wish we could map 24 hours a day. Initially we did 15 cases per month, but now we're up over 100."

■ **Network analysis.** Whether your network consists of sales offices spread across a region or ambulance services in a city, GIS can find its weak spots. At PacTel, a sub-

sidiary of Pacific Telesis, director of network information technology Jerry Sprecher uses a high-powered GIS to display locations where the company's cellular signals peter out. The system, which runs on Sun Microsystems workstations, combines street maps, locations of cellular transmitters, and 3-D representations of local topography based on satellite data. It lets Sprecher show, for instance, where a subscriber driving up Interstate 80 into the Sierra Nevada will lose his connection—and where PacTel should put more transmitters.

☐ **Disaster management.** Insurance companies are finding that GIS helps them serve customers faster when disaster strikes. During Hurricane Andrew last year, ITT Hartford used MapInfo software to track the storm's attack on the Florida coastline. The company was able to determine which zip codes would be most affected, who it policyholders were in those areas, and how much in damages it might have to pay. The analysis helped it dispatch adjusters quickly to the hardest-hit neighborhoods.

☐ **Fleet management.** Yellow Freight Systems of Overland Park, Kansas, is one o

CLOSE ENCOUNTERS WITH COMPUTER MAPS

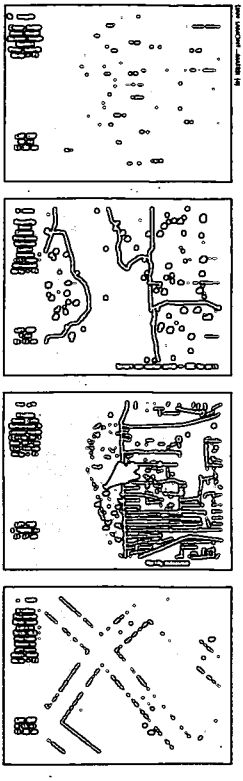
☐ You and your family are cruising down Interstate 64 in Kentucky. You've been promising your young son that you'll find someplace fun to stop, but you don't have any ideas, and he's starting to whine. You pull into a rest area, figuring you can look at that familiar map with the YOU ARE HERE splotch, pore over a bunch of brochures, and identify a nearby tourist trap that will interest the lad. Instead, fright of frights, you're faced with a video kiosk, and damned if its screen doesn't resemble—gulp—a computer!

Never fear, cyberphobes. Like an increasing number of GIS applications available to consumers, the five visitor kiosks being tested by the state of Kentucky are aimed at people like you. This one, for instance, lets you call up tourist attractions in four regions of the state. Touch "Keeneland" on the screen, and you get a video clip of racehorses, a voice-over explaining that visitors are welcome to early-morning workouts at the racetrack, and, best of all for the weary traveler, clear directions for getting there. More than 3,000 people a day use the kiosks, which were designed by PlanGraphics, a GIS consulting firm in Frankfort, Kentucky, and programmed by Applied Graphics of St. Paul. According to PlanGraphics President John Antenucci, drivers can expect such kiosks on the Massachusetts Turnpike next year.

For business travelers, Strategic Mapping's Local Expert software combines maps and tourist data on floppy disks for laptops. The program offers information on more than 100 cities around the world. Updated bimonthly, it features a selection of hotels and restaurants, useful tips such as where to change money, and listings of cultural and sporting events that will coincide with your trip. An August visitor to Rome, however, discovered that the program isn't so expert yet. It gave the correct phone number to call for tickets to *Tosca* at the Baths of Caracalla, but almost all of the 24 Italian restaurants listed were closed for much of the month. (Prices: $99 for the program with one city; $25 per additional city; $15 per update.)

So-called personal navigation systems are gradually making their way into cars. In Japan, some 22,000 drivers already use them. The systems, which combine an antenna, a CD-ROM player, and a computer built into the dash, display full-color maps that are updated as the car travels. If the driver gets hungry, the computer will direct him to the nearest restaurant. Price: $2,000 and up; Japanese electronics companies may offer U.S. versions by the end of next year.

GIS can even help you buy a house. A Seattle realtor linked via modem to the Puget Sound multiple-listing service can type in criteria such as "3BR, Kirkland area, $350,000 to $450,000" and pull up a map showing available homes in that suburb, complete with price tags. Zooming in on a particular neighborhood, the realtor can show how close a house is to schools, parks, and shopping malls. Gary McAvoy, CEO of Northwest GeoGrafx, which designed the system, says that by next fall realtors will be able to show house hunters photos of the properties on-screen. Eventually the system will include digitized videos, so prospective buyers can "walk" through houses in the realtor's office instead of driving all the way to Kirkland only to discover that that third bedroom is really a broom closet.



☐ **Homing in: Seattle realtors show prospective buyers a 50-mile-wide view of the region (top) before zooming in on Kirkland, a suburb. Houses for sale appear along with prices; red star marks the one that best fits the buyer's criteria.**

many transportation companies that depend on elaborate GIS setups to manage huge vehicle fleets. Yellow has a hub system like those run by airlines: operations planning coordinator Ken Peck needs a network of 31 Sun workstations equipped with ESRI software to keep track of 3,700 trucks traveling more than 640 million miles a year. Before the GIS was installed, the chore of defining delivery zones for each of 600 terminals was left to a secretary, who used a Rand McNally atlas and Magic Markers. Not surprisingly, scheduling was less than efficient. Peck's GIS does a better job, allowing for such factors as speed limits and the number of loading docks at terminals in determining the zones. The system lets Yellow supply customers with up-to-date maps that divide the U.S. into one-day, two-day, and other zones, and show how long a shipment will take.

■ **Laying it on: Map computer on tractor uses information from global positioning satellites to help farmer apply exactly the right dose of fertilizer.**

■ **Regulatory compliance.** Utilities and banks are natural users of GIS technology because laws govern the way they serve their regions. Norwest Corp., a Minneapolis bank with $48 billion in assets, is setting up a GIS intended, among other things, to help it obey the 1977 Community Reinvestment Act and other laws that prohibit racial discrimination in lending. Says Karen Alnes, director of community reinvestment programs: "We'll use the system to look at where our loan applications come from, where we are making our approvals and denials, and to identify patterns as required by law. It's a vast improvement over putting pins in a map, which is essentially what we've done up to now."

Consumer watchdog groups have already become sophisticated in using GIS to monitor mortgage lending. Essential Information, a nonprofit founded by Ralph Nader in 1979, recently used a system donated by ESRI to analyze government data on 1.3 million home purchase loan applications received by banks and mortgage companies in 16 cities. The resulting maps vividly show the difference between the behavior of most banks and that of mortgage companies less constrained by federal lending laws.

One set of maps, for example, superimposes the 1991 lending in Los Angeles by Sears Mortgage Corp. and Great Western Bank on a map of the city that has been highlighted to show minority neighborhoods. Instantly apparent: Lightly regulated Sears made far fewer loans in those neighborhoods than heavily regulated Great Western. While Sears's share of the home lending market in white neighborhoods was 4% in 1991, it held less than 0.3% of the loans made in minority neighborhoods. Great Western, on the other hand, had a share of 4.7% in white neighborhoods and fully 16.9% in minority neighborhoods.

ON THE HORIZON are potent new applications that marry computer maps with signals from global positioning satellites (GPS). The signals enable any vehicle equipped with a receiver to pinpoint its location as it moves. Eventually GIS and GPS could transform aviation and shipping—and even agriculture, if Donald Larson can realize his vision.

An Iowa farmer with technological know-how, Larson has worked with tractor manufacturers on a system that brings some scientific accuracy to the process of mixing and spreading chemical fertilizer. Traditionally, soil samples are dra from different locations in field, the results are averag and one mix of chemicals spread across the entire fie The problem is that soil qu ty varies, and not all parts o field should get the same dc of fertilizer.

The software unites a G receiver right on the trac with a Compaq PC showin computerized map of t field and its various types soil. As the tractor's positi is continually updated, t PC makes sure the rig amount of the fertilizer is d pensed. The system prin the field for maximum yi and reduces harmful run because low-producing ac don't get too much fertiliz Larson says Deere and ot tractor giants are "look into" the technology; A Chem, a Minnesota manuf turer, already sells a simila equipped tractor.

GIS is on its way to becoming a st dard business tool. Within the next cade, mapping software will almc certainly find its way onto your PC—a you probably won't even think of it a GIS when it arrives. Joe Francica, sen marketing manager at Intergraph, a le ing provider of high-end GIS prograr believes that maps will soon serve as an tegral part of other software, just spreadsheets do today: "If you look at s cessful personal finance programs li Quicken or Microsoft Money, the guts those programs are spreadsheets. As happened with spreadsheets, GIS will come an embedded technology." Mapp functions have already started to show embedded in database software sold companies such as OneSource Informat Services, a Lotus Development spin AST Research now includes mapping s ware with some of its machines.

The mapping industry recognizes trend. The editors of its newest trade m azine, which first appeared nine mon ago, rejected the idea of having the acronym anywhere in the title. Inste they opted for *Business Geographics*. more and more companies are discover business geographics is fast becomin business necessity.

STATEMENT OF M.S. ARAKI, EXECUTIVE VICE PRESIDENT, LOCKHEED MISSILES AND SPACE CORP.

Mr. ARAKI. Mr. Chairman and Vice Chairman, I appreciate the opportunity to be here today to review the status of Lockheed Missiles and Space Company's effort in commercial remote sensing. The work and the attention of the Chairman and Vice Chairman of this Committee have given to the issue of commercial remote sensing and its future have been very helpful to U.S. industry, and Lockheed in particular is very appreciative of your efforts.

At your request I will provide an update on the government's approval process for commercial remote sensing, CRSS; review the commercial market requirements for one meter resolution and discuss the use of existing assets, government competition, and their impact on commercial remote sensing.

In the interest of time, my remarks will be brief. I am prepared for more detailed remarks for the record if the Committee so pleases to have.

As you know, when the President of Lockheed Missiles and Space Company, Mr. John McMahon, last testified before this Committee on June 10, 1993, he announced the submittal of an application of the Department of Commerce for an operating license for CRSS, a private remote sensing space system with one meter resolution. On July 8, 1993, LMSC received confirmation from Commerce that our application for CRSS was considered substantially complete. In August, LMSC presented a briefing to the Commerce Department, which chaired the interagency review of the CRSS operating license application, which included participants from the Intelligence Community, the Joint Chiefs of Staff, and the Departments of State and Defense.

Unfortunately, we received a letter from the Commerce Department on October 15, 1993, informing LMSC that the final action on our application to operate private remote sensing space systems would not occur within the 120 days stipulated. The delay was attributed to lack of completion of consultation process between Commerce and the Department of State and Defense. Specifically, the Commerce Department indicated that the State Department had requested Commerce to postpone issuance of the license until the subject can be considered by a soon to be scheduled National Security Council Deputies Committee meeting. Since this notification, we have learned that the Department of State has notified Commerce of its approval subject to some anticipated conditions. However, the Deputies meeting has yet to be held.

Senator KERREY of Nebraska. You mean Department of Defense notified Commerce, or State?

Mr. ARAKI. The Department of Defense has provided their approval.

Following the SSCI hearing on June 10, 1993, the Intelligence Community and the NRO's Industrial Advisory Council, as chartered by the DCI, met numerous times to define, draft, coordinate and finalize a policy document—the same document that Mr. Frey mentioned in his testimony—and it established the performance and operations for aerial photography. With CRSS the Geographic Information Systems market can have easy, quick access to an enormous repository of data at lower cost. We believe that the cur-

rent CRSS design provides LMSC with the best avenue to meet the commercial market demands and ensure profitability.

While we believe that a significant commercial market exists for CRSS, and have designed a system to meet the commercial market demands, we recognize that CRSS products, both domestically and overseas, may be sold and used for other than their intended purpose, such as foreign national security requirements. In the near term, this market for CRSS data may be significant. The condition of the license requires us to deny data to anyone if there is a risk to U.S. national security. However, the CRSS target market is commercial geographical information, and because of its current size and potential for its unparalleled substantial growth.

A recent news article indicated that the U.S. government is considering the possibility of selling from national technical means, which could compete with aerospace companies involved in commercial remote sensing. If true, such a proposal could pose a serious impediment to CRSS and defense diversification in general. The proposals outlined in this article range from concepts associated with burden sharing to actual selling of NTM data to commercial customers. While existing U.S. assets can provide the commercial market with imagery, it will not directly assist aerospace companies to retain key skills important to maintaining critical industrial base capabilities.

In general, the use of existing assets to support foreign governments should only occur in circumstances where mutual national security needs cannot be met in any other fashion from commercially available sources. In addition, if data from existing assets are to provide national entities in return for monetary compensation, it should be priced based on recovering the full burden of the recurring costs. This should avoid government competition and undermining of U.S. private sector efforts.

A bit of transparency in openly publishing U.S. government policies on commercial sales can go a long way in eliminating uncertainty among potential customers, and provide a predictable and encouraging environment for commercial initiatives by U.S. companies.

Over the last four years, due to defense cuts, LMSC has been forced to downsize from approximately 30,000 to 18,000 employees, We expect that the Federal government budget reductions will force further reductions. As we eliminate jobs, LMSC as well as the aerospace industry in general is losing highly skilled employees and the critical skill base which the U.S. government will need to meet future national security requirements.

In the case of Lockheed's commercial remote sensing effort, it allows us to move forward with more than 700 jobs to be sustained over a three year period at LMSC, and another 1800 jobs distributed in the United States among all the team members working with us on the program. These jobs are not only important to Lockheed, but are also essential in maintaining U.S. industrial base in general. In addition, a one meter system holds the potential expanding the GIS market by at least $1 billion in annual sales. In terms of employment, these additional sales would generate approximately 30,000 new job in the U.S. economy.

In summary, the growth of the Geographic information market is a critical, important untapped area in the new information age that we are facing. CRSS digital maps can trigger a dramatic increase in GIS growth and use world wide. It is a potential win/win situation for the United States where industry can move into new profitable commercial areas, while retaining these skills that can be helpful to U.S. government for future use. This Administration, Congress, and industry can play a key role in fashioning policies and practices to foster these efforts.

I welcome the opportunity to work with you in resolving any of the issues raised by Lockheed's efforts in commercial remote sensing and would be happy to answer any questions that the Committee may have.

Thank you.

Senator KERREY of Nebraska. Thank you, Mr. Araki.

Ms. Armani.

[The prepared statement of Ms. Armani follows:]

STATEMENT BY ROBIN ARMANI, MANAGING DIRECTOR, VITRO-SAAS KFT

Thank-you Mr. Chairman and members of the Committee for the opportunity to present my views on Commercial Remote Sensing.

I am Robin Armani, Managing Director of Vitro-SAAS Kft, an American-Hungarian joint venture company engaged in software development, systems integration, and scientific application services in Hungary and the rest of Europe. My company is a member of the European Association of Remote Sensing Laboratories (EARSel). Vitro-SAAS uses remotely sensed data—data collected by satellites or aircraft-mounted sensors, including but not limited to commercial imagery, to support a variety of land management and environmental programs for customers in Europe. As you know, remotely sensed data can provide important and unique information over wide ares to support many different applications. In Hungary, the applications may be loosely gathered under an environmental umbrella, and include such applications as crop forecasting and forest assessment, as well as more advanced assessments of a number of important environmental situations, such as the changes caused by the Gabcikovo dam (the Bös-Nagymaros barrage system). For other European customers we are integrating new remote sensing resources, including Russian-developed synthetic aperture radar, to detect deep underground features. My associates and I have worked with several organizations in Hungary, Ukraine, and Russian for the past 3 years.

There is a growing and mature market for information derived from remotely-sensed data in Europe. Even in central Europe, where funding is severely constrained, the market for this information is growing because this data provides information that cannot otherwise be effectively observed or measured, and because this data is cost effective for a wide variety of applications. Naturally, in these resource-restricted countries, funding for such applications is limited, and "dual-use" is not a new phenomenon, but a fact of life. Time today will preclude review of the samples of products and applications I have brought with me today; however, I will review them with interested staff and am confident that the will report to you the breadth and technical excellence of these products produced by various European companies. I have been impressed by the advanced nature of the applications work in Hungary and Russia. These products match or exceed our best production capabilities today. This surprised me when I saw that many products, such as the 1987 topographic image map, and recent classifications and change detection applications (Atch 1), were produced during the COCOM era—a time when our own applications were as restricted as the technology we sought to protect. I will leave for the record several products courtesy of the Hungarian Remote Sensing Center, FÖMI, who produced them using PC technology and home-grown software that continues to support production. FÖMI is currently undergoing privatization, and is integrating western technology, including SUN workstations and new image processing software, provided to FÖMI this year by the European Space Agency (ESA).

Your letter of invitation asked for my views on the "market for commercial imagery," and posed many key questions that I will address in turn:

1. What do the commercial imagery customers want?

The customers want information—information they can use to solve problems or to support decisions: geographic information, geo-referenced information, often multi-temporal or time-sensitive information—for a variety of applications from resource use to environmental monitoring. The ability to integrate the many types of imagery with other information is becoming increasingly important, and the market is racing in this direction. Imagery, commercial or not, cloaked or not in secrecy or scientific jargon—provides a limited set of data that must be interpreted and integrated with other information to address the customers' information requirements. The different types of imagery under discussion today, multispectral, radar, and panchromatic or optical, provide different types of information, at different scales, for different applications. They are highly complementary, and do not directly compete for the same segment of the market.

The European market for environmental information to support resource (land use, water, agriculture, forestry) applications for sustainable development will continue to grow. Customers will continue to include nations, ministries, institutes, and industries with myriad resource management requirements. Applications for the countries engaged in nation building (not just developing countries but much of central and Eastern Europe, who are coping with severe resource constraints and serious environmental burdens) will increase, as will the market serving the fast growing industries engaged in environmental monitoring, assessment and remediation planning. As funds become more restricted, the customers will choose the imagery or data that gives them the most information for their money—an integrated product developed from a complex data set at a price they can afford.

My view is that the market will be dominated by the companies who do not get overly focused on the data, or imagery; the market will be dominated by the companies (whether they are imagery suppliers or not) that focus on and satisfy the customers' information requirements. These information requirements are best served by the effective integration of the abundance of data types available today using advanced, but affordable technology. The direction of this technology is to bypass or at least bridge, the current gaps between the different technology areas, in particular, the artificial separation that exists today between image processing and geographic information systems. Data integration will realize the full synergy of the optical, multispectral and radar data. Those of us in the application community know well the power of integrating multispectral and optical data—but today, few in Europe or the U.S. have begun to integrate radar and optical data, much less more complex data sets. This focus on integration parallels a shift in European budget priorities, from sensor design to data use, a trend that will increase as space budgets continue to decline.

2. What is the Eurasian market for commercialized satellite imagery: panchromatic/high resolution, multispectral and radar?

The commercial satellite imagery market is complex and dynamic, and therefore is difficult to characterize—its size, shape, and direction change depending on the aspect from which you analyze it. The Remote Sensing Technology Center of Japan (RESTEC) reported that the market for commercial remote sensing data increased by 20 percent in 1992 with similar gains expected in 1993. More than half of the orders are for Landsat imagery, only 11 percent of the orders placed were for SPOT. I was unable to obtain similar statistics from Eurimage, but believe their sales are consistent with the RESTEC figures. SPOT Image reports a higher annual turnover than EOSAT ($40 million and $12 million respectively in 1992); however, the highest number of orders placed worldwide today are for Landsat multispectral imagery. Does this reflect SPOT's higher price, corporate management and marketing, government subsidization, or a more intricate combination of factors? EARSel estimates that the European value added industry is growing commensurate with the investment in remote sensing resources, citing in particular current revenues exceeding $40 million in France, and over $30 million in Germany. I will leave the interpretation of the numbers for the market studies of the satellite developers; such statistics are ephemeral, and less meaningful than the trends in application, and especially the interaction of the various market areas.

As indicated earlier, the satellite remote sensing systems that are operational today are complementary. The markets for each type of data or imagery must be interpreted in the context of the system capability and cost. Professor Dr. G. Konecny, now at the University of Hannover in Germany and the Vice Chairman of EARSel, provided an excellent summary of operational remote sensing satellite systems, their applications and limitations, and their per square kilometer cost (Atch 2) at the International Symposium on the Operationalization of Remote Sensing in the Netherlands, in April 1993. A comparison of the price per image, scene or swath size, and cost per square kilometer for each of the operational remote sensing satellite systems (Atch 2, page 8) indicates the imperfect nature of the commer-

cial imagery market. This is complicated by the fact that multiple types of data are used for different types of applications, and the cost of the application increases with the required resolution. For example, a Forest Mapping or Land Use Survey derived from Landsat costs between $6 and $13/sq. Km depending on scale and resolution, a Forest Inventory or Land Use Map derived from aerial photography (scale of 1:10,000) costs $350–$520/sq. Km (Atch 2, page 13).

MULTISPECTRAL IMAGERY

The most important market for multispectral imagery (MSI) today are resource applications, and Landsat Thematic Mapper (TM) has been the best source of digital MSI. Landsat TM's broad spectral range (TM provides seven bands of imagery which record energy in the visible (bands 1,2,3), near infrared (band 4), shortwave infrared (bands 5,7) regions, and the longwave infrared (band 7) region), medium resolution (28.5 meters), and wide area coverage (185 km × 170 km) have made Landsat the data of choice for many resource applications, especially where regional monitoring is required. These application include landcover or forest assessment, crop yield prediction, geology and non-renewable resource exploration to name just a few. Our own military applications of Landsat, repeatedly demonstrated in DESERT STORM, and more recently in Somalia, provide powerful examples of the types of military intelligence applications happening world-wide today. Landsat covers more of the electromagnetic spectrum than the Russian or French systems, and is lower in cost than the French SPOT XS. The Russian systems are cheaper but are not digital and are currently less capable in terms of spectral coverage and resolution. The new Japanese Earth Resources System (JERS–1) has a spectral range very similar to Landsat and an L-Band SAR, both at a spatial resolution of about 18 meters.

The Landsat market share has increased as our understanding of the power of the multispectral information has grown through applications experience, and as computer technology has made data processing affordable. Price, particularly price for information content, has been and will remain important—Landsat has been affordable to customers who cannot afford to buy SPOT. Initiatives to offer data or products, and data processing technology at affordable prices, such as to universities, has been effective in increasing market share. Such price and data processing curves will continue to influence the market response to all types of commercial imagery. I want to underscore that the loss of Landsat 6 has put this, our biggest market, at risk.

RADAR IMAGERY

Radar data, which might be viewed as an extension of multispectral into the microwave and millimeter portion of the spectrum, provides data independent of weather, and uniquely detects certain natural phenomena. The new synthetic aperture radars, such as the ERS–1 and JERS, are also considered resource satellites and are complementary to the multispectral and optical capabilities of systems like Landsat and SPOT. They were designed to provide special environmental information, such as sea surface and ice conditions over large, even global areas; however, the market is new and consequently is still restricted by limitations on our understanding of the data and by our data processing capabilities.

Europe and Canada are investing heavily in commercial imaging radar. ESA has advertised the global environmental role of ERS–1 and planned follow-on satellites, complete with glossy brochures stating their commitment to coordinate the various satellite systems to pursue aims that are of interest to the whole of humanity. A recent meeting of ERS–1 users in Germany concluded that while ERS–1 was successfully fulfilling expectations on measuring sea states, ocean physics, and ice assessment, few other "practical" applications have been developed. This view reflects the biases of an applications community conditioned over years to use more traditional data types. The European Multisensor, Multiaircraft Campaign (EMAC) will test many current and prototype sensors, with a heavy SAR emphasis, beginning in 1994 (Atch 3). Canada, a full participant in the ERS–1 program, will launch RADARSAT (like ERS–1, a C band SAR) in 1995, and expects the economic benefits to include the creation of 10,000 person years of employment in Canada, and revenues reaching C$800 million in the public and private sector.

Russia has also successfully developed imaging radar systems, but has taken a different approach to the sensors and to data processing. On my first visit to Moscow, I asked the Head of the Applied Space Physics Department at the Space Research Institute (IKI, of the Russian Academy of Sciences) about Russian work with multispectral or hyperspectral systems. Before he took me on a tour to see their next generation radiometers, Dr. Etkin introduced me to the Head of Analysis and

Requirements for NPO Mashinostroeniya, Dr. Pavel Shirohov. I told Dr. Shirokov that I was not particularly interested in radar, having worked most extensively with Landsat MSI. He immediately responded that this was understandable, since American radar systems don't work. It is a problem of design and a problem of processing, he explained, adding that American scientists do not understand radar physics. He claimed that, in warping our radar systems to produce perfect images, we have destroyed the ability to exploit the significant phenomena. Russia has developed a signal processing (versus image processing) approach to radar data, which they believe uniquely detects certain natural and man-made phenomena. These phenomena included advances in non-acoustic antisubmarine warfare (NASW) (Atch 4), as well as detection of deep underground geophysical features indicative of water, diamonds, and oil (Atch 5). Our position in the commercial radar imagery market? We aren't even a player in this market; we need to get in the game.

PANCHROMATIC IMAGERY

Optical, or panchromatic data offers visible information at higher spatial resolutions. SPOT 10 meter panchromatic imagery is often used to "sharpen" other MSI, for example, because it currently provides better (i.e., visually interpretable) object definition and positional accuracy. This is especially important for cartography, the dominant application for SPOT (thirty percent of SPOT applications are cartographic) and the Russian panchromatic and space photography systems today. Dr. Konecny demonstrated (Atch 2, page 30) that for the cartographic applications in highest demand today—scales of 1:50,000 and 1:25,000—only aerial photography can provide the higher resolution, and better planimetric and altimetric accuracies required for accurate mapping. Cost and repeatability of aerial photography have constrained the satisfaction of the market demand: only 17 percent of the world is mapped at 1:25,000, and just 56 percent of the land area mapped at 1:50 000 percent.

While U.S. one meter panchromatic data could potentially capture the cartographic and some of the other survey markets (Atch 2, page 8) served by aerial photography today, price will be a key factor in the market response, regardless of whether it is sanitized government data or a new commercial imagery system. SPOT has made market gains in the past 7 years, but remains cost prohibitive for large portions of the potential market. European Landsat users were eager to receive the 15 meter panchromatic band that was to have been available on Landsat 6; in part because it would enhance Landsat spatial resolution without the burden of image rectification that exists when merging Landsat and SPOT. While the availability of 2 meter panchromatic data will support the positional accuracy and visible detail requirements needed to extend the satellite imagery market to the "local survey" level, the market will be partially defined by the data content. The aerial survey market is supported in part today by its ability to put varying and highly specific sensors in the right place; these sensors cover the spectrum from color infrared photography to gamma ray spectrometers.

Russia today advertises the availability of archival 2 meter imagery from their national systems. Additionally, they offer to acquire and deliver new imagery, from their national systems currently in orbit, for any place in the world. The Russians have noted that they are resampling this imagery, and putting it to the market at far less than its potential capability. They are now discussing release of 2 foot—as opposed to 2 meter—resolution imagery. Once the U.S. begins selling national imagery on the world market, the market and the market players will respond. We have to be prepared to release both archived and newly acquired imagery, resampled to match the Russian (and other) offerings to remain competitive.

Russian 2 meter panchromatic imagery is not selling well now. This may be largely due to poor marketing and distribution, it also reflect something about the market readiness to absorb this data at its current price ($1080 for a scene of 100 x 100 Km if it exists in archive; $2880 if new collection is required) and data content. There is a basic business lesson in this experience that could affect the "commercial viability" of our own national data—the ability to deliver the product is critical. Just as Europe is growing the user base for new radar systems, we must invest if we want to establish a market presences. We must undertake now to explore potential applications and retool to support the integration of the imagery with other data types, and address the type of architecture required to match the performance of the successful commercial imagery companies. Who will market the distribute the data, in what forms, and on what basis?

Decreasing the resolution of commercial optical imagery to 1 meter international policy and national implications that must be considered and addressed. The market for high resolution optical or radar imagery will include a number of nations, orga-

nizations, and individuals who will buy this data for military and industrial intelligence applications. Consider, for example, the level of detail on the digital orthophoto (stereo image map) of Berlin, which was produced by a German firm using Russian 2 meter KVA data (Atch 6). Russia has expressed significant concern about the national security implications of a US decision to release high resolution imagery, citing in particular the threat to our mutual good relations posed by the exploitation of this data by aggressor states such as Libya, Iraq, and Iran (Atch 7). We must coordinate this action with the international space community and address associates security considerations, and we must understand the implications for our own national security and national budget.

IMPACT OF THE LANDSAT 6 FAILURE

Europe and Japan are well positioned to fill the Landsat 6 gap. Although SPOT XS cannot match Landsat's spectral range, SPOT initially, and soon JERS–1 will move to fill the Landsat 6 void if we do not act immediately to replace Landsat 6, to restore Landsat program integrity (some in Europe believe we built a duplicate satellite, as we did with Landsat 4/5 (Thematic Mapper), and to maintain data continuity. This will hand nearly the entire market to Europe at a critical time—there will be scant motivation to shift in 5 years (the projected launch of Landsat 7 was scheduled for 1998) to "new" or "higher resolution." By 1998, higher resolution data (1 meter or better) optical data will be competing with SPOT–4, ERS–2 (1994), RADARSAT (1995), JRS and the next generation, "earth observation" systems, and by that time, research will have created the understanding and developed applications (many are likely to be developed from necessity as Landsat gap fillers) that do not exist today.

3. What are the Eurasian government and industry intentions to enter and regulate the commercial remote sensing market?

Europe is strongly committed to earth observation, or remote sensing technology, in the context of a strong commitment to space. They have structured a long-term (1992–2005) Space Program, which includes a clear industrial policy statement focused on improving the worldwide competitiveness of European industry. Russia continues to pursue a reasonably strong space program despite financial difficulties, and has made many overtures for joint programs with the United States. We have not responded to or engaged Russia, but Europe is working hard to work with Russia—collectively, through joint ESA/Russian programs, and through bilateral and trilateral arrangements.

In 1992, despite a backdrop of worsening economic conditions and declining funds for space, Europe restated its commitment to space and to remote sensing by adopting at the Ministerial level, resolutions that clearly signaled to European researchers and industry that there would be a future in space technology, and indicated which directions European space policy would take. (Atch 8). Heading the list of priorities and reported successes was European progress in Earth Observation. The Ministers assured the succession to the ERS–1 satellite, which was launched in 1991 as the first in a series of European environmental monitoring satellites. The resolution reflects the importance of the environment to the European political agenda, and makes special reference to the unique and indispensable contribution remote sensing makes to environmental monitoring. The Ministers adopted a companion resolution on International Cooperation (Atch 9) which strongly reaffirms Europe's intent to intensify international cooperation, not only among the 13 member states, but significantly, to expand cooperation with the United States and Russia. A separate resolution (Atch 10) reflects the priority attached to working with Russia and indicates the direction of ESA-Russian space cooperation.

Like Europe, Russia has adopted a global view. Russia has made unprecedented overtures for joint remote sensing programs with the United States, proposing significant related programs in key defense areas as well as important new initiatives focused on environmental monitoring (Atch 11, Gem, GEES). The US government has generally not responded. U.S. industry is exploring many opportunities but is constrained by the policy vacuum. Europe, not only ESA but also individual European countries, especially France and Germany, is moving aggressively to participate with key elements of the Russian space program in all areas.

Russia has offered to jointly develop our next generation remote sensing system (Atch 12). Russia has offered to put a Landsat-6 look-alike into space in two years for a cost of $60 million, including the price of launch. They offer to place a three frequency, space-based radar into space in two years, for $120 million, and a combination Landsat-6 with three frequency imaging radar on a single platform in three years for only $150 million—little more than the cost of a US launch. There cannot be sufficient justification for spending $2 billion to do this ourselves, when for

an order of magnitude less money, we can demonstrate world leadership and support the growth of industries in the United States, in Russia, and in Europe.

4. How can we assure US dominance of the commercial imagery market while protecting US security interests?

I invite you to urge the Executive Branch to revitalize our national space policy to demonstrate world leadership, to grow our national investment in space, and to recapture and maintain US leadership in remote sensing, a critical area of Space technology. We can best and most cost effectively establish a world leadership position through a policy of cooperation and inclusion, not of competition. We must integrate our interests with those of Europe and the rest of the world. We can no longer afford the expensive and artificial segregation of military and civilian systems; we can no longer afford to ignore or reinvent foreign capabilities. Specific recommendations:

4.1. The United States should create and fund a joint, integrated remote sensing program with participation of U.S. industry and government, and Russia industry and government. Russia should be invited as a full partner to recognize and capitalize on their extensive technology, experience, to reduce program cost, to support Russia in her efforts to convert current and future generation space systems to peaceful applications, and to respond to their real initiatives in this area. We should further invite Europe and Japan to participate—and consider appropriate ESA and/or Japanese roles; perhaps duplicate sensor development or specific launch/operations roles, which might be awarded on a competitive basis. A joint international approach will grow the commercial remote sensing pie instead of wrestling for smaller slices. A shared program will decrease program cost (this means competitive data cost), improve technology, grow the market, and better support full commercialization. Equally significant, it will create a foundation for global environmental monitoring and create a basis for shared problem solving.

4.2. It is essential to maintain Landsat data continuity and to add additional capabilities by developing information content (spectral extension) with modest spatial resolution improvement (5–10 meters). Landsat-6 would have continued our 21 year supply of MSI to users around the world—this is our market today, and it continues to grow. Medium or high resolution (1 meter) panchromatic imagery will not replace but can complement the multispectral. A joint program with Russia should support extending the spectral capability and adding complementary optical and SAR sensors for less than what we would spend to replace Landsat-6.

4.3. We need to shift our focus from sensor design to data use—this will require budget action. We need to revitalize American exploitation and application technologies; these are, in large part due to over-compartmentation by the government, stagnant, expensive, and limited in production capability. We must *not* support or subsidize any further U.S. space (government or commercial) developments that will enrich developers at the expense of users. We must structure and budget to support the new commercial products, including but not limited to panchromatic, but must not let this become the vehicle for continued feathering of the same government imagery nests. There must be funding to support the development of new applications and data integration. We must temper our fascinations with counting trees, maintain our ability to see the forests, and learn to assess the key features of both in new dimensions. There should be a freer exchange with industry, and a concerted effort by the government to understand, if not keep pace, with international technology approaches and applications, particularly as the latter impact foreign intelligence capabilities.

4.4. We should establish a new Landsat lead and motivate them to succeed in progressing to full commercialization. This must remain a partnership of government and industry; however, a Management Switch is required. Industry should be placed in the in lead position with government support on policy, funding, and architecture development. Changing government leads has not worked; Commerce and NASA failed or refused to play, leaving DoD the de facto lead. Continued DoD program management is cost prohibitive under the current arrangement. In addition, DoD has failed despite repeated Congressional direction, to develop an end-to-end architecture to support data exploitation and use, and has not responded to considerable Russian initiatives in this area. A totally commercial system and operation must be carefully planned, or it will not be viable. We must motivate industry to succeed, and not just to generate investment. This will require fresh blood and new thinking. The best way to freshen the pot is to draw talent from the user and applications communities, to ensure a bottoms up design of a full architecture, not just a new space system.

5. What are the European strengths in the commercial remote sensing market?

Europe has a global focus. They have a comprehensive space policy and long-term plan that includes earth observation and industry. They have developed a new

unique and strong niche with ERS–1, which complements SPOT, and they will protect their market gains aggressively. European government and industry don't just work together—it is a symbiotic existence. Of course, this is exaggerated in the Central and East European states, where the government procurement authorities are also the winning contractors.

Europe (like Canada) has targeted space technology as a strategic area for the future. Europe and Canada are aggressively growing a new generation of users, through a variety of integrated programs ranging from cooperative application programs (donations of hardware, software, data, and training) to comprehensive training courses for students from developing nations. All this is accomplished, of course, with strong government subsidization.

Europe has an active and open scientific network, which brings industry, government, and academia together to transfer, master, and push the rapidly changing technologies. They are proactive in stimulating new research directions in remote sensing and associated disciplines, and they are capitalizing on their efforts to develop and draw in scientists from the rest of the world, not just from central and east Europe. Over 1000 representatives from 79 nations attended the international symposium on the Operationalization of Remote Sensing in Enschede, the Netherlands 19–23 April 1993. The list of participating countries spanned the continents and included large delegations from China, Iran, as well as representatives from Africa (Congo, Nigeria, Kenya, as well as Libya, and South Africa), and most of the Middle East nations.

6. How do they perceive US intentions and strengths in this area?

Europe is currently unsure of our intentions, lacking clear signals from the new Administration. This creates some defensiveness, or sensitivity, because there is a general feeling that America is turning away from Europe. In this context, they are likely to view release of 1 meter optical data as a competitive move, counter to their own efforts to develop complementary systems, unless it is further coordinated with the international space community.

Europe regards our 21 years of Landsat imagery as a tremendous strength and an important, continuing contribution. Our actions (or failure) to replace Landsat will be read closely and they will respond to capture this market if we drop out of the game. Without a clearly articulated American policy or the context of a long-term program, they can only read it for what it is—a budget issue, and not a national priority. We are perceived to have many more advanced capabilities, retained as secret or exclusive to military, than we have offered commercially. I believe we are perceived to have a strong industrial base, and a strong research and development program, including slightly superior integration and interpretation capabilities. This reflects the European success and presence of many outstanding American companies, including ERDAS and Intergraph, as well as the companies testifying with me today.

ATTACHMENTS

1. FOMI products: Space image topographic map, 1987; Landsat images and Change Detection, Bos-Nagymaros Barrage System, 1990, courtesy FOMI.
2. The Operational Status of Remote Sensing, a Viewpoint of the European Association of Remote Sensing Laboratories, Prof. Dr. Gottfried Konecny, April 1993.
3. EMAC program overview.
4. IKI Image, Claimed Submarine Detection, courtesy ISMA.
5. IMARC Image, courtesy Vega-M.
6. Stereo map of Berlin, courtesy OIM GMBh.
7. Etkin Letter on Security Implications of Release of High Resolution Imagery.
8. Resolution on the Implementation of the European Long-Term Space Plan and Programmes, 10 November 1992, ESA Annual Report, Annex 6, pp99–110.
9. Resolution on International Cooperation, 10 November 1992, ESA Annual Report, pp113–114.
10. Resolution on Space Cooperation with Russian Federation, 10 November 1992, ESA Annual Report, pp114–115.
11. GEM, GEES courtesy RTS.
12. IKI letters on Joint Remote Sensing System, courtesy ISMA.

MSI sensor systems are designed to record energy levels received in specific spectral regions. Landsat TM Bands 1 through 5 and 7 record energy in the visible (1,2,3), near infrared (4), and shortwave infrared (5,7) regions, while band 6 records emitted infrared, such as the energy emitted from fires and power plants, in the longwave infrared region. SPOT records reflected energy in the visible and near infrared range, but also has a panchromatic sensor that provides black and white imagery.

ESA member states are Austria, Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. Finland is an Associate Member of the Agency. Canada is a cooperating State.

EARSel, founded in 1976, serves the sponsoring agencies, The European Space Agency (ESA), the Commission of the European Communities (CEC), and the Council of Europe, as a European scientific network to master the challenges introduced by the rapidly changing technology of remote sensing.

My customers have 2–3 yr. revisit requirements; however, getting cloudfree imagery is a problem. Yield forecasting requires 3 images during growing season; FOMI review of Quicklook showed 40% of the imagery was more than 50% cloud-covered; they are using SPOT, and will try to use ERS–1 to mitigate, supplement.

Operationalization of Remote Sensing Conference Participants, 19–23 April 1993: Algeria 1, Argentina 2, Australia 12, Bangladesh 2, Belgium 28, Benin 1, Bolivia 1, Brazil 1, Brunei Darussalaam 1, Bulgaria 1, Burkina Faso 3, Canada 36, Chile 2, China 28, Colombia 3, Congo 1, Croatia 4, Denmark 2, Djibouti 1, Egypt 6, Finland 5, France 41, Germany 49, Ghana 2, Greece 2, Hungary 6, Iceland 1, India 16, Indonesia 11, Iran 17, Ireland 1, Israel 3, Italy 34, Ivory Coast 2, Japan 3, Jordan 1, Kenya 6, Libya 4, Luxembourg 1, Malaysia 2, Malta 1, Mongolia 1, Morrocco 1, Mozambique 1, Nigeria 3, Norway 10, Palestine 3, Philippines 2, Poland 3, Portugal 8, Romania 2, Russia 3, Saudi Arabia 2, Slovenia 3, South Africa 10, Spain 10, Sri Lanka 1, Sweden 15, Switzerland 8, Syria 2, Thailand 11, The Netherlands 291, Trinidad and Tobago 1, Tunisia 1, Turkey 3, Uganda 1, United Arab Emirates 1, United Kingdom 60, USA 36.

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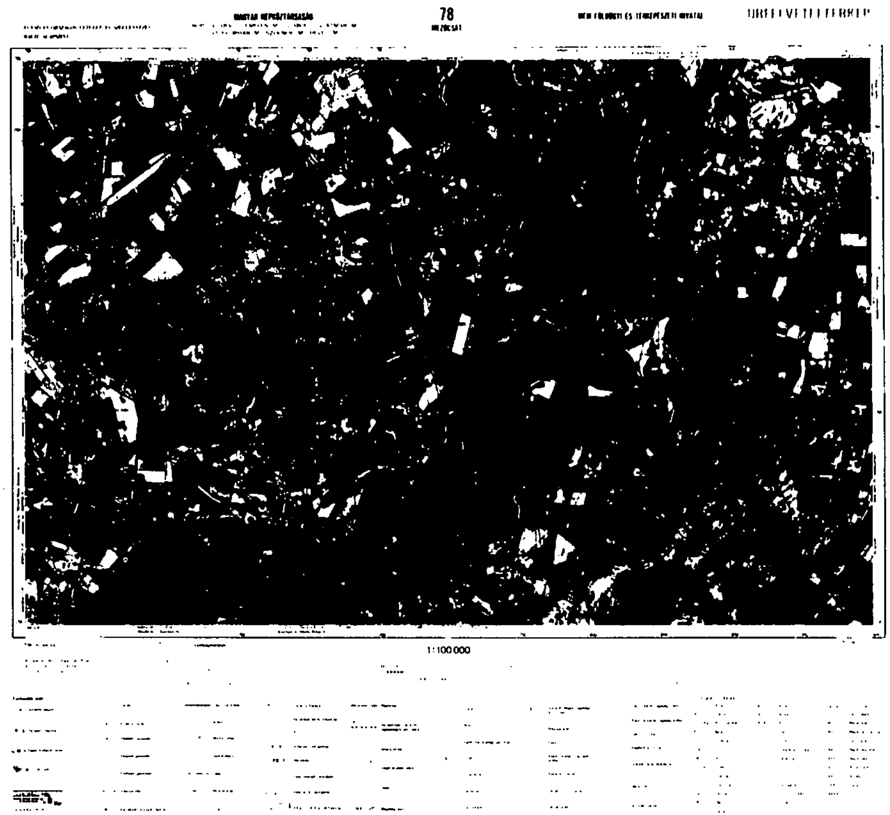
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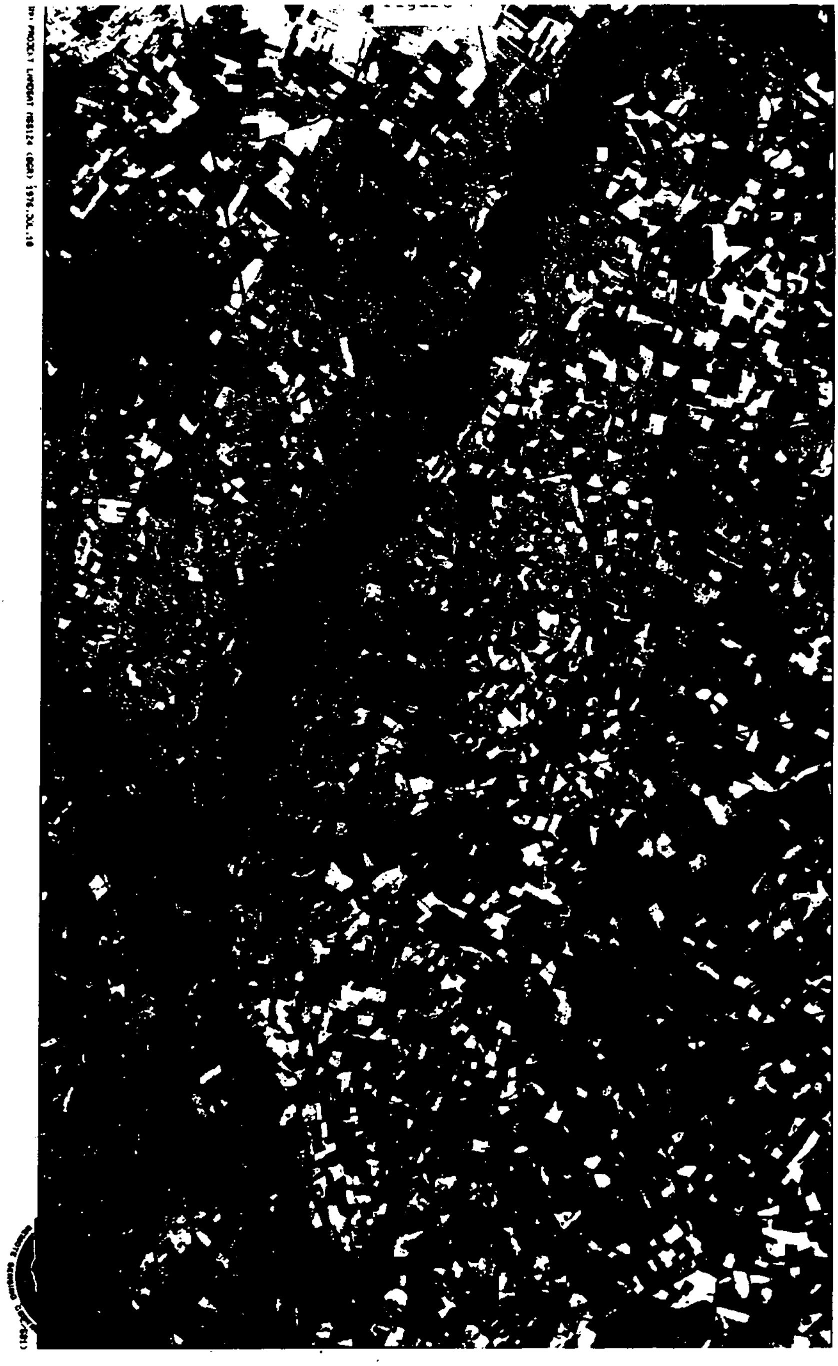

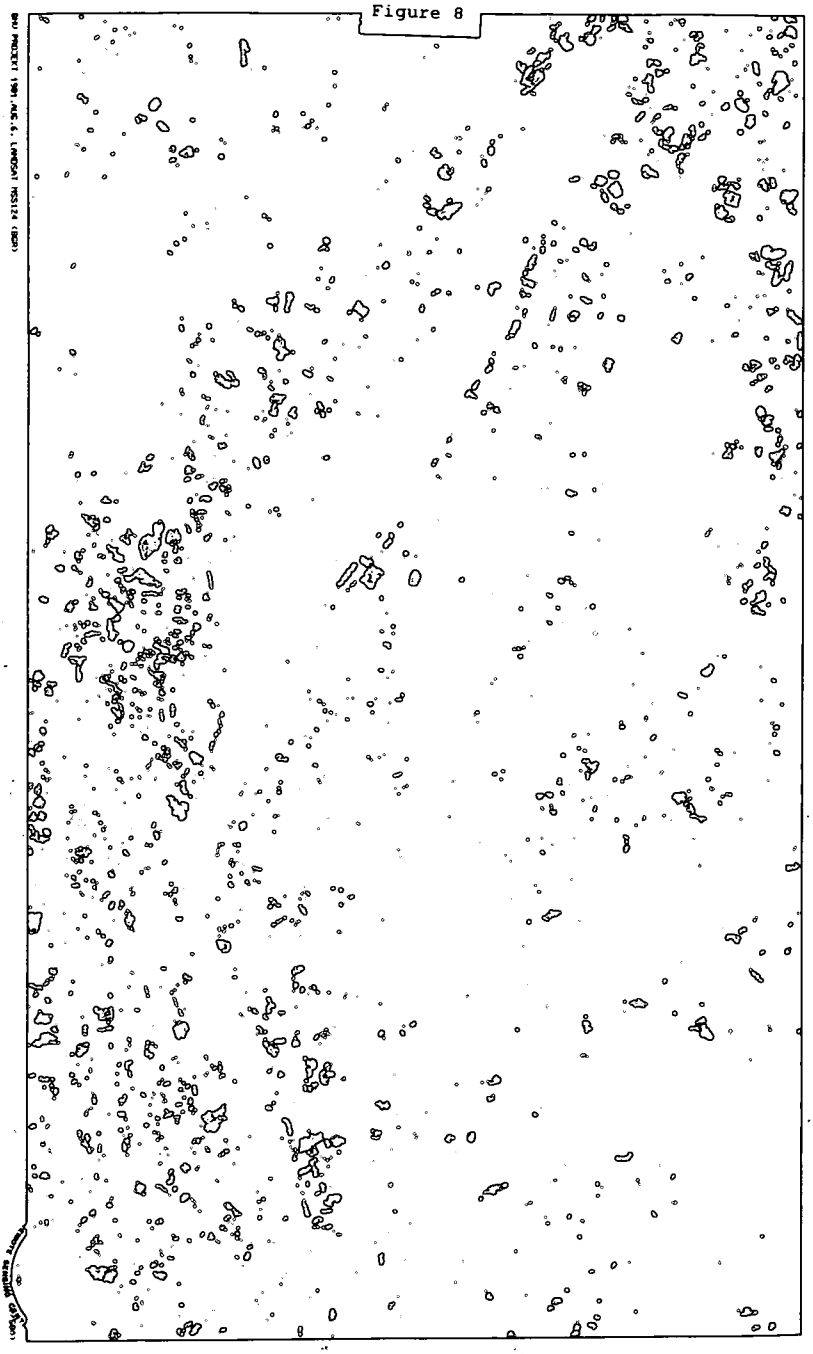
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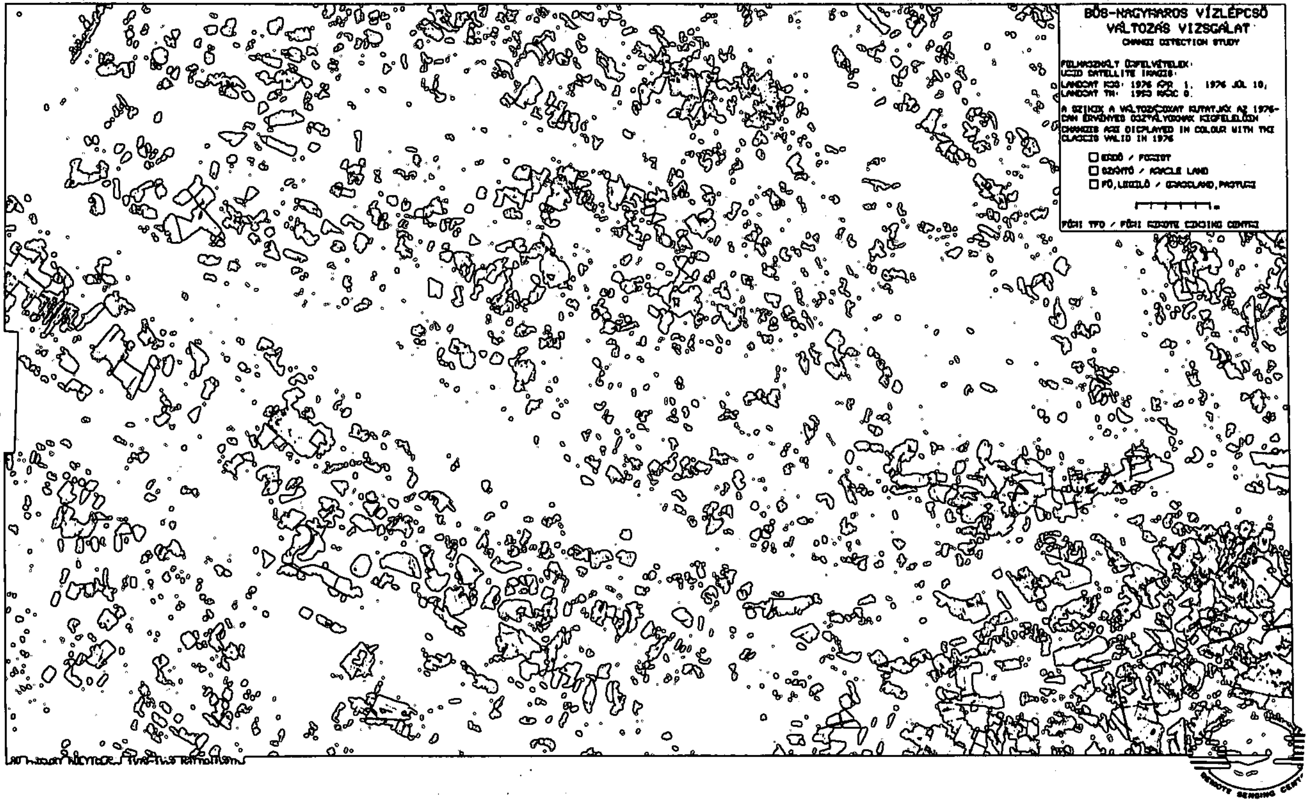
Figure 10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SPOTMap

FRANCE
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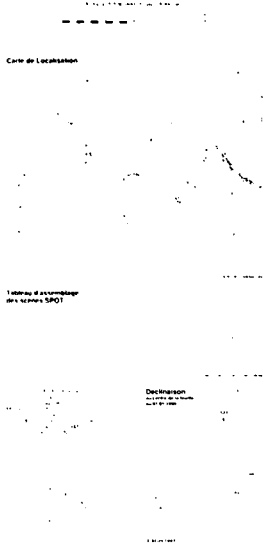

Première image SPOT 3
27 Septembre 1993

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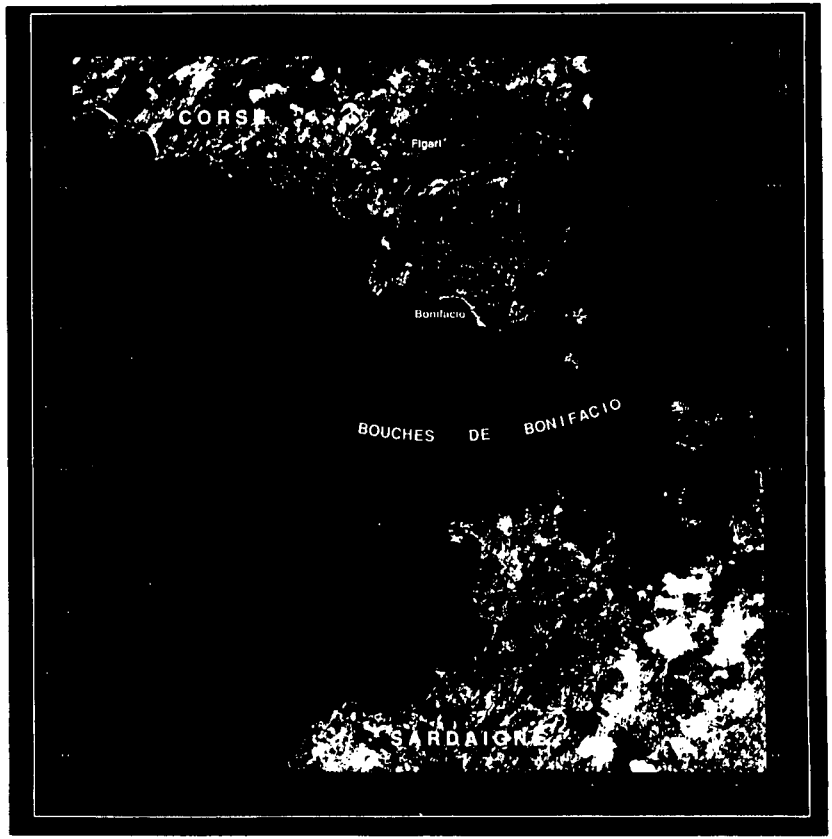
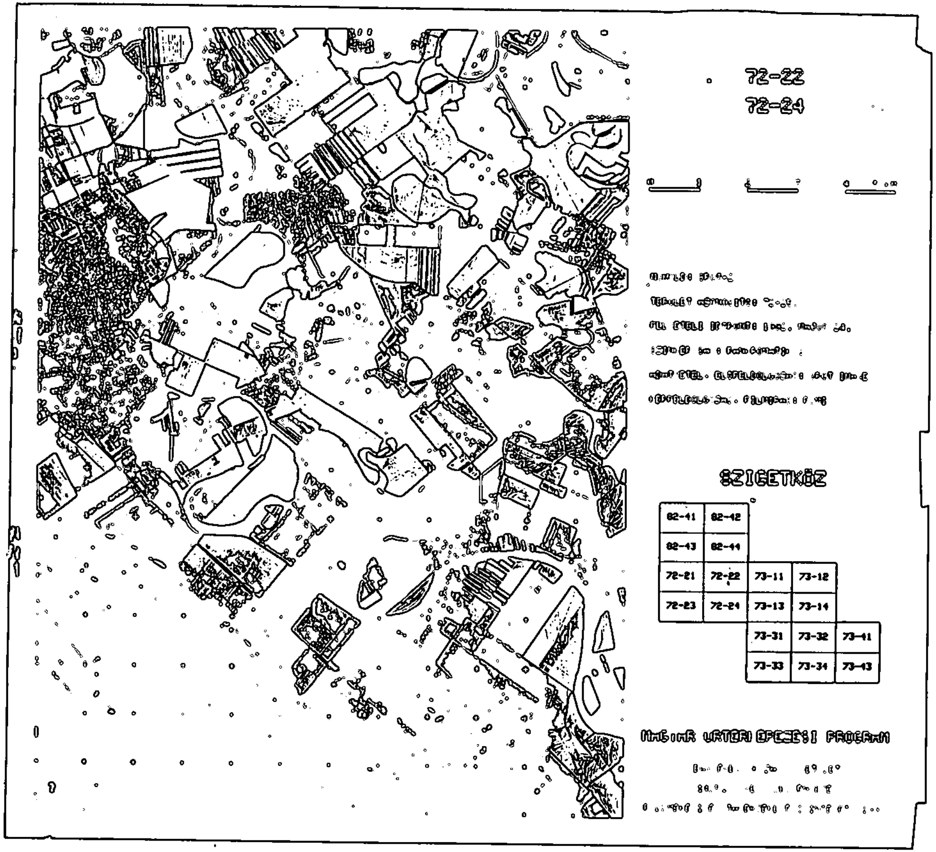
SPOT IMAGE

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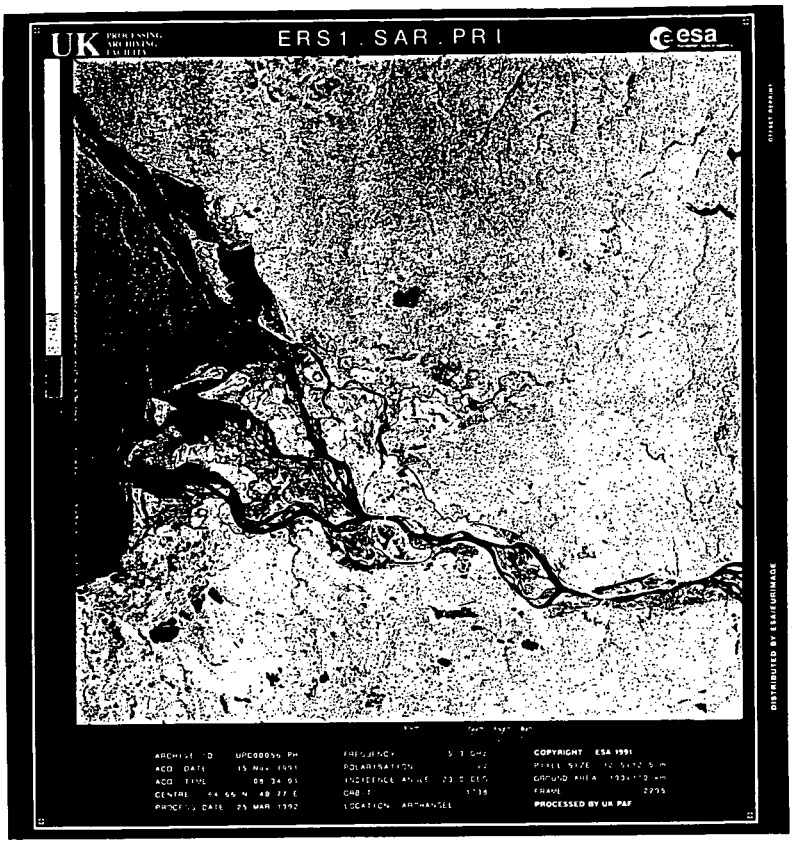
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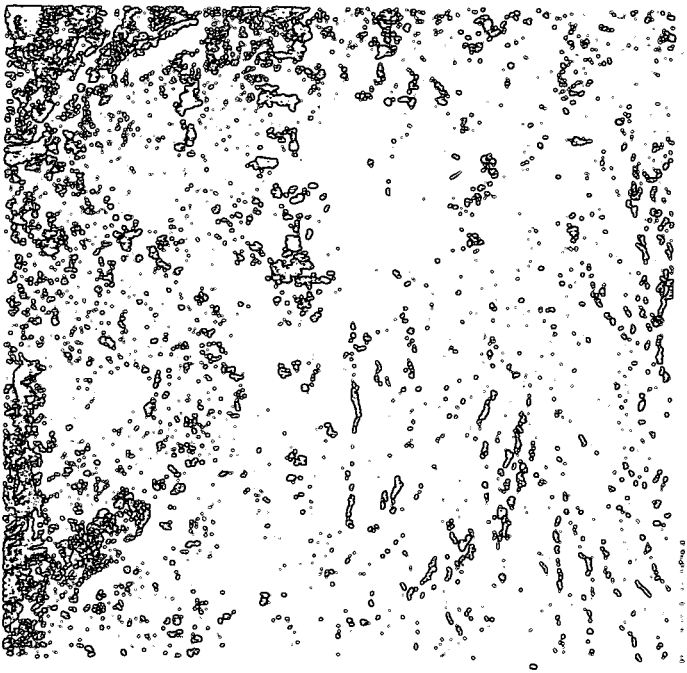


Darmstadt (Germany)

ATTACHMENT 2

The Operational Status of Remote Sensing - a Viewpoint of the European Association of Remote Sensing Laboratories

paper presented to the International Symposium
„Operationalization of Remote Sensing"

Enschede, Netherlands
April 1993

by

Gottfried Konecny,
University of Hannover,
Germany

(Vice Chairman of EARSeL)

1. This session is on issues, needs, bottlenecks and opportunities.

2. We are all convinced, that Remote Sensing can be used operationally. Otherwise a conference which expected to have 400 participants, would not have 1000. Also Christine Nielsen has convinced us, that we have all the prerequisites of being successful.

3. The implementation of a technique usually takes a generation. I nave been chairman of an ISP(RS) working group on geometry of remote sensing with a symposium in 1970 organized by the ITC in Delft, in which I reported on the optical sensing possiblities of scanners and Mr. Franz Leberl, now Professor at Graz, of radar as the only papers on the subject.

4. Prof. Schermerhorn, the founder of ITC and one of the founders of operational photogrammetry made a comment at the end of our presentations: „I feel very much at home here. In the 1920's there were people who envisioned the operational use of photogrammetry which in the 50's became a reality. In 1970 we talk this way about remote sensing.
   According to Prof. Schermerhorn analogy remote sensing should achieve operational capability in the year 2000.
   In 1993 we are at the edge of a turnover and must ask ourselves crucial questions in which way the challenge of operational remote sensing can be realized. The problems faced by remote sensing now in the order of priority are:
   (1) - organizational
   (2) - educational
   (3) - and lastly and least importantly technical.

   (1) the organizational problems stem from the fact that governments and users want information. The method of obtaining it does not matter as long as it is
   - convenient (regularly available (cloud antenna coverage) no restrictions)
   - affordable and
   - accurate enough (for decision making)
   If remote sensing does not give the only available answer then it must be analyzed in cost and benefit to other methods obtaining the information with quality considerations included.

   (2) The educational problems arise from the fact, that remote sensing per se is no discipline, but merely a technique which requires an application. The end result may not be an image but the simple information itself. This means that a

result may not be an image but the simple information itself. This means that a remote sensing specialist is no professional unless he has a professional background in an application.

(3) The technical problems, depending on available sensors and platforms, are either solved or solvable.

This has been demonstrated by a research community represented in Europe by EARSeL, in Asia by AARS, in Latin America by SELPER and perhaps in Africa by the OACT, which are all regional members of ISPRS.

To find out the status of operational remote sensing one has only to look at the value added remote sensing product spending in country, e.g. France and Germany.

Turnover of Value Added Remote Sensing Industry

France	Turnover
IGN (Government)	25 M US $
Private Industry	14 M US $

Germany

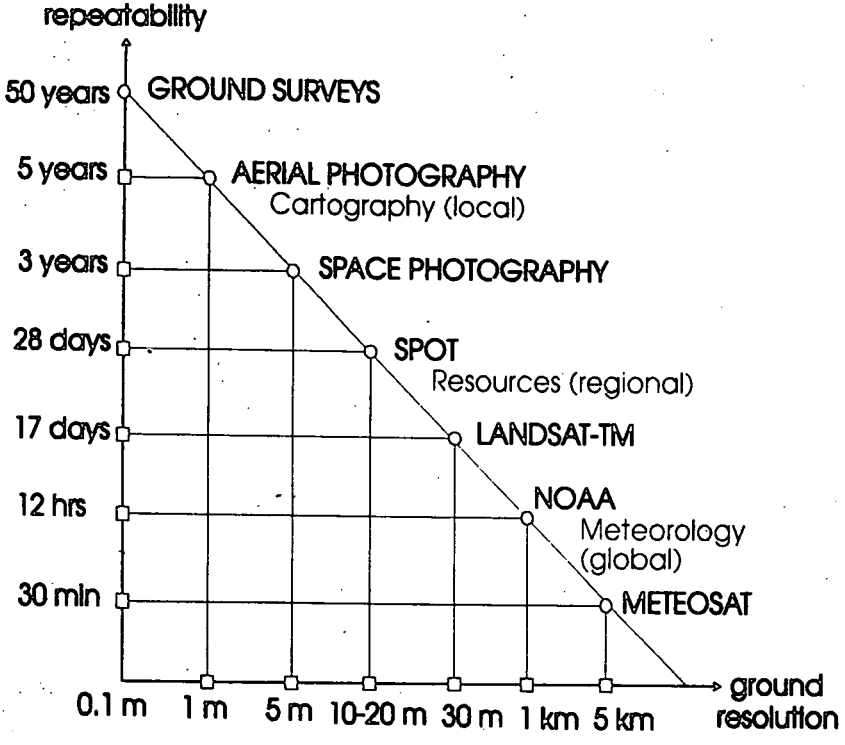
Private Industry	3.5 M US $

Turnover of Private Photogrammetry

Germany

Private Industry	30 M US $

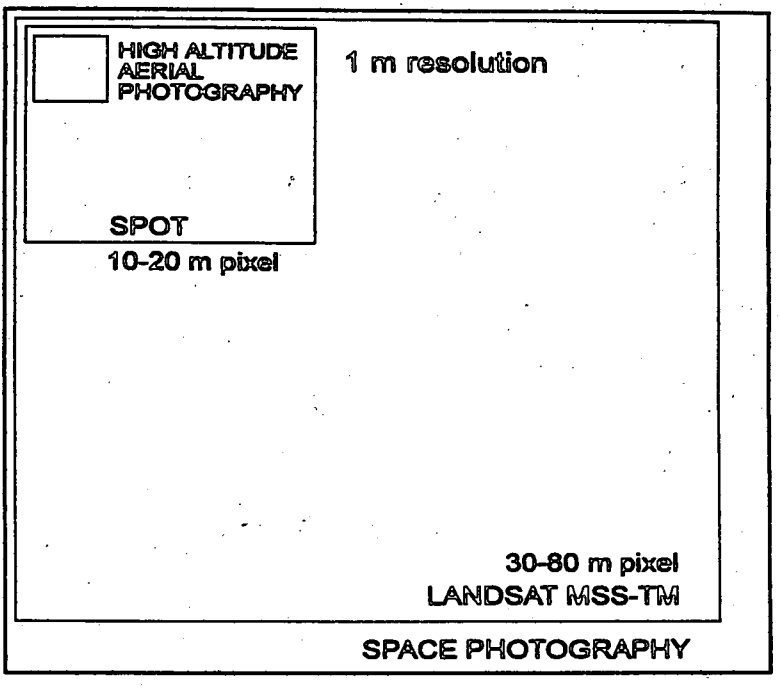
Resolution and Repeatability of Remote Sensing Systems



Operational Satellite Remote Sensing Systems

Space Agency	Meteorology	Resources	Cartography
USA	GOES NOAA	LANDSAT	(LFC)
CIS	METEOR	MKF 6 KATE 2000	KFA 1000 KWR 1000
France	-	SPOT-XS	SPOT P
ESA	METEOSAT	ERS-1	-
Japan	GMS	MOS	-
India	INSAT	IRS-1	-
China	-	Satellite Photography	-
Germany	-	(Moms)	(MC) Stereo-Moms

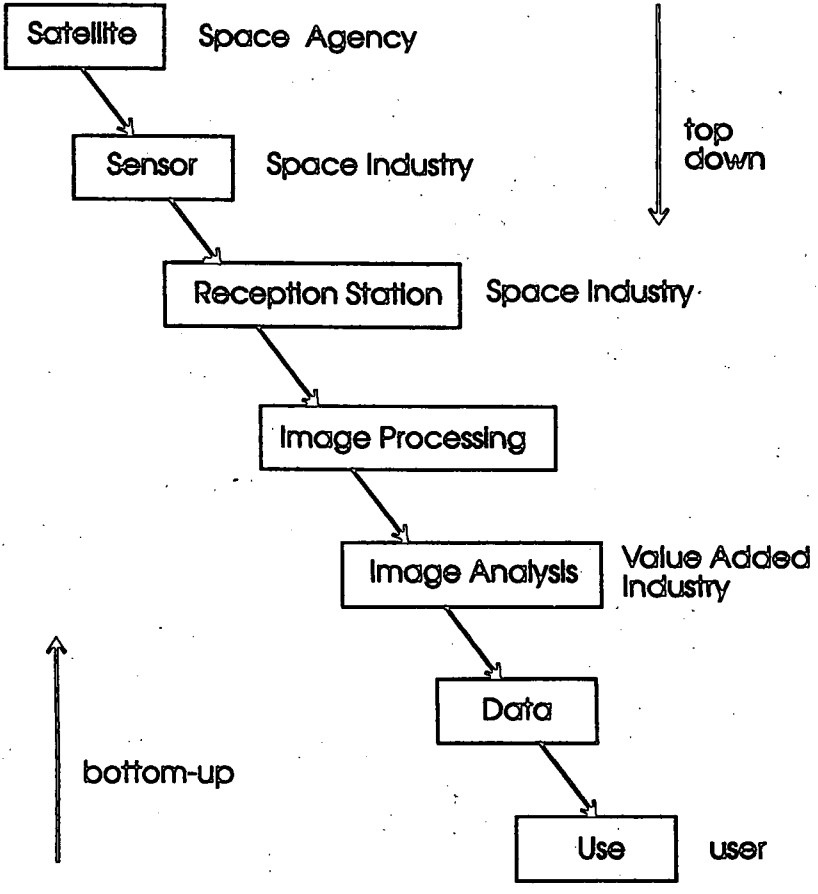
Satellite Image Coverage



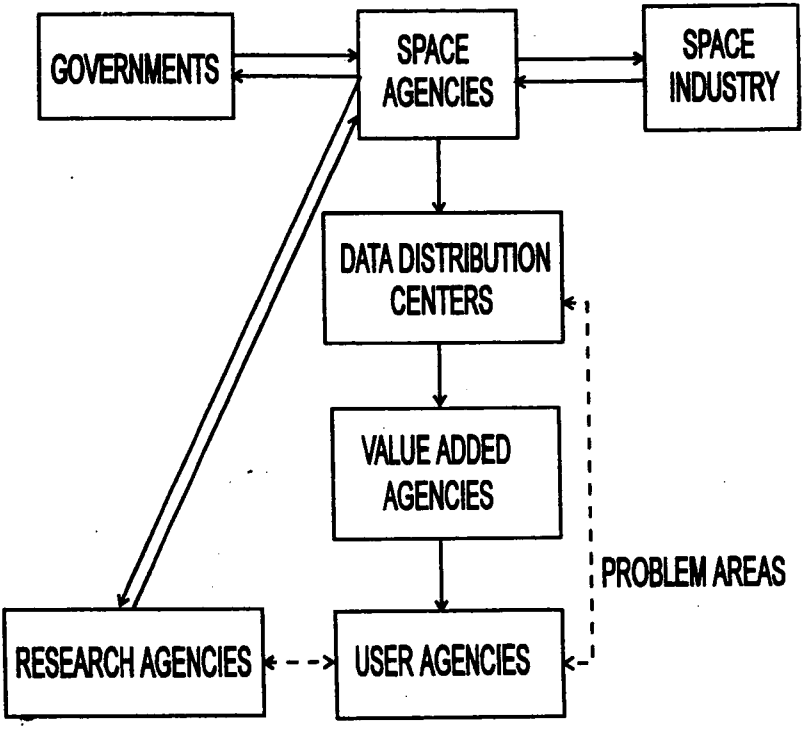
Cost Comparison of Space Imagery

Sensor	Country	No. of bands	Price per image	Swath	Resolution	US$/km^2
Meteosat	ESA	3	113 $	hemisphere	5 km	0,000
NOAA-AVHRR	USA	5	115 $	280 km	1 km	0,0[illegible]
Landsat MSS	USA	4	1233 $	185 x 170 km	80 m	0,0[illegible]
MOS-1	Japan	4	316 $	100 km	50 m	0,0[illegible]
Landsat TM	USA	7	5180 $	185 x 170 km	30 m	0,15
Spot P	France	1	3133 $	60 km	10 m	0,87
Spot XS	France	3	2487 $	60 km	20 m	0,69
ERS-1	ESA	1	800 $	100 km	12.5 m	0,08
IRS-1	India	4	300 $	130 km	36 m	0,01
KFA 1000	CIS	2	1150 $	120 km	7,5 m	0,08
MKF 6MA	CIS	6	880 $	175 x 260 km	20 m	0,02
MK 4	CIS	4	1200 $	150 km	10 m	0,08
TK 350	CIS	1	4700 $	180 x 270 km	10 m	0,01
KWR 1000	CIS	1	3200 $	60 km	2 m	2,00

Development of Remote Sensing Satellites



Satellite Remote Sensing Development



SPOT-IMAGE - TURNOVER

1986	3 M US $
1987	11,2 M US $
1988	18 M US $
1989	24,6 M US $
1990	33 M US $
1991	40,8 M US $

(Image Sales 16 M US $ = 40 %)

SPOT IMAGERY USE

CARTOGRAPHY	30 %
AGRICULTURE	20 %
ENVIRONMENT	20 %
GEOLOGY	15 %
FORESTRY	10 %
URBAN PLANNING	4 %
VERIFICATION	1 %

SPOT VALUE ADDED PRODUCT PRICES

GEOCODED IMAGE MAPS

1: 25 000	15 000 US $
1: 50 000	7 000 US $
1:100 000	3 000 US $

DIGITAL ELEVATION MODELS

DEM 10 m	8 000 US $
DEM 20 m	5 000 US $

Aerial Photography and Aerial Mapping Prices

Aerial Photography Prices

Image Scale	Cost/km^2
1:60 000	4 $
1:30 000	8 $
1: 3 500	16 $

Mapping Prices from Aerial Photography

Map Scale	Image Scale	Cost/km^2
1:25 000	1:60 000	42 $ desert & rural
1:25 000	1:30 000	165 $ rural & urban
1: 5 000	1:30 000	1000 $ desert
1: 5 000	1:30 000	3000 $ rural
1: 1 000	1: 6 000	12 000 $ urban
1: 500	1: 3 500	16 000 $ urban
digital ortho-photo 1:25 000	1:40 000	24 $ digital record only
digital ortho-photo 1:10 000	1:30 000	120 $
digital ortho-photo 1: 5 000	1:30 000	240 $

Survey Costs

Field	Type	Scale	Imagery	Cost/km²
AGRICULTURE	Phenol. Change	1:1 000 000	NOAA	80 $/km²
BIO-MATERIAL	Biomass Change	1:1 000 000	NOAA	80 $/km²
FORESTRY	Forest Mapping	1: 250 000	MSS	6 $/km²
GEOLOGY	Reconnaissance	1: 100 000	TM	20 $/km²
FORESTRY	Forest Development	1: 100 000	TM	20 $/km²
IRRIGATION	Watershed Mapping	1: 100 000	TM	10 $/km²
LEG. PLANNING	Planning Study	1: 100 000	TM	25 $/km²
LAND USE	Land Use Mapping	1: 100 000	TM	13 $/km²
BIO-MATERIAL	Biomass Inventory	1: 100 000	TM	20 $/km²
EROSION	Vegetation Cover	1: 100 000	TM	20 $/km²
DESERTIFICATION	Change Detection	1: 100 000	TM	35 $/km²
FOOD SECURITY	Cultivation Inventory	1: 100 000	TM	25 $/km²
ENVIRONMENT	Environment Inventory	1: 100 000	TM	50 $/km²
LEG. PLANNING	Feasibility Study	1: 50 000	Spot-XS	40 $/km²
ENVIRONMENT	Risk Zone Mapping	1: 50 000	KFA 1000	150 $/km²
URBAN DEVELOPMENT	Urban Change	1: 50 000	KFA 1000, Spot-P	45 $/km²
TOPOGRAPHY	Base Map	1: 50 000	aer. phot.	120 $/km²
GEOLOGY	Photogeology	1: 25 000	aer. phot.	150 $/km²
TRANSPORT	Road Design	1: 20 000	aer. phot.	180 $/km²
TOPOGRAPHY	Orthophoto	1: 12 000	aer. phot.	24 $/km²
WATER SUPPLY	Base Map	1: 10 000	aer. phot.	800 $/km²
FORESTRY	Forest Inventory	1: 10 000	aer. phot.	350 $/km²
LAND USE	Land Use Mapping	1: 10 000	aer. phot.	520 $/km²
BIO-MATERIAL	Energy Study	1: 10 000	aer. phot.	250 $/km²
TRANSPORT	Photogr. Map	1: 10 000	aer. phot.	700 $/km²
CADASTRE	Orthophoto Map	1: 10 000	aer. phot.	400 $/km²
TOPOGRAPHY	Base Map	1: 5 000	aer. phot.	2 000 $/km²
TOPOGRAPHY	Orthophoto	1: 5 000	aer. phot.	78 $/km²
CADASTRE	Photogr. or Survey Map	1: 2 000	aer. phot.	10 000 $/km²
CADASTRE	Orthophoto	1: 2 000	aer. phot.	1 000 $/km²
TOPOGRAPHY	Orthophoto	1: 1 000	aer. photo	800 $/km²
URBAN CADASTRE	Base Map	1: 1 000	aer. photo	20 000 $/km²
URBAN PLANNING	Multipurpose Cadastre, Utilities, Topogr.	1: 500	aer. photo	40 000 $/km²

Contents

Review of the Operational Status of Remote Sensing

in the following application areas

- 1. meteorology and climatology
- 2. non-renewable resources and geology
- 3. hydrology and water management
- 4. forestry
- 5. agriculture
- 6. tidal waters, coastal areas and inland waters
- 7. land cover mapping
- 8. cartography

1. Meteorology and Climatology

1. Demand

- weather prediction for
  - agriculture
  - forestry
  - traffic
  - urban planning

  in real time

- climate for
  - greenhouse effect (CO_2)
  - ozone layer depletion (by CFC)
  - water supply

  long term

1.2 Observation Systems

- ground

  observations of
  - temperature
  - wind
  - surface properties
  - radiation
  - precipation

  problem: interpolation between costly ground stations

- satellite

  meteorological satellites
  - Meteosat
  - NOAA
  - ERS-1

  problems:
  - extraction of required information in near real time
  - assimilation of information into forecasting schemes
  - not all parameters measurable by present systems

1.3 Capabilities of Remote Sensing

1.3.1 Thermodynamic properties of atmosphere and surface

- temperature: □ ocean to +/- $0{,}5^{O}$
  □ atmosphere(clouds) to +/- 2^{O} (problem of inversions)

- water content: □ MW sounders only in lower atmosphere
  □ multispectral measurements of cloud water in top layers

1.3.2 Atmospheric Wind Fields

- cloud motion: □ by geostationary satellites
- wind: □ back scatter lidar needed, but not feasible

1.3.3 Surface Properties

- wave height: □ ERS-1 over oceans and coastal seas
- sea ice extent
- continuous snow cover
- vegetation index: □ NOAA

1.3.4 Radiation

- vertical heat flux ■ only under clear skies to +/- 0.5 to 1°
- radiation budget ■ diurnal observartons required
  ■ hybrid models needed
  ■ (cloud base, surface temperature)

1.3.5 Precipitation

- cold cloud estimates ■ uncertain
- measurements now not possible ■ IR & MW radiometers

2. Non Renewable Resources and Geology

2.1 Demand

Mapping of
- geological stratification
- tectonics
- geomorphology
- drainage & erosion
- vegetation as indicator
- lithology
- pedology
- geochemistry
- ground water
- soil contamination
- sand transport
- hazards

problem: most exploitable resources are not directly observable (covered by soil, bedrock, vegetation)

2.2 Observation Systems

- ground
  - sampling of minerals
- aerial surveys
  - photography (interpretation)
  - aerial multispectral scanning
- satellite
  - resources satellites (Landsat, Spot, space photography)

2.3 Capabilities of Remote Sensing

- spectral information
  - can differentiate geological stratification via vegetation in range 0.5 - 0.67 μm and as stress indicator in 0.7 μm

Differentiable are

- Fe in 0,87μm
- rock surfaces in 1,6 μm
- shales,micas, carbonates in 2.0-2.5 μm
- nitrates, sulfates in 3-5 μm
- volcanism, silicates, carbonates in 8-14 μm

- textural information

  is interpretable from
  - visual images (0.5 - 0.8 μm)
  - in X-band radar (3 cm)

  surface roughness in 25 cm

- stereo information

  is useful for interpretation, drainage information

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2.4 Summary for Non-Renewable Resources and Geology

- Visual interpretation of images combined with sampling and spectral measurements in the field are the rule

- direct observations of minerals are the exception

  They are often not detected because of
  - too small areas
  - too low concentrations
  - mixtures

Nevertheless the following finds have been made by remote sensing:
- gold in Turkey
- oil in Pakistan
- sulphidic ores in Bolivia
- oil bearing rocks in Turkey
- faults for prevention of dam construction hazards

3. Hydrology and Water Management

3.1 Demand for Hydrology

- Measurement of
  - run off (temporal, spatial
  - soil moisture
  - evapotranspiration
  - rainfall
  - snow cover (yearly variations)
  - snow depth
- Development of Hydrological Models involving
  - interception, infilitration, percolation of run off
  - landuse, slope, aspect, ground state, vegetation type
  - soil moisture
- Mapping of Flood Levels

3.2 Observation Systems for Hydrology

Ground

Most parameters need to be determined by ground sampling

Satellites

Meteorological satellites, resources satellites and high resolution systems are useful for additional information

Problem: There is a gap between the obtainable and the required spatial and temporal resolution (e.g. for mapping)

3.3 Capabilities of Remote Sensing for Hydrology

- snow cover mapping
  with area differentiation of 200 km^2 for NOAA
  10 km^2 for Landsat MSS
  2.5 km^2 for Landsat TM
  is feasible

- snow depth determination
  is possible by passive MW at low resolution and in profiles by x-ray spectrometry

- melting snow is visible in X & C band radar,
  problem: topographic disturbance

3.4 Summary for Hydrology and Water Management

- snow cover mapping has become operational for the Alps and the Himalayas

- for other purposes temporal and spatial resolution of existing sensors is insufficient.

4. Forestry

4.1 Demand

type	global demand	national demand	local demand
forest cover mapping	AVHRR, TM	TM	-
forest type mapping	-	TM (7 classes) only aerial photography	aerial photogr.
forest management	-	-	aerial photogr.
forest damages	-	TM	aerial photogr.
landuse planning	-	TM	aerial photogr.
habitat studies	-	-	aerial photogr.

4.2 Observation Systems

ground	sampling
aerial sensing	aerial photography
	thermal sensing
satellites	AVHRR useful for global studies only

4.3 Capabilities of Remote Sensing for Forestry

- Satellite Remote Sensing is useful for global and coarse national inventories, not
  - all required forest types are classifiable unless multidate imagery for phenological change is used
- Preference is given to optical sensors rather than radar
- Thermal Imagery is useful for fire control
- High Spectral Resolution requirements have been overestimated

4.4 Summary for Forestry

- Aerial photogrammetry remains the most useful interpretation tool for national and local requirements
- Interpretation results are best incorporated into a GIS

5. Agriculture

5.1 Demand

- agricultural monitoring at regional level (inventories)
- control of crops

5.2 Observation Systems

- ground monitoring

slow, costly and unreliable reporting

- satellite survey area sampling

via Spot and Landsat images (ERS-1 under investigation) using automatic classification)

53 sampling sites in the CEC in 1992, processing takes 10 days

5.3 Capabilities of Remote Sensing for Agriculture

- satellite remote sensing is satisfactory for major crops (wheat)
- for olive trees, vineyards aerial photography is required
- sofar only sampling of major crops in sampling sites has been feasible (cost & availability of images
- continuous monitoring of crops via NOAA would be necessary

5.4 Summary for Agriculture

- Crop Monitoring of major crops by high resolution satellite is feasible if availability of dta is secured and the cost question is resolved. Operational use is promising.

- A GIS is required for data administration.

6. Tidal waters, Coastal Areas, Inland Waters

6.1 Demand

- Water quality
- Ecological Monitoring of Water and Land influenced by the Sea (sedimentation, erosion, flooding)

6.2 Observation Systems

- In situ
  measurements from ships
- Aerial Sensing
  aerial photography, thermal sensing, airborne SLAR
- Satellites
  NOAA, Landsat, Spot, ERS-1

6.3 Capabilities of Remote Sensing

- NOAA (North Sea) ■ sea surface temperature
  ■ suspended water
  ■ algae
- Nimbus CZCS (1978-84) fuelidity, algae
- Landsat/Spot ■ sediment, currents, erosion, geomorphology in intertidal zone
- SLAR ■ oil spills
- aerial photography ■ vegetation (false color)
  ■ DTM, flooding
- airborne laser techniques ■ water quality

6.4 Summary for Tidal Waters, Coastal Areas, Inland Waters

- Satellite remote sensing is useful for large areas (NOAA) and intermediate areas (Landsat-Spot)

- It needs to be calibrated with in situ samples
  +/- 5 mg/l suspended matter
  +/- 30 mg/l chlorophyll-algae
  +/- 1° temperature
  +/- 20 cm transparency

- Airborne techniques are in general more flexible

- Incorporation of the data into a GIS is required

7. Land Cover

7.1 Demand

Land surface data at national scales for monitoring environmental change through differences in land use. Conflicting demands on land exist from agriculture, forestry, water resources, recreation, industry, environmental quality.

The C.E.C. has initiated the CCRINE program for observation of 44 land cover classes.

7.2 Observation Systems

- Mapping
  - Maps can be several years out of date
  - Maps do not contain all required land cover classes
- Satellites
  - Landsat-TM & Spot images (multitemporal archive) and their supervised multitemporal max. likelihood classification based on field survey sites

7.3 Capabilities of Remote Sensing

- In the U.K. 60 TM quarter scenes have been used with 25 m resampled pixels
- 512 field survey sites were used
- 25 classes have been derived
- the classification accuracy is 85 to 90 % for 25 ha areas
- The inaccuracy is due to
  - mixed pixels
  - misregistration
  - differency in class definition (radio-metric versus actual)

7.4 Summary for Land Cover Mapping

- TM & Spot is operationally usable
- automatic classification is cost effective
- use of the data is possible for
  - bio-diversity
  - modelling of ecological impacts
  - estimation of pollutants
  - cell phone network planning with a DTM
  - catchment modelling
  - habitat mapping

8. Cartography

8.1 Demand:

There is a general demand for topographic maps at 1:50 000 in developing countries and at 1:25 000 for developed countries.

For the 6 settled continents 56 % of the land area are covered by 1:50 000 and 17 % by 1:25 000.

The update rate for 1:50 000 is 2.3 % per annum and 4.9 % for 1:25 000 maps and to 83.4 % with 1:25 000 maps.

The European update rate is 6.6 % for 1:50 000 and 7.5 for 1:25 000.

8.2 Observation Systems:

The standard observation method for mapping is aerial photography.

The mapping standards are:

	for 1:25 000 mapping	for 1:500 000 mapping
position accuracy	+/- 5 m	+/- 10 m
elevation accuracy	+/- 5 m	+/- 5 m
object size (detectability)	2 m	2-5 m

8.3 Capability of Remote Sensing

Satellite imagery has the following restrictions, after appropriate geometric processing:

	Landsat sat-TM	Spot-XS	Spot-P	KFA 1000
position accuracy	+/- 10 m	+/- 6 m	+/- 3 m	+/- 5 m
elevation accuracy	-	+/- 10 m stereo required with h/b = 1	+/- 5 m stereo required with h/b = 1	+/- 15 m stereo required with h/b = 1
object size	> 30 m	> 20 m	> 10 m	> 5 m

8.4 Summary for Cartography

- Only Spot-P satisfies mapping requirements for 1:50 000
- satellite mapping is marginal in performance as compared to aerial photography
- Spot-mapping is 4 times more cost effective
- it has been used in developing countries (Africa) for map updating 1:50 000

9. Conclusions

- Approach should be bottom-up, rather than top-down

- requirements are for
  - higher spatial resolution (2 m)
  - provision of stereo
  - more frequent coverage
  - integration into GIS

- remote sensing is operational in the Developing World
  - with lesser quality demands

but not yet fully in Europe

Robin - For Your Information
March 1993
Barry

esa
european space agency

EMAC 94/95

European Multi-sensor Airborne Campaign

Preliminary Announcement of Opportunity

The experience gained from these programmes is proving to be very valuable in exploiting the potential of the ERS-1 SAR data in these application areas. The plan for 1994 is to continue to work with the established SAR groups, with interest focussed on the application potential of the ASAR system planned for ENVISAT-1 (dual polarisation, phase difference and variable viewing modes), the development of polarimetric SAR techniques and integration with optical imaging spectrometer systems.

Experiment planning is still at an early stage of definition. However, multi-temporal data acquisition will be an important part of the experiment, and efforts will concentrate on a small number of test sites. Suggestions for possible test sites and collaborators in Eastern Europe are welcomed.

The main emphasis will be on the acquisition of multi-temporal, multi-frequency SAR data, but imaging spectrometer data acquisition will also be included.

2.2 Hydrology

Airborne remote sensing campaign activities are planned as part of the NOrdic hydrological-meteorological Pilot EXperiment (NOPEX) concerned with studies of areal evaporation and the interaction between land surface and atmosphere for understanding climatic processes. This is a major experiment with similar objectives to previous hydrologic-atmospheric pilot experiments (HAPEX's), such as HAPEX-MOBILHY in France (1985-87), FIFE in Kansas, USA (1987-89), EFEDA in Spain (1991) and HAPEX-SAHEL in Niger (1992). A continuation of the FIFE experiment, named BOREAS, is being planned to take place in 1993/94 within the boreal forest of north America. The main measurement period for NOPEX is to start in 1994, and this fits in well with the schedule for EMAC-94/95.

The main objectives of NOPEX are to develop an understanding of hydrological and meteorological conditions governing exchange processes on a horizontal scale of 50 - 100km sq.. Efforts will concentrate on the interaction between a forest dominated land surface and the atmosphere. The test area selected for NOPEX is located to the north-west of Uppsala, Sweden, and contains both forest and agricultural areas.

Airborne measurements of soil water, snow and forest biomass are an important part of the planned programme, with interests concentrating on the use of SAR and passive microwave instruments.

2.3 Snow and Ice

Snow and ice experiments will be carried out within the framework of Microwave Airborne Campaign on Snow and Ice (MACSI'95) programme proposed by the Helsinki University of Technology (HUT). Some links with a programme of Sea Ice experiments planned by the Technical University of Denmark (TUD) are also anticipated. The main objectives are to provide passive and

3. Candidate Instruments

3.1 SARs

Technical details of the EMISAR being developed in Denmark as part of the EARSEC initiative are provided in Appendix A. Other possible airborne SAR instruments to be used in EMAC-94/95 include:

- The ESAR operated by DLR, Germany
- The French RAMSES SAR
- The PHased Array Universal Sar (Pharus) being developed in The Netherlands
- Russian Tu-134 flying laboratory SAR
- The JPL/NASA AIRSAR
- The Canadian C/X SAR
- The Canadian Star 1

SAR operating frequencies and polarisations

Instrument	Frequencies	Polarisations
EMISAR	5.3GHz (C-band) 1.4GHz (L-band)	VV, HH, VH, HV (Full polarimetric)
ESAR	9.25Ghz (X-band) 5.3GHz (C-band) 1.4GHz (L-band)	VV, HH, VH, HV (Full polarimetric)
RAMSES	94GHz (W-band) 35GHz (Ka-band) 15GHz (Ku-band) 10GHz (X-band) 6GHz (C-band) 3GHz (S-band) 1GHz (L-band)	VV, HH, VH, HV (Full polarimetric)
Pharus	5.3GHz (C-band)	VV, HH, VH, HV (Full polarimetric)
Russian SAR	5.3GHz (C-band) VHF	HH, VV, HV, and VH
AIRSAR	5.3GHz (C-band) 1.25GHz (L-band) 0.44GHz (P-band)	HH, VV, VH, HV (Full polarimetric)
C/X SAR	5.3GHz (C-band) 9.25GHz (X-band)	VV, HH, VH, HV (Full polarimetric)
Star 1	5.3GHz (C-band)	HH

Microwave radiometer operating frequencies and polarisations.

Instrument	Frequencies	Polarisations
HUT	Profiling 6.8Ghz, 10.65GHz, 18.7GHz, 23.8GHz, 36.5GHz Imaging 90GHz	V & H
TUD	Imaging 17GHz, 34GHz	V
PORTOS	Profiling 4.9GHz, 10.6GHz, 23.6GHz, 36.6GHz	V & H (channels 1 &2) V or H (channels 3 & 4)

4. Submission of Proposals

Interested institutes and researchers are invited to submit an expression of interest to ESA and JRC, providing information under the following headings:

1. Subject of interest.
2. Experimenters (i.e. Principal and Co-Investigators).
3. Proposed test sites.
4. Instrument data requirements.
5. In-situ data collection.
6. Provisional study methodology.

This information will be used by ESA and JRC to help in defining the campaign programme in advance of an Experimenters Planning Meeting in May/June 1993. All those responding to this preliminary A.O will be informed of this meeting, together with operators of each of the instruments described in the previous section. Both measurement objectives and instrument capabilities will be considered fully at the meeting, before finalising the campaigns programme for 1994/95. A final call for EMAC-94/95 experiments will be issued following the Experimenters Planning Meeting.

Proposals should be short and concise (maximum 3 A4 pages), and submitted by 16th April 1993 to:

E.Attema

ESA/ESTEC, Postbus 299, 2200 AG Noordwijk, THE NETHERLANDS

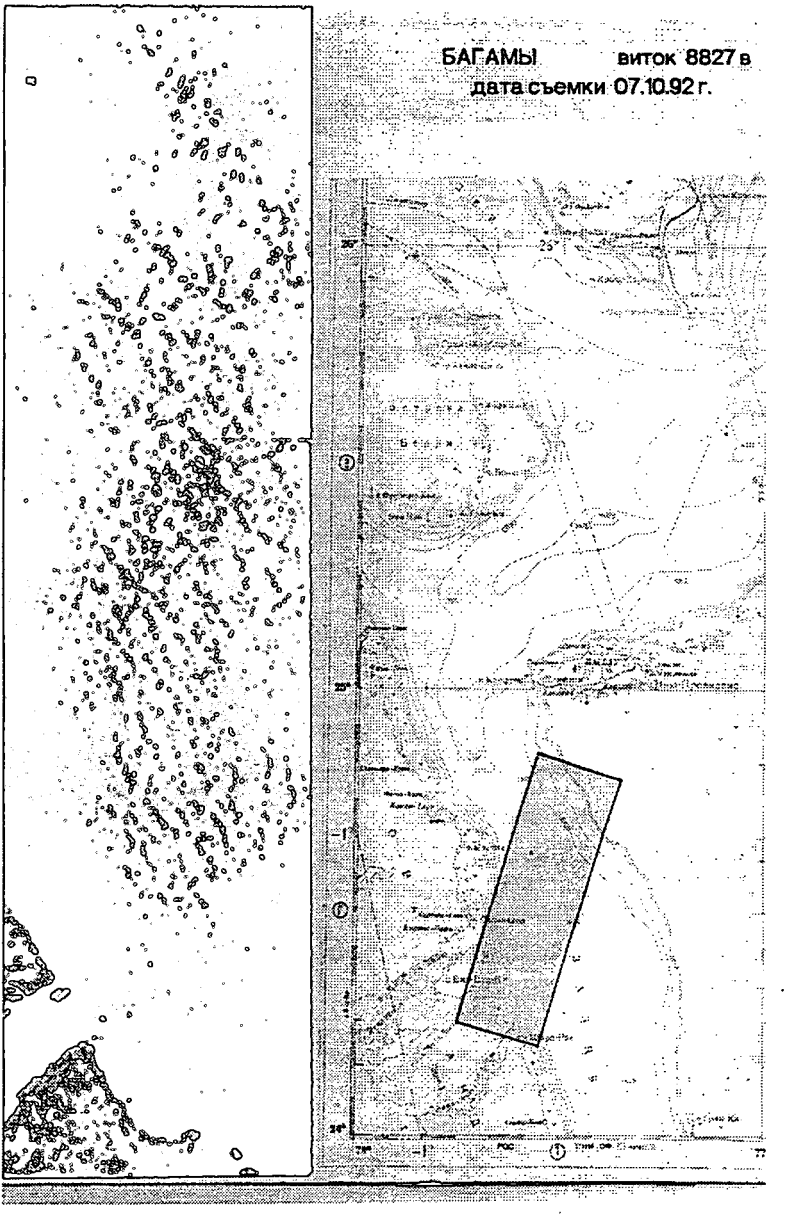
Tel: (31) 1719 84461 Fax: (31) 1719 85617

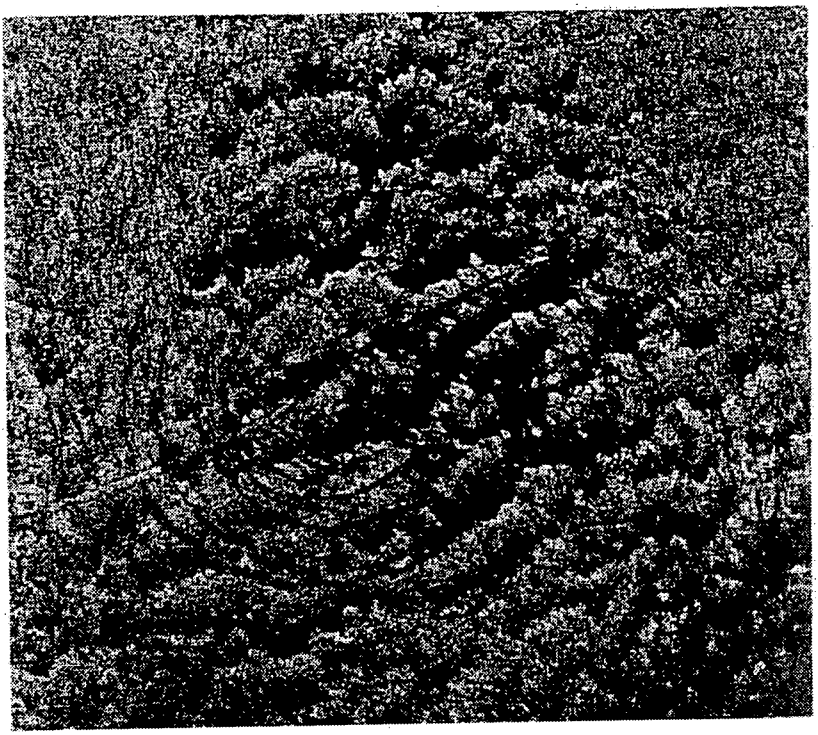
A copy of all proposals should be sent to:

A.J.Sieber

Advanced Techniques, Inst. for Remote Sensing Applications, JRC, I 21020 Ispra, ITALY

Fax: (39) 332 785469

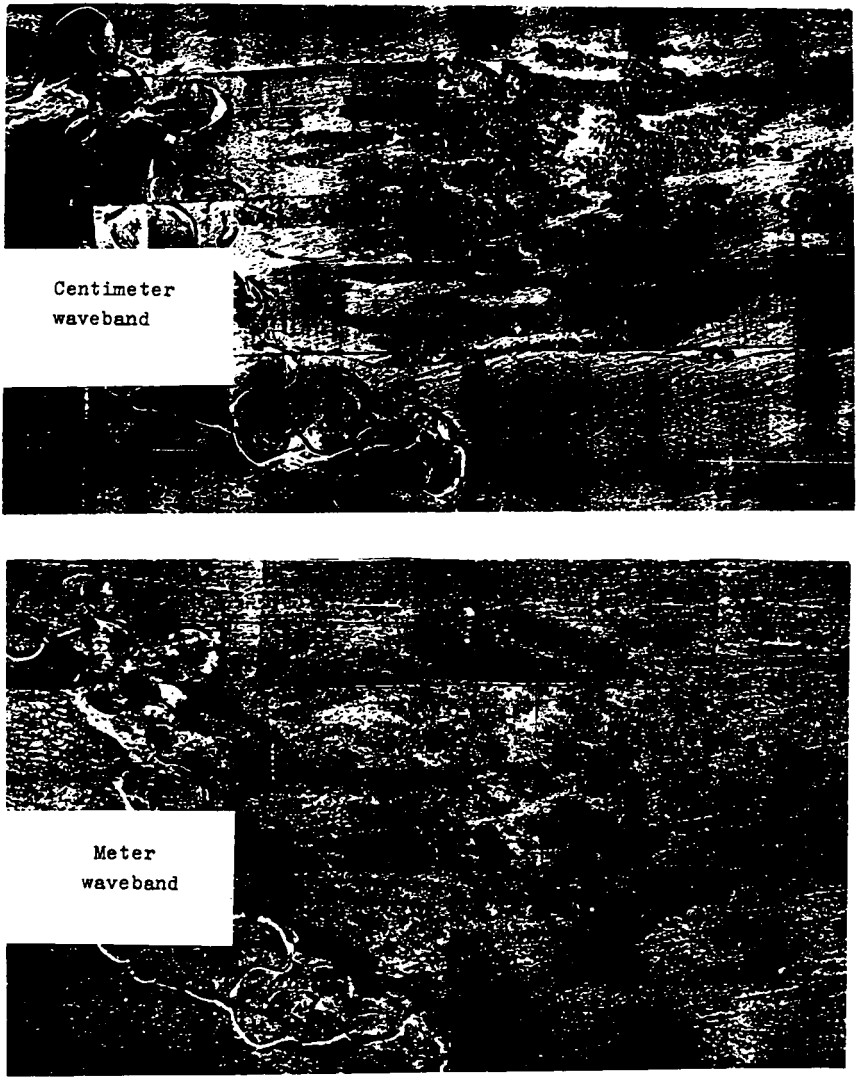

БАГАМЫ виток 8827 в
дата съемки 07.10.92 г.



ATTACHMENT 5

Figure 11

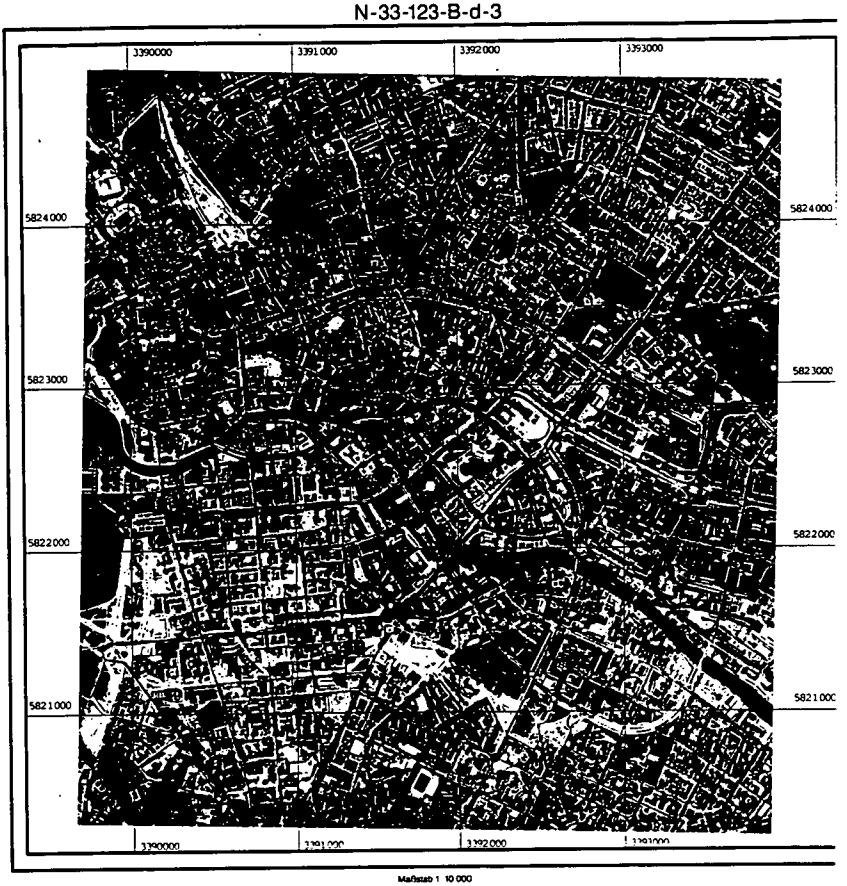
RADAR IMAGE (PHOTOSHEME) OF AN ARID AREA
(in Turkmen region)



ATTACHMENT 6

Weltraum-Orthophotokarte

Berlin-Mitte
N-33-123-B-d-3



ATTACHMENT 7

IRINA 7 095 187 6370 P.0

SPACE RESEARCH INSTITUTE

ACADEMY OF SCIENCES, RUSSIA

Applied Space Physics Department

Moscow, 117810, GSP-7, Profsoyuznaya 84/32,
FAX (7)095 333-10-56,
Phone 333-52-79, Telex 411498 STAR SU

FAX Number: 187 63 70

TO: Robin Armani, Douglas Rakenthaler

November 8,1993

Dear Robin, Dear Douglas,
According to your proposal, I send both you my comments on letter from Senat committee to Robin.
1. As you know my opinion, free market of space radar images can be used by new agressive countries like Libia, Iran or Iraq, for breaking good relation between Russia and USA.
2. Only Russia and USA have today possibility to produce all types of high resolution optical and radar imagers including resolution near 1 m. Such radar is not required for ocean, land and "oil spot" control, but it can be used for military or industrial intelligence (like US-Lacrosse satellite radar). Today Russia proposed to market black/white images with 2 m resolution, but, I think, you understand it isn't finish our possibilities.
3. According to p.p. 1,2 for "ptotecting US security interests" it is necessary to have special G-G US-RF agreement in field of cooperation for producing and using of such satellites and devices including US funding together joint "Space Monitoring Systems" from goverment and business sources (for example, according to our joint program for ISMA).
It can be first "material step" by including Russia in NATO. (Read, please, our preprint "Strategical cooperation ...").

Sincerely yours,

V.Etkin

ATTACHMENTS 8-10

Annex 6

Resolution on the Implementation of the European Long-Term Space Plan and Programmes
adopted on 10 November 1992

The Council meeting at Ministerial Level,

HAVING REGARD to ESA/C-M/XCVII/Res. 1 (Final) on the European Long-Term Space Plan 1992-2005 and programmes, adopted in Munich on 20 November 1991,

HAVING REGARD to ESA/C-M/XCVII/Res. 2 (Final) on programmes for observation of the Earth and its environment, adopted in Munich on 20 November 1991,

HAVING REGARD to the Director General's proposal for the Agency's policy and programmes (ESA/C-M(92)3), submitted in response to the instruction given by Council meeting at Ministerial Level in Munich on 19 and 20 November 1991 to achieve the best possible relationship between the requirements of cost and effectiveness, in particular through a widened and strengthened cooperation with States that have already developed advanced space technologies,

NOTING the work already done in the Agency's delegate bodies to prepare or adapt the legal instruments relating to the programmes on which decisions were called for in the above-mentioned Resolutions of Council meeting at Ministerial Level,

CHAPTER I
Long-Term Space Plan

1. ENDORSES the Director General's proposal for the Agency's policy and programmes referred to in the preamble, as a revision of the European Long-Term Space Plan 1992-2005 which constitutes the strategic framework for the Agency's activities, planning and programmes.

2. ENDORSES the introduction in the planning of the Agency's major optional programmes of a stepped approach aimed at reconciling the need to maintain continuity in the Agency's programmes and activities with the ability to respond, when needed, to the changes taking place in the overall political, financial, scientific and technological environment. This approach allows the taking of immediate decisions on developing certain programme elements and on reorientation activities over the period 1993-95, with a view to preparing for necessary complementary decisions in 1995.

3. RECOGNISES that the Director General's proposal ensures the continuity of European space policy while allowing for a gradual widening of international cooperation to the benefit of the Agency's programmes.

CHAPTER II
Decisions on Programmes called for in Resolution of Council Meeting at Ministerial Level of 20 November 1991

ENDORSES the decisions taken by the States participating in the various programmes referred to in this Chapter, which are made in accordance with the Director General's proposal for the Agency's policy and programmes (ESA/C-M(92)3) and permit the continuation and satisfactory execution of those programmes in

Annexe 6

Résolution sur la mise en oeuvre du plan spatial européen à long terme et des programmes adoptée le 10 novembre 1992

Le Conseil siégeant au niveau ministériel,

VU la Résolution ESA/C-M/XCVII/Rés. 1 (Final) sur le Plan spatial européen à long terme 1992-2005 et les programmes, adoptée à Munich le 20 novembre 1991,

VU la Résolution ESA/C-M/XCVII/Rés. 2 (Final) sur les programmes d'observation de la Terre et de son environnement, adoptée à Munich le 20 novembre 1991,

VU la proposition du Directeur général relative à la politique et aux programmes de l'Agence (ESA/C-M(92)3), soumise en réponse aux instructions données par le Conseil siégeant au niveau ministériel à Munich les 19 et 20 novembre 1991 en vue d'atteindre le meilleur rapport possible entre les impératifs de coût et d'efficacité, en particulier grâce à un élargissement et à un renforcement de la coopération avec des Etats ayant déjà développé des technologies spatiales avancées,

PRENANT NOTE des travaux déjà accomplis au sein des organes délibérants de l'Agence en vue de préparer ou d'adapter les instruments juridiques relatifs aux programmes au sujet desquels des décisions ont été demandées dans les Résolutions du Conseil siégeant au niveau ministériel précitées,

CHAPITRE I
Plan spatial à long terme

1. ENTERINE la proposition du Directeur général relative à la politique et aux programmes de l'Agence visée au preambule à titre de révision du Plan spatial européen à long terme 1992-2005 qui constitue le cadre stratégique des activités, plans et programmes de l'Agence.

2. ENTERINE l'introduction dans la planification des grands programmes facultatifs de l'Agence d'une méthode par étapes visant à concilier la nécessité de maintenir la continuité des programmes et activités de l'Agence et la capacité de réagir, en cas de besoin, aux modifications intervenant dans le contexte politique, financier, scientifique et technologique. Cette méthode permet de prendre des décisions immédiates en ce qui concerne la réalisation de certains éléments de programme et la conduite d'activités de réorientation sur la période 1993-1995, en vue de préparer les décisions complémentaires qui devront être prises en 1995.

3. RECONNAIT que la proposition du Directeur général assure la continuité de la politique spatiale européenne tout en donnant les moyens d'élargir graduellement la coopération internationale au bénéfice des programmes de l'Agence.

CHAPITRE II
Décisions relatives aux programmes appelées par les Résolutions du Conseil siégeant au niveau ministériel le 20 novembre 1991

ENTERINE les décisions prises par les Etats participant aux différents programmes visées dans le présent chapitre, lesquelles sont conformes à la proposition du Directeur général relative à

accordance with the Resolutions of Council meeting at Ministerial Level of 20 November 1991 referred to in the preamble.

WELCOMES the decisions taken at this Ministerial Meeting by the States participating in the programmes referred to in this chapter, which constitute the agreed basis for amending the Declaration applicable to each of the said programmes.

A. Programmes for Observation of the Earth and its Environment

1. NOTES the decision of the States participating in the POEM-1 programme that the work undertaken in 1992 pursuant to the decision taken on 20 November 1991 by Council meeting at Ministerial Level entails completion of phase 1 of the POEM-1 programme on 31 December 1992;

2. NOTES that the POEM-1 programme will comprise as of 1 January 1993 the two elements described below and that, in accordance with the Director General's proposal referred to in the preamble which fulfils the requirement for a report contained in Chapter III of Resolution ESA/C-M/XCVII/Res.2 (Final), both elements will use the Polar Platform developed under the Columbus programme and use the Data Relay System (DRS) for data transmission, telemetry and command:
   (1) the Envisat-1 mission planned for launch in 1998, which will be mainly dedicated to understanding and monitoring the environment and to providing radar data as a continuation of the data provided by ERS-2 through inclusion of the instruments referred to in the Director General's proposal;
   (2) the Metop-1 mission planned for launch in 2000, which will provide operational meteorological observations, to be carried out taking into account the requirements expressed by the Eumetsat Council and in accordance with the terms of an Agreement to be concluded with Eumetsat.

3. NOTES the decision of the States participating in the POEM-1 programme to execute the Envisat-1 mission with an allocated financial envelope estimated at 1134.5 MAU at mid-1991 economic conditions and the preparatory activities for the Metop-1 mission with an allocated financial envelope estimated at 40 MAU at the same economic conditions, it being understood that the corresponding envelopes will be financed in accordance with the contribution scales in Table I attached hereto, giving a total of 1174.5 MAU.

4. INVITES the States participating in the POEM-1 programme to decide before the end of 1994 to develop the Metop-1 mission on the basis of a proposal from the Director General, accompanied by a cooperation Agreement negotiated with Eumetsat; and NOTES that on current assumptions, the Agency's contribution to Metop-1 development is estimated at 625 MAU at mid-1991 economic conditions, which includes the costs of the DRS terminal.

5. WELCOMES the Resolution adopted by the Eumetsat Council at its meeting of 22-23 September 1992 confirming Eumetsat's intention to cooperate with ESA in developing a second generation of Meteosat satellites and to contribute to the Metop-1 mission. The preparatory activities for the Metop-1 mission take due account of the above resolution. The relevant parallel decisions by the Eumetsat Council on financing Eumetsat's own preparatory activities will be needed by mid-1993. Such

la politique et aux programmes de l'Agence (ESA/C-M(92)3) et permettent de poursuivre et d'exécuter lesdits programmes de façon satisfaisante en accord avec les Résolutions adoptées par le Conseil siégeant au niveau ministériel le 20 novembre 1991 visées au préambule.

ACCUEILLE FAVORABLEMENT les décisions prises au cours de la présente session ministérielle par les Etats participant aux programmes visés dans le présent chapitre, décisions qui constituent la base approuvée pour amender la Déclaration applicable à chacun desdits programmes.

A. Les programmes d'observation de la Terre et de son environnement

1. PREND NOTE de la décision des Etats participant au programme POEM-1 selon laquelle les travaux entrepris en 1992 en application de la décision prise le 20 novembre 1991 par le Conseil siégeant au niveau ministériel conduisent à l'achèvement de la phase-1 du programme POEM-1 le 31 décembre 1992;

2. NOTE que le programme POEM-1 comprendra, à partir du 1er janvier 1993, les deux éléments décrits ci-dessous et que, conformément à la proposition du Directeur général visée au préambule qui fait droit à l'obligation de faire rapport inscrite au chapitre III de la Résolution ESA/C-M/XCVII/Rés. 2 (Final), ces deux éléments utiliseront la plate-forme polaire réalisée dans le cadre du programme Columbus et le système de relais de données (DRS) pour la transmission des données, la télémesure et la télécommande:
   (1) la mission Envisat-1, dont le lancement est fixé à 1998, qui aura pour principal objet la connaissance et la surveillance de l'environnement, ainsi que la fourniture de données radar en continuité des données d'ERS-2 par l'emport des instruments visés dans la proposition du Directeur général;
   (2) la mission Métop-1, dont le lancement est fixé à l'an 2000, chargée d'observations météorologiques opérationnelles, qui sera conduite compte tenu des besoins formulés par le Conseil d'Eumetsat et conformément aux termes d'un Accord à conclure avec Eumetsat.

3. PREND NOTE de la décision des Etats participant au programme POEM-1 d'exécuter la mission Envisat-1 dans les limites d'une enveloppe financière estimée à 1134,5 MUC aux conditions économiques de la mi-1991 et les activités préparatoires de la mission Métop-1 dans les limites d'une enveloppe financière estimée à 40 MUC aux mêmes conditions économiques, ce qui aboutit à un total de 1174,5 MUC, étant entendu que les enveloppes correspondantes seront financées conformément aux barèmes des contributions figurant au tableau I ci-joint.

4. INVITE les Etats participant au programme POEM-1 à décider avant la fin de 1994 de réaliser la mission Métop-1 sur la base d'une proposition du Directeur général accompagnée d'un Accord de coopération négocié avec Eumetsat; et NOTE que, selon les hypothèses actuelles, la contribution de l'Agence à la réalisation de Métop-1 est estimée à 625 MUC aux conditions économiques de la mi-1991, coûts du terminal DRS compris.

5. ACCUEILLE FAVORABLEMENT la Résolution adoptée par le Conseil d'Eumetsat lors de sa réunion des 22 et 23 septembre

decisions by the Eumetsat Council are required in order for the Agency to decide whether the Metop-1 mission will be continued unchanged beyond 1993 or will be modified.

6. NOTES that, in accordance with the Director General's proposal referred to in the preamble, and in particular Annex 8 thereto the Envisat-1 ground segment will have recourse to both the Agency's and national facilities developed for ERS-1 and ERS-2, will take account of the ongoing phase B studies and will be further designed to provide efficient linkage with the systems being developed worldwide, and in particular in the environmental science community.

7. RECOGNISES that the Agency's activities and programmes in the field of observation of the Earth and its environment play an important role in providing suitable means for monitoring ice, oceans and the atmosphere; and RECOGNISES further that these activities and programmes contribute to a coherent and effective European Earth-observation policy, which, among other things, takes into account the uses that developing countries can make of observation data.

8. INVITES the Director General to take the initiative of consulting with European entities active in the field, in particular the Commission of the European Communities, Eumetsat, appropriate national bodies and the user communities, with a view to acquiring a solid basis for the formulation and strengthening of a European Earth-observation policy as an element of a worldwide strategy.

B. The DRS Element of the DRTM Programme

1. NOTES the decision taken by the States participating in the DRS element of the DRTM programme that the work undertaken so far, pursuant to the decision taken on 20 November 1991 by Council meeting at Ministerial Level and including tasks within the Data Relay Preparatory Programme, the Technology Mission and phase 1 of the DRS Programme Element, entails the completion of definition activities and constitutes a satisfactory basis for initiating the development of the Data-Relay System.

2. NOTES that the DRS Programme Element will comprise as of 1 January 1993 the full development of the first DRS satellite for launch in 1999 in order to meet the requirements of the Earth observation and other programmes; and INVITES the participating States to take a complementary decision in February 1995 with regard to the integration and launch of the second flight unit.

3. NOTES the decision of the States participating in the DRS element of the DRTM programme to execute the full development of the DRS system with an overall corresponding financial envelope estimated at 945 MAU at mid-1991 economic conditions (of which 199.4 MAU are the subject of the complementary decision mentioned in paragraph (2), it being understood that the corresponding envelope will be financed in accordance with the contribution scale in Table I attached hereto.

1992 qui confirme qu'Eumetsat a l'intention de coopérer avec l'ESA à la réalisation d'une deuxième génération de satellites Météosat et de contribuer à la mission Métop-1. Les activités préparatoires de la mission Métop-1 tiennent dûment compte de la Résolution précitée. Il conviendrait que le Conseil d'Eumetsat prenne d'ici la mi-1993 les décisions parallèles pertinentes ayant trait au financement des activités préparatoires propres à Eumetsat. Ces décisions doivent être prises par le Conseil d'Eumetsat pour que l'Agence puisse décider si la mission Métop-1 se poursuivra telle quelle au-delà de 1993 ou si elle sera modifiée.

6. NOTE que, conformément à la proposition du Directeur général visée au préambule, et en particulier à son annexe 8, le secteur sol d'Envisat-1 fera appel aux installations de l'Agence et aux installations nationales réalisées pour ERS-1 et ERS-2, prendra en compte les études de phase B en cours et sera en outre conçu de manière à assurer une liaison efficace avec les systèmes en cours de réalisation au niveau mondial, et en particulier dans le cadre de la communauté des spécialistes des sciences de l'environnement.

7. RECONNAIT que les activités et programmes de l'Agence dans le domaine de l'observation de la Terre et de son environnement jouent un rôle important en matière de protection de l'environnement, notamment en fournissant des moyens adaptés à la surveillance des glaces, des océans et de l'atmosphère; et RECONNAIT en outre que ces activités et programmes contribuent à la cohérence et à l'efficacité de la politique européenne d'observation de la Terre, qui tient compte, entre autres choses, de l'utilisation que les pays en développement peuvent faire des données d'observation de la Terre.

8. INVITE le Directeur général à prendre l'initiative de consulter les entités européennes actives dans ce domaine, notamment la Commission des Communautés européennes, Eumetsat, les entités nationales compétentes et les communautés d'utilisateurs, afin d'asseoir sur des bases solides l'élaboration et le renforcement d'une politique européenne d'observation de la Terre en tant qu'élément d'une stratégie mondiale.

B. L'élément DRS du programme DRTM

1. PREND NOTE de la décision des Etats participant à l'élément DRS du programme DRTM selon laquelle les travaux exécutés à ce jour, en application de la décision prise le 20 novembre 1991 par le Conseil siégeant au niveau ministériel et comprenant les tâches faisant partie du programme préparatoire de relais de données, de la mission de technologie et de la phase-1 de l'élément de programme DRS, conduisent à l'achèvement des activités de définition et constituent une base satisfaisante pour mettre en route le développement du système de relais de données.

2. NOTE que l'élément de programme DRS comprendra, à partir du 1er janvier 1993, la réalisation effective du premier satellite DRS pour qu'il puisse être lancé en 1999 en vue de satisfaire les impératifs des programmes d'observation de la Terre et d'autres programmes et INVITE les Etats participants à prendre, en février 1995, une décision complémentaire au sujet de l'intégration et du lancement de la deuxième unité de vol.

84-837 O - 95 - 4

C. The Columbus Programme

1. NOTES the decision taken by the States participating in the Columbus Programme that the work undertaken in 1992 pursuant to the decision taken on 20 November 1991 by Council meeting at Ministerial Level entails completion of Phase 1 of the Columbus Programme on 31 December 1992.

2. NOTES that the Columbus Programme will comprise as of 1 January 1993 the four elements described below:
   (1) development and launch of the Columbus Attached Laboratory, including the development of the ground segment and the conduct of operational and utilisation activities up to the launch planned for 1999;
   (2) development and launch, which is planned for 1998, and initial operations of the Columbus Polar Platform, including the ground segment necessary for its control;
   (3) execution of the Columbus precursor-flight activities to prepare for exploitation of the Columbus Attached Laboratory and to provide intermediate flight opportunities for th user community;
   (4) execution over the period 1993–95 of system studies and definition activities involving international cooperation on a future crewed in-orbit infrastructure, in order to prepare for activities to be carried out in the second planning step.

3. NOTES the decision of the States participating in the Columbus Programme to execute development of the Columbus Attached Laboratory with an allocated financial envelope estimated at 2516.8 MAU at mid-1991 economic conditions, of which 350.0 MAU are allocated to the preparation for utilisation and operation are subject to a complementary decision to be taken by a double two-thirds-majority vote of the participating States in February 1995 as indicated in Chapter III, and development of the Polar Platform with an allocated financial envelope estimated at 694.0 MAU at the same economic conditions, to proceed with execution of Columbus precursor flights, including MIR flights, with an allocated financial envelope estimated a 315.9 MAU at the same economic conditions, and the execution of studies on a future crewed in-orbit infrastructure, with an allocated financial envelope estimated at 30.0 MAU at the same economic conditions; it is further understood in that decision that the corresponding envelopes, amounting to 3556.7 MAU, will be financed with regard to activities undertaken as of 1 January 1993 in accordance with the contribution scales in Table I attached hereto.

4. INVITES the Director General to take the appropriate measures, possibly including prolongation of the development of the Columbus Attached Laboratory by a maximum of one year, so as to reconcile the requirements of the programme with the financial resources made available by the participating States, as indicated in Table I attached hereto.

5. TAKES due account of the preliminary information, provided in the Director General's proposal referred to in the preamble, on the envisaged costs and principles for sharing the costs of the exploitation programme for the Columbus Attached Laboratory and INVITES the Director General to formulate a final proposal in this regard so that a decision on the said exploitation programme can be taken in due time.

3. PREND NOTE de la décision des Etats participant à l'élément DRS du programme DRTM de mener à bien la réalisation du système de relais de données dans les limites d'une enveloppe financière globale estimée à 945 MUC aux conditions économiques de la mi-1991 (dont 199,4 MUC doivent faire l'objet de la décision complémentaire mentionnée au paragraphe 2, étant entendu que l'enveloppe correspondante sera financée conformément au barème des contributions qui figure au tableau I ci-joint.

C. Le programme Columbus

1. PREND NOTE de la décision des Etats participant au programme Columbus selon laquelle les travaux entrepris en 1992 en application de la décision prise le 20 novembre 1991 par le Conseil siégeant au niveau ministériel conduisent à l'achèvement de la phase 1 du programme Columbus le 31 décembre 1992.

2. NOTE que le programme Columbus comprendra, à partir du 1er janvier 1993, les quatre éléments décrits ci-dessous:
   (1) la réalisation et le lancement du laboratoire raccordé Columbus, y compris la réalisation du secteur sol et la conduite des activités opérationnelles et d'utilisation jusqu'au lancement prévu en 1999;
   (2) la réalisation et le lancement, prévu en 1998, ainsi que l'exploitation initiale de la plate-forme polaire Columbus, y compris le secteur sol nécessaire à la commande et au contrôle de celle-ci;
   (3) l'exécution des vols précurseurs Columbus pour préparer l'exploitation du laboratoire raccordé Columbus et fournir à la communauté des utilisateurs des occasions de vol intermédiaires;
   (4) l'exécution, au cours de la période 1993–1995, d'activités de définition et d'études système, mettant en jeu une coopération internationale sur une future infrastructure orbitale habitée, en vue de préparer les activités à exécuter dans la deuxième étape du calendrier.

3. PREND NOTE de la décision des Etats participant au programme Columbus de procéder à la réalisation du laboratoire raccordé Columbus dans les limites d'une enveloppe financière estimée à 2516,8 MUC aux conditions économique de la mi-1991, dont 350 MUC affectés à la préparation de l'utilisation et de l'exploitation feront l'objet d'une décision complémentaire que les Etats participants doivent prendre à la double majorité des deux tiers en février 1995 comme il est dit au chapitre III et à la réalisation de la plate-forme polaire dans les limites d'une enveloppe financière estimée à 694,0 MUC aux mêmes conditions économiques, à l'exécution des vols précurseurs Columbus, vols Mir compris, dans les limites d'une enveloppe financière estimée à 315,9 MUC aux mêmes conditions économiques, et à l'exécution d'études sur une future infrastructure orbitale habitée dans les limites d'une enveloppe financière estimée à 30 MUC aux mêmes conditions économiques, ce qui aboutit à un total de 3556,7 MUC; étant entendu, aux termes de cette décision, que les enveloppes correspondantes seront financées, en ce qui concerne les activités entreprises à partir du 1er janvier 1993, conformément aux barèmes des contributions qui figurent au tableau I ci-joint.

6. INVITES the States participating in the Columbus Programme to monitor closely the evolution of development of the International Space Station and to take decisions as appropriate to provide for the necessary adjustment of the programme.

7. RECOGNISES the Agency's responsibilities with regard to the selection and training of astronauts; RECALLS that the European Astronauts Centre was created with the specific responsibility of fulfilling those functions; NOTES that the costs corresponding to the Columbus Programme's requirements in this respect are covered by the said programme; and NOTES further that the role and funding of the Centre will be reviewed in 1995 in line with the complementary decisions to be taken by the end of 1995 with regard to crewed space activities.

D. The Hermes Programme

1. NOTES the decision taken by the States participating in the Hermes Programme that the work undertaken in 1992 pursuant to the decision taken on 20 November 1991 by Council meeting at Ministerial Level entails completion of Phase 1 of the Hermes Programme on 31 December 1992.

2. NOTES that the Hermes Programme, as defined in the Director General's proposal referred to in the preamble, introduces a reorientation period of three years from 1 January 1993 for the purpose of studying the following three strategic options for implementation of a future crewed transportation system:
   - cooperation with Russia
   - cooperation with the United States
   - an autonomous European scenario

   and comprises the following activities:

   (1) system studies, primarily directed towards definition of an ESA–Russian Hermes crew transportation vehicle, and development of critical technologies based on the Hermes definition, for an estimated amount of 338 MAU at mid-1991 economic conditions;
   (2) a detailed definition study for the ESA Assured Crew Return Vehicle (ACRV), as an element of cooperation with the United States relating to the International Space Station, for an estimated amount of 45 MAU at mid-1991 economic conditions;
   (3) detailed definition studies and pre-development of servicing elements, for an estimated amount of 94 MAU at mid-1991 economic conditions.

3. NOTES the decision of the States participating in the Hermes Programme to execute the programme reorientation activities with an overall corresponding financial envelope estimated at 567 MAU at mid-1991 economic conditions, including 90 MAU for commitments made during Phase 1 of the programme, it being understood that the corresponding envelope will be financed with regard to activities undertaken as of 1 January 1993 in accordance with the overall contribution scale in Table I attached hereto and that the Participating States' contributions will be called up in accordance with the separate contribution scales correspondimg to the activities described under Section 2 above.

4. INVITE le Directeur général à prendre les mesures appropriées comprenant éventuellement la prolongation d'un an au maximum de la réalisation du laboratoire raccordé Columbus afin de concilier les impératifs du programme avec les ressources financières mises à disposition par les Etats participants selon le tableau I ci-joint.

5. PREND bonne note des premières informations fournies dans la proposition du Directeur général visée au préambule sur les coûts envisagés et sur les principes de partage des coûts du programme d'exploitation du laboratoire raccordé Columbus et INVITE le Directeur général à formuler une proposition finale en ce sens afin qu'une décision sur ledit programme d'exploitation puisse être prise en temps opportun.

6. INVITE les Etats participant au programme Columbus à suivre de près la façon dont se déroule le développement de la Station spatiale internationale et, le cas échéant, à prendre des décisions sur les ajustements à apporter au programme.

7. RECONNAIT à l'Agence la responsabilité de la sélection et de la formation des astronautes; RAPPELLE que le Centre des astronautes européens a été créé spécifiquement pour assumer ces fonctions; NOTE que les coûts correspondant au besoins du programme Columbus à cet égard sont couverts par ledit programme; et NOTE en outre que le rôle et le financement de ce Centre seront réexaminés en 1995 en fonction des décisions complémentaires à prendre avant la fin de 1995 au sujet des activités spatiales avec équipage.

D. Le programme Hermes

1. PREND NOTE de la décision des Etats participant au programme Hermes selon laquelle les travaux entrepris en 1992 en application de la décision prise le 20 novembre 1991 par le Conseil siégeant au niveau ministériel conduisent à l'achèvement de la phase-1 du programme Hermes le 31 décembre 1992.

2. NOTE que le programme Hermes, tel qu'il est défini dans la proposition du Directeur général visée au préambule, prévoit, à partir du 1er janvier 1993, une réorientation d'une durée de trois ans en vue d'étudier les trois options stratégiques suivantes pour la mise en oeuvre d'un futur système de transport avec équipage:
   - coopération avec la Russie
   - coopération avec les Etats-Unis
   - scénario européen autonome

   et porte sur les activités suivantes:

   (1) études système axées principalement sur la définition d'un véhicule de transport d'équipage Hermes ESA–Russie et mise au point de technologies critiques basées sur la définition d'Hermes, pour un montant estimé à 338 MUC aux conditions économiques de la mi-1991;

   (2) étude de définition détaillée du véhicule de secours pour le retour de l'équipage (ACRV) de l'ESA en tant qu'élément réalisé dans le cadre de la coopération avec les Etats-Unis au sujet de la Station spatiale internationale pour un mon tant estimé à 45 MUC aux conditions économiques de la mi-1991;

4. INVITES the States participating in the Hermes Programme to include in the corresponding Declaration suitable provisions for the decisions to be taken on the development of the crewed transport system and the servicing elements selected in the course of the three-year reorientation period from 1993 to 1995, and INVITES the Director General to prepare a final proposal as a basis for the required complementary decisions in 1995.

CHAPTER III
Review of the In-Orbit Infrastructure Programmes: Columbus Attached Laboratory, DRS, Hermes

1. AGREES to proceed in February 1995 to a review of the infrastructure programmes referred to in Chapter II above, on the basis of a report of the Director General concerning the status of their execution and the results of the negotiations he will have conducted with international partners.

2. HAVING REGARD to the Intergovernmental Agreement and the Memorandum of Understanding concluded on the International Space Station, INVITES the Director General to negotiate with NASA the terms of an agreement on the allocation of the exploitation costs of the International Space Station which will satisfy the following requirements:
   - a commitment by NASA that the Agency contribution to the Space Station annual common system operations costs will remain under a firm fixed financial ceiling;
   - a commitment by NASA to the effect that a significant portion of the said Agency's contribution shall be made through the provision of goods and service in kind, such as the Assured Crew Return Vehicle (ACRV), the Automated Transfer Vehicle (ATV) using the Ariane launcher and the Data Relay System (DRS), so as to minimise the exchange of funds.

3. INVITES the States participating in the Columbus Attached Laboratory element of the Columbus Programme to decide, by a two-thirds majority representing at least two-thirds of the contributions to the programme, the unblocking of the amount of 350 MAU, earmarked for preparation of utilisation and operations, referred to in Section 3 of Chapter IIC.

4. INVITES the Member States to agree, on the basis of a proposal of the Director General, principles for the financing of the exploitation costs of the Columbus Attached Laboratory.

5. INVITES the Director General to negotiate with Russia the terms of an agreement on the joint development of a crewed space transportation system and to report on the status of these negotiations to the Participating States concerned in time for the review referred to in Section 1 above.

6. INVITES the States participating in the Hermes Programme to determine, on the basis of this report, if the terms and conditions negotiated respectively with Russia and the United States permit the decision to be made on the options identified in Section 2 of Chapter IID.

7. INVITES the States participating in the DRS Programme Element to decide, by a two-thirds majority representing at least two-thirds of the contributions to the programme, the integration of the second flight unit, and to decide the launch of the said unit by a unanimous vote, as referred to in Section 2 of Chapter IIB.

(3) études de définition détaillée et travaux de prédéveloppement portant sur des éléments de desserte pour un montant estimé à 94 MUC aux conditions économiques de la mi-1991.

3. PREND NOTE de la décision des Etats participant au programme Hermes d'exécuter les activités de réorientation du programme dans les limites d'une enveloppe financière globale correspondante estimée à 567 MUC aux conditions économiques de la mi-1991, ce chiffre comprenant une somme de 90 MUC pour les engagements pris au cours de la phase 1 du programme, étant entendu que l'enveloppe correspondante sera financée, en ce qui concerne les activités entreprises à partir du 1er janvier 1993, conformément au barème général de contributions qui figure au tableau I ci-joint et que les contributions des Etats participants seront appelées conformément aux barèmes de contributions distincts correspondant aux activités décrites au paragraphe 2 ci-dessus.

4. INVITE les Etats participant au programme Hermes à inclure dans la Déclaration correspondante des dispositions adéquates au sujet des décisions à prendre sur le développement du système de transport avec équipage et des éléments de desserte choisis au cours de la période de réorientation de trois ans de 1993 à 1995; et INVITE le Directeur général à préparer une proposition finale devant servir de base aux décisions complémentaires à prendre en 1995.

CHAPITRE III
Examen des programmes d'infrastructure orbitale: laboratoire raccordé Columbus, DRS, Hermes

1. CONVIENT de procéder en février 1995 à un examen des programmes d'infrastructure visés au chapitre II ci-dessus, sur la base d'un rapport du Directeur général relatif à l'état d'avancement de leur exécution et aux résultats des négociations qu'il aura conduites avec les partenaires internationaux.

2. VU l'Accord intergouvernemental et le Mémorandum d'Accord conclus sur la Station spatiale internationale, INVITE le Directeur général à négocier avec la NASA les termes d'un accord relatif à une affectation des coûts d'exploitation de la Station spatiale internationale propre à répondre aux impératifs suivants:
   - engagement de la NASA aux termes duquel la contribution de l'Agence aux coûts communs annuels d'exploitation des systèmes de la Station spatiale restera en-deçà d'un plafond financier forfaitaire définitif;
   - engagement de la NASA conduisant à ce qu'une part significative de ladite contribution de l'Agence soit apportée sous la forme de biens et de services fournis en nature tels que le véhicule de secours pour le retour de l'équipage (ACRV), le véhicule de transfert automatique (ATV) faisant appel au lanceur Ariane et le système de relais de données (DRS), afin de réduire au minimum les échanges de fonds.

3. INVITE les Etats participant à l'élément laboratoire raccordé Columbus du programme Columbus à décider, à une majorité des deux tiers représentant au moins deux tiers des contributions au programme, le déblocage du montant de 350 MU visé au point 3 du chapitre IIC, réservé à la préparation, à l'utilisation et de l'exploitation.

CHAPTER IV
Other Programmes

STRESSING the need to explore with Member States ways in which the development and launching of small satellites could contribute to fulfilment of the objectives outlined in the Long-Term Space Plan with regard to all the sectors of space activities referred to in this chapter,

CONSIDERING that the private sector involvement in the utilisation of available resources, and in financing and operating responsibilities, is to be encouraged,

A. Science Programme

REAFFIRMS its support for the Science Programme and for full and timely implementation of the Horizon 2000 Programme, in accordance with the provisions of Resolution ESA/C/XCIII/Res.2 (Final) of 13 December 1990 and RECOGNISES that the Horizon 2000 programme, by furthering understanding of the Universe through space astronomy and in-situ exploration of the solar system, is the key element in implementing European space science policy; and INVITES the Director General to submit in 1995, taking account of scientific, technical and political developments and after consultation with the scientific community, a plan for the continuing implementation of European space science policy.

B. Earth-Observation Programmes

1. RECOGNISES the need to start the Meteosat Second Generation Programme in 1993 on the basis of the Director General's programme proposal, taking into account the terms of the agreement to be concluded concerning Eumetsat's participation, and INVITES interested Member States to establish the necessary legal instruments.

2. INVITES the Director General to submit in 1993 to Member States a programme proposal concerning an Earth observation data user programme.

3. RECALLS the interest expressed by the scientific community in the Aristoteles programme as described in the Long-Term Space Plan and RECOGNISES the need to continue minimum activities to allow for execution of the said programme.

C. Microgravity Programme

AGREES that the States participating in the Microgravity Programme shall proceed with the reorganisation of the said programme to include the following two elements:

(a) a basic microgravity research programme (EMIR) dedicated to scientific use of the microgravity environment;
(b) a programme to develop the facilities required for microgravity experiments to be carried out in the Columbus Attached Laboratory.

4. INVITE les Etats membres à convenir, sur la base d'une proposition du Directeur général, de principes relatifs au financement des coûts d'exploitation du laboratoire raccordé Columbus.

5. INVITE le Directeur général à négocier avec la Russie les termes d'un accord relatif à la réalisation en commun d'un système de transport spatial habité et à rendre compte aux Etats participants intéressés de l'état d'avancement de ces négociations en temps voulu pour l'examen visé au point 1 ci-dessus.

6. INVITE les Etats participant au programme Hermes à vérifier, sur la base de ce rapport, si les conditions négociées respectivement avec la Russie et les Etats-Unis permettent de prendre une décision sur les options mentionnées au point 2 du chapitre IID.

7. INVITE les Etats participant à l'élément de programme DRS à décider, à une majorité des deux tiers représentant au moins deux tiers des contributions au programme, de l'intégration et du lancement de la deuxième unité de vol, et à décider du lancement de ladite unité par un vote à l'unanimité, comme il est dit au point 2 du chapitre IIB.

CHAPITRE IV
Autres programmes

SOULIGNANT la nécessité de rechercher avec les Etats membres par quels moyens la réalisation et le lancement de petits satellites pourraient contribuer à atteindre les objectifs exposés dans le plan spatial à long terme pour tous les secteurs des activités spatiales visés au présent chapitre,

CONSIDERANT qu'il convient d'encourager la participation du secteur privé à l'utilisation des ressources disponibles ainsi qu'à l'exercice de responsabilités en matière de financement et d'exploitation,

A. Programme scientifique

REAFFIRME son soutien au programme scientifique et à la mise en oeuvre, en temps opportun, de l'intégralité du programme Horizon 2000 conformément aux dispositions de la Résolution ESA/C/XCIII/Rés. 2 (Final) du 13 décembre 1990, et RECONNAIT que le programme Horizon 2000, parce qu'il améliore notre connaissance de l'univers par l'astronomie spatiale et l'exploration in situ du système solaire, est l'élément clé de la mise en oeuvre de la politique européenne en matière de science spatiale, et INVITE le Directeur général à soumettre en 1995, compte tenu du contexte scientifique, technique et politique, et après consultation de la communauté scientifique, un plan ayant pour objet la poursuite de la mise en oeuvre de la politique européenne en matière de science spatiale.

B. Programmes d'observation de la Terre

1. RECONNAIT la nécessité de mettre en route en 1993 le programme Météosat de deuxième génération sur la base de la proposition de programme du Directeur général, compte tenu des termes de l'accord à conclure au sujet de la participation d'Eumetsat, et INVITE les Etats membres intéressés a établir les instruments juridiques nécessaires.

D. Telecommunications Programme

1. AGREES the principle of continuing the activities previously undertaken within the Payload and Spacecraft Development and Experiments (PSDE) Programme and the Advanced Systems and Technology Programme (ASTP); NOTES the findings of the Agency's working group on satellite telecommunications policy, which stress the far-reaching implications for European industry of the European Commission's plan for deregulation in this economic sector; and CALLS for close consultation with operators, regulatory authorities and industry in order to implement a consistent policy for improving the competitiveness of the European telecommunications industry.

2. NOTES the strategy described in the Director General's proposal referred to in the preamble, which seeks to achieve greater coherence in the Agency's telecommunications activities and to merge as far as possible programmes and activities referred to in Paragraph 1 within a unified programme on Advanced Research in Telecommunications Systems (ARTES); INVITES the interested States to establish the necessary legal instruments and to indicate as soon as possible their level of participation.

E. Launcher Programmes

1. RECOGNISES the need for continuous research and technology accompaniment activities during the operational lifetime of the Ariane launchers, so as to ensure their technical reliability and performance, as a responsibility shared between the design authority and industry, and WELCOMES the Director General's proposals in this respect; and AGREES in principle to set up before the end of 1995 the programmes necessary for ensuring an orderly transition from Ariane-4 to Ariane-5, as well as those which are required to permit further evolution of the Ariane-5 launcher's capabilities.

2. RECOGNISES that the Guiana Space Centre (CSG) is an essential element in the Agency's strategy and EXPRESSES its willingness to continue to build on the experience gained from exploitation of the CSG for the benefit of the Agency's programmes;
RECALLING the report presented to Council by the Director General on 8 November 1992 on the present status of the discussions held with CNES on the execution of the CSG activities beyond 1992, INVITES the Directors General of the Agency and of CNES to finalise the terms of an agreement on the continued funding of the CSG beyond 1992 and submit it to the Agency's relevant bodies with a view to early approval by Council at Delegate Level.

3. INVITES the Member States to pursue their efforts to define the Future European Space Transportation Investigation Programme (FESTIP) so that a decision on its start-up can be taken as soon as possible.

d'Eumetsat, et INVITE les Etats membres intéressés à établir les instruments juridiques nécessaires.

2. INVITE le Directeur général à soumettre aux Etats membres en 1993 une proposition de programme relative à un programme pour les utilisateurs de données d'observation de la Terre.

3. RAPPELLE l'intérêt manifesté par la communauté scientifique à l'égard du programme Aristoteles, tel qu'il est présenté dans le Plan spatial à long terme et RECONNAIT la nécessité de poursuivre un minimum d'activités en vue de permettre l'exécution dudit programme.

C. Programme de recherche en microgravité

CONVIENT que les Etats participant au Programme de recherche en microgravité procéderont à la restructuration de ce programme afin d'y inclure les deux éléments suivants:
(a) un programme de recherche fondamentale en microgravité (EMIR) axé sur l'utilisation scientifique des conditions de quasi-impesanteur;
(b) un programme ayant pour objet de réaliser les équipements nécessaires aux expériences en microgravité à mener à bord du laboratoire raccordé Columbus.

D. Programme de télécommunications

1. APPROUVE le principe d'une poursuite des activités déjà entreprises dans le cadre du programme de développement et d'expérimentation de charges utiles et de véhicules spatiaux (PSDE) et du programme de systèmes et de technologies de pointe (ASTP); PREND NOTE des conclusions du Groupe de travail ESA sur la politique de télécommunications par satellite qui soulignent l'étendue des conséquences pour l'industrie européenne du projet de déréglementation de la Commission des communautés européennes dans ce secteur économique; et DEMANDE une concertation étroite avec les exploitants, les autorités réglementaires et l'industrie afin de mettre en oeuvre une politique cohérente visant à améliorer la compétitivité de l'industrie des télécommunications européenne.

2. PREND NOTE de la stratégie exposée dans la proposition du Directeur général visée au préambule, visant à renforcer la cohérence des activités de l'Agence en matière de télécommunications et à fusionner, dans la mesure du possible, les programmes et activités visés au paragraphe 1 dans le cadre d'un programme unique de recherche de pointe sur les systèmes de télécommunications (ARTES); INVITE les Etats intéressés à établir les instruments juridiques nécessaires et à faire connaitre dès que possible le niveau de leur participation.

E. Programmes de lanceurs

1. RECONNAIT la nécessité de mener sans interruption des activités d'accompagnement de recherche et de technologie pendant la durée de vie opérationnelle des lanceurs Ariane de manière à garantir leur capacité d'emport et leur fiabilité technique au titre d'une responsabilité partagée par l'autorité de conception et l'industrie, et ACCUEILLE FAVORABLEMENT les propositions soumises à cet égard par le Directeur général; et, de plus, CONVIENT en principe d'instaurer avant la fin de 1995 les programmes propres à assurer un transition méthodique entre Ariane-4 et Ariane-5 ainsi que les programmes

F. Technology

WELCOMES the approval by Council at its 103rd Meeting of the Resolution on the General Support Technology Programme (GSTP), ESA/C/CIII/Res. 1 (Final), and INVITES Member States to subscribe expeditiously to the corresponding programme Declaration.

CHAPTER V
European Launcher Policy

WHEREAS the Ariane launcher developed by the Agency is a strategic asset providing Europe with autonomous access to space and must be preserved as a vital component of European space policy and of the Long-Term Space Plan,

1. REAFFIRMS the principles of European space launcher policy laid down in Resolution ESA/C/CIII/Res. 2 (Final), adopted on 23 October 1992.

2. INVITES the Member States to implement the principle of granting preference to the Ariane launcher for their own missions and those of European and international bodies in which they participate in accordance with the provisions of the Declaration on the production phase renewed on 21 May 1992 and to encourage the satellite operators, which they have entrusted with the task of meeting the needs of the general public in fields such as telecommunications, also to grant preference to the Ariane launcher.

3. INVITES the Director General to submit proposals designed to further the principle of European preferential use of the Ariane launchers.

4. INVITES the Director General to contribute in close cooperation with both the Member States and the competent bodies of European Communities, to the conclusion of an agreement, or other form of terms and conditions, with the governments of other space-faring nations to ensure fair conditions in the launcher market.

CHAPTER VI
Industrial Policy

RECALLING the objectives of the Agency's industrial policy as set out in Article VII of the Convention, namely to meet the requirements of the European space programme in a cost-effective manner, to improve the worldwide competitiveness of European industry, to ensure that all Member States participate in an equitable manner in implementing the European space programme, and to exploit the advantages of free competitive bidding,

1. CONSIDERING the industrial impact of the reorientation called for in the Director General's proposal, DECIDES that the lower limit for the cumulative return coefficient referred to in Article IV.6 of Annex V to the Convention, below which special measures are to be taken in accordance with Article V of that Annex, be maintained at 0.95 for the present three-year period (1991–93) and be fixed at 0.96 for the following period (1994–96), it being understood that the objective continues to be to achieve an overall return coefficient as near as possible to the ideal value of 1 for all countries.

nécessaires à l'évolution ultérieure des capacités du lanceur Ariane-5.

2. RECONNAIT que le Centre spatial guyanais (CSG) est un élément essentiel de la stratégie de l'Agence et EXPRIME sa volonté de continuer à tirer parti de l'expérience acquise dans le cadre de l'exploitation du CSG au bénéfice des programmes de l'Agence.

   RAPPELANT le rapport présenté au Conseil par le Directeur général le 8 novembre 1992, qui fait le point des discussions conduites avec le CNES au sujet de l'exécution des activités du CSG au delà de 1992, INVITE les Directeurs généraux de l'Agence et du CNES à arrêter les modalités d'un accord relatif à la poursuite du financement du CSG au-delà de 1992 et à soumettre cet accord aux organes compétents de l'Agence en vue de son approbation rapide par le Conseil au niveau des délégués.

3. INVITE les Etats membres à poursuivre leur action visant à définir le programme européen de recherche appliquée sur les futurs systèmes de transport spatial (FESTIP) afin qu'une décision sur sa mise en route puisse être prise le plus tôt possible.

F. Technologie

ACCUEILLE FAVORABLEMENT l'approbation par le Conseil, lors de sa 103ème session, de la Résolution habilitante relative au programme général de technologie de soutien (GSTP), ESA/C/CIII/Rés.1 (Final), et INVITE les Etats membres à souscrire rapidement à la Déclaration de programme correspondante.

CHAPITRE V
Politique en matière de lanceurs européens

CONSIDERANT que l'Europe dispose, avec le lanceur Ariane réalisé par l'Agence, d'un atout stratégique pour un accès autonome à l'espace et que ce lanceur doit rester un élément essentiel de la politique spatiale européenne et du Plan spatial à long terme,

1. REAFFIRME les principes de la politique européenne en matière de lanceurs énoncés dans la Résolution ESA/C/CIII/Rés. 2 (Final), adoptée le 23 octobre 1992.

2. INVITE les Etats membres à appliquer, conformément aux dispositions de la Déclaration relative à la phase de production, renouvelée le 21 mai 1992, le principe consistant à se servir en priorité du lanceur Ariane pour la conduite de leurs propres missions et des missions d'organismes européens ou internationaux auxquelles ils participent et à encourager les exploitants de satellites à qui ils ont confié la mission de répondre aux besoins du grand public dans des domaines comme celui des télécommunications, à accorder également la préférence au lanceur Ariane.

3. INVITE le Directeur général à soumettre des propositions visant à promouvoir le principe de la préférence européenne pour l'utilisation des lanceurs Ariane.

4. INVITE le Directeur général à contribuer, en collaboration étroite avec les Etats membres et les organes compétents des Communautés européennes, à la conclusion avec les

2. REAFFIRMS the guidelines and measures concerning the Agency's industrial policy which were decided upon by Council meeting at Ministrial Level in The Hague in 1987 and in Munich in 1991, INVITES the Director General, in consultation with Member States, to further evaluate and formulate proposals in this respect, in particular proposals to minimise the overall surplus and deficit situations, in order to allow the Industrial Policy Committee and Council to take the appropriate decisions and STRESSES that, when establishing and implementing procedures for fulfilling industrial policy objectives, the particular situation of each Member State's industrial infrastructure shall be given due consideration.

3. INVITES States participating in the Columbus and Hermes Programmes to insert in the relevant programme Declarations provisions allowing for the application of the appropriate measures to correct imbalances recorded in the programmes at the end of 1992, bearing in mind the provisions of Section 1 above with regard to the cumulative return coefficient, and ensuring that all Participating States have a guaranteed return coefficient of 0.9 at programme completion.

CHAPTER VII
General Provisions

NOTING with satisfaction the statements made by Delegations at the present Council Meeting regarding their participation in the programmes referred to in Chapter II, together with the scales of contributions in Table I attached hereto,

WHEREAS it is essential to take measures at an early date that will ensure programmatic and financial continuity in the execution of the Agency's programmes,

RECALLING that the present Resolution introduces a reorientation period for the purpose of evaluating new opportunities for international cooperation and preparing for the adoption, before the end of 1995, of complementary decisions that will be needed to ensure satisfactory execution of a number of the Agency's optional programmes,

A. Transitional Measures

1. URGES the States participating in the programmes referred to in Chapter II to adopt, by the end of 1992, the corresponding 1993 budgets on the basis of the present Resolution, which shall thus constitute the legal basis for their adoption and execution until adoption of the corresponding amended programme Declarations, using the financial envelopes and scales of contributions contained in this Resolution.

2. INVITES the States participating in the programmes concerned to complete their revision of the corresponding Declarations by 31 March 1993 at the latest on the basis of this Resolution so as to ensure the necessary continuity of the said programmes.

3. AUTHORISES the Director General to take without delay the action needed to begin implementation of each of the programmes concerned, while taking care not to commit the Agency beyond 1993 budgets as long as the corresponding Declaration referred to in Section 2 above is not finalised and entered into force.

gouvernements d'autres puissances spatiales d'un accord ou autre forme d'arrangement garantissant des conditions équitables sur le marché des lanceurs.

CHAPITRE VI
Politique industrielle

RAPPELANT les objectifs de l'Agence en matière de politique industrielle énoncés à l'article VII de la Convention, à savoir répondre aux besoins du programme spatial européen d'une manière économiquement efficiente, améliorer la compétitivité de l'industrie européenne dans le monde, garantir que tous les Etats membres participent de façon équitable à la mise en oeuvre du programme spatial européen, et bénéficier des avantages de l'appel à la concurrence,

1. CONSIDERANT les conséquences pour l'industrie de la réorientation demandée dans la proposition du Directeur général, DECIDE que la limite inférieure du coefficient de retour cumulé mentionnée à l'article IV, paragraphe 6 de l'Annexe V de la Convention, en deçà de laquelle des mesures spéciales doivent être prises en application de l'article V de ladite Annexe, sera maintenue à 0,95 pour la période triennale actuelle (1991–1993) et sera fixée à 0,96 pour la période suivante (1994–1996), étant entendu que l'objectif visé demeure de faire bénéficier tous les pays d'un coefficient de retour aussi proche que possible de la valeur idéale égale à l'unité.

2. REAFFIRME les lignes directrices et les mesures relatives à la politique industrielle de l'Agence, qui ont été arrêtées par le Conseil siégeant au niveau ministériel à La Haye en 1987 et à Munich en 1991; INVITE le Directeur général à poursuivre en concertation avec les Etats membres l'évaluation et la formulation de propositions allant dans ce sens, et en particulier de propositions tendant à réduire au maximum les situations d'excédent ou de déficit global, afin de permettre au Comité de la politique industrielle et au Conseil de prendre les décisions appropriées; et SOULIGNE que lors de l'établissement et de la mise en oeuvre des procédures visant à atteindre les objectifs de politique industrielle, il sera tenu dûment compte de la situation particulière de l'infrastructure industrielle de chacun des Etats membres.

3. INVITE les Etats participant aux programmes Columbus et Hermes à insérer, dans les Déclarations de programme correspondantes, des dispositions prévoyant les mesures spécifiques à appliquer pour corriger les déséquilibres enregistrés dans ces programmes à la fin de 1992, en tenant compte des dispositions du paragraphe 1 ci-dessus relatives au coefficient de retour cumulé et garantissant à tous les Etats participants un coefficient de retour de 0,9 à l'achèvement du programme.

CHAPITRE VII
Dispositions générales

PRENANT NOTE avec satisfaction des déclarations faites par les Délégations à la présente session du Conseil au sujet de leur participation aux programmes visés au Chapitre II ainsi que des barèmes de contributions figurant au tableau I ci-joint,

CONSIDERANT qu'il est indispensable de prendre à une date proche des mesures garantissant, au niveau programmatique et financier, la continuité d'exécution des programmes de l'Agence,

B. Other General Provisions

1. INVITES the Director General to implement the provisions of his proposal referred to in the preamble pertaining to the Agency's ground infrastructure and to pursue the definition of that infrastructure, making the best use of existing facilities and available services of the Agency and of Member States as a first priority, and of those of the Associate Member and Cooperating States in accordance with the applicable arrangements; and further INVITES the Director General to formulate proposals in due course with a view to establishing the basis for any decisions that may be required in this respect, including the complementary decisions to be taken by the end of 1995.

2. RECOGNISES that the size and importance of the major optional programmes together with the budgetary constraints experienced by Member States call for further efforts in improving the management of these programmes; DECIDES to set up a Council Working Group to examine proposals for improving the supply of information to Participating States concerning the execution of the said programmes and for handling any structural deficits that may arise in their financial coverage; the working group shall also examine proposals aiming at reconciling the budgetary planning of Member States with the efficient and timely execution of these programmes with a view, in particular, to accommodating those Member States that need to contain their annual contributions within predetermined financial limits; REQUESTS the working group to submit its findings to Council before 28 February 1993; INVITES the States participating in the programmes concerned to incorporate in the corresponding Declarations the measures adopted by Council, taking into account the specific features of each programme; AGREES that the process described above shall not prejudge the finalisation and entry into force of the said Declarations pursuant to Section A2 above.

3. RECOGNISES that the existing system of the Agency to adjust contributions for variations in conversion rates should be modified in order to cope with monetary fluctuations more effectively; AGREES to decide at its next session at delegate level in December 1992 on interim measures to address the effects in 1992 and 1993 of the recent monetary fluctuations until a fully modified system and its adoption procedures have been agreed upon; and INVITES the Director General to make a proposal to the said Council session, taking due note of the views expressed during this session, and which shall be based in particular on the following alternative solutions already described, among others, in document ESA/C(92)92:
   - in the first instance, to apply the retroactive adjustment to a State's contributions only to the extent that amounts are not actually spent in the State concerned.
   - to apply a 50% abatement on adjustments of contributions both on the payments to the Agency as well as on reimbursement by the Agency;

   DECIDES to set up a Council Working Group in order to report before the end of 1993 with a view to proposing a reform of the Agency's adjustments mechanism towards a more complete and equitable system.

RAPPELANT que la présente Résolution instaure une période de réorientation ayant pour objet d'évaluer de nouvelles possibilités de coopération internationale et de mener des activités préparatoires en vue d'adopter, avant la fin de 1995, les décisions complémentaires nécessaires pour garantir la bonne exécution d'un certain nombre de programmes facultatifs de l'Agence,

A. Mesures transitoires

1. INVITE INSTAMMENT les Etats participant aux programmes visés au Chapitre II à adopter, avant la fin de 1992, les budgets 1993 correspondants sur la base de la présente Résolution, qui constituera donc le fondement juridique de leur adoption et de leur exécution jusqu'à l'adoption des Déclarations de programme amendées correspondantes, et ce en utilisant les enveloppes financières et les barèmes de contributions figurant dans la présente Résolution.

2. INVITE les Etats participant aux programmes en cause à procéder le 31 mars 1993 au plus tard à la révision des Déclarations correspondantes sur la base de la présente Résolution, de façon à garantir la continuité indispensable desdits programmes.

3. AUTORISE le Directeur général à prendre sans tarder les mesures nécessaires pour mettre en route l'exécution de chaque programme concerné tout en prenant soin de ne pas engager l'Agence au-delà des budgets de 1993 tant que la déclaration correspondante, visée au point 2 ci-dessus, n'aura pas été définitivement arrêtée et ne sera pas entrée en vigueur.

B. Autres dispositions générales

1. INVITE le Directeur général à mettre en oeuvre les dispositions de sa proposition visée au préambule relatives à l'infrastructure sol de l'Agence et à poursuivre la définition de cette infrastructure, en faisant le meilleur usage possible, en priorité, des moyens existants et des services disponibles à l'Agence et chez les Etats membres, puis de ceux des Etats membres associés et coopérants, selon les arrangements en vigueur; INVITE en outre le Directeur général à formuler, en temps opportun, des propositions visant à jeter les bases de toute décision pouvant se révéler nécessaire à cet égard, y compris les décisions complémentaires qui doivent être prises avant la fin de 1995.

2. RECONNAIT que la taille et l'importance des grands programmes facultatifs ainsi que les contraintes budgétaires rencontrées par les Etats membres demandent des efforts supplémentaires pour améliorer la gestion desdits programmes; DECIDE de créer par la présente Résolution un groupe de travail du Conseil chargé d'examiner des propositions visant à améliorer la communication aux Etats participants des informations sur l'exécution desdits programmes et à faire face à tout déficit structurel qui pourrait survenir dans leur couverture financière; le groupe de travail examinera également des propositions visant à concilier la planification budgétaire des Etats membres et l'exécution de ces programmes de façon efficace et dans les délais, en vue notamment de tenir compte des Etats membres qui doivent maintenir leurs contributions annuelles dans le cadre de limites financières prédéterminées; DEMANDE au groupe de travail de soumettre ses conclusions au Conseil avant le 28 février 1993; INVITE les Etats participant

4. INVITES the Director General to assist the scientific community active in the field of Earth observation in the definition of its priorities and to explore in due course, in consultation with Member States and Finland, the possibility of incorporating the science and research parts of the Earth-Observation Programme in the Agency's mandatory activities, and to make proposals to Council to that effect; and further INVITES the Director General to pursue similar actions as appropriate with regard to the field of microgravity.

5. DECIDES to consider the complementary decisions required for the programmes referred to in Chapter II of this Resolution at a meeting at Ministerial Level to be held in 1995.

aux programmes concernés à intégrer dans les Déclarations correspondantes les mesures retenues par le Conseil, en tenant compte de la spécificité de chaque programme; CONVIENT que le processus décrit ci-dessus se déroulera sans préjudice de la mise en forme définitive et de l'entrée en vigueur desdites Déclarations en application du point A(2) ci-dessus.

3. RECONNAIT qu'il faudrait modifier le système actuel de l'Agence concernant l'ajustement des contributions pour cause de variations des taux de conversion pour pouvoir réagir plus efficacement aux fluctuations monétaires; CONVIENT de décider lors de sa prochaine session au niveau des délégués, en décembre 1992, de mesures intérimaires ayant trait aux effets des récentes fluctuations monétaires en 1992 et 1993 jusqu'à ce qu'il ait été convenu d'un système entièrement modifié et de ses procédures d'adoption; et INVITE le Directeur général à faire, lors de ladite session du Conseil, une proposition prenant bonne note des vues exprimées au cours de la présente session et qui se fondera notamment sur l'alternative suivante, déjà exposée entre autres dans le document ESA/C(92)92:
   - en premier lieu, appliquer l'ajustement rétroactif aux contributions d'un Etat uniquement pour les montants qui n'ont pas été effectivement dépensés dans l'Etat en cause;
   - appliquer un abattement de 50% sur les ajustements des contributions, tant en ce qui concerne les paiements à l'Agence que les remboursements par l'Agence;

   DECIDE de créer un Groupe de travail du Conseil chargé de faire rapport avant la fin de 1993 en vue de proposer une réforme du mécanisme d'ajustement en vigueur à l'Agence devant aboutir à un système plus complet et équitable.

4. INVITE le Directeur général à accorder son soutien à la communauté scientifique oeuvrant dans le domaine de l'observation de la Terre pour ce qui est de définir ses priorités et à explorer en temps opportun, en concertation avec les Etats membres et avec la Finlande, la possibilité d'incorporer les activités scientifiques et de recherche du programme d'observation de la Terre dans les activités obligatoires de l'Agence, et à faire au Conseil des propositions à cet effet; et INVITE en outre le Directeur général à mener, en fonction de la situation, des actions similaires dans le domaine de la microgravité.

5. DECIDE d'examiner les décisions complémentaires requises par les programmes visés au Chapitre II de la présente Résolution qui devront être prises à une session au niveau ministériel devant se tenir en 1995.

TABLE I

The Delegations declare that their respective States will participate as follows in the programmes referred to in Chapter II of this Resolution and will ensure the continuation of the said programmes on the basis of the corresponding amended Declarations, it being understood that full financial coverage for the Agency's programmes is essential for their orderly execution:

Les délégations déclarent que leurs Etats respectifs participeront aux programmes visés au chapitre II de la présente Résolution selon le barème suivant et assureront la poursuite desdits programmes sur la base des Déclarations amendées correspondantes, étant entendu qu'une couverture financière intégrale des programmes de l'Agence est indispensable à leur bonne exécution.

A. The POEM-1 Programme

Participants	Envisat-1 Mission	Metop-1 Preparation
	%	%
A	1.00	1.00
B	4.00	4.00
DK	0.5–1.00	0.5–1.00
F	25.00	25.00
D	17.40	18–22.00
I	12.00	16.00
NL	2.14	4.60
N	1.30	1.50
E	7.00–8.00	7.00–8.00
S	5.10	3.35
CH	4.00	4.00
UK	21–25.00	14.60
CDN	2.7–5.00	—
SF	1.20	—
TOTAL	104.34–112.14	99.55–105.05

B. The DRS Element of the DRTM Programme

Participants	Scale, %
A	1.50
B	4.00
F	[20.00]
D	12.00
I	45.00
NL	2.00
E	up to 4.00
S	1.80
CH	0.10*
UK	1.00
SF	0.40
TOTAL	up to 91.80

* This figure corresponds to the Swiss contribution of 2% to the former Phase 1 of the DRS Programme Element of the DRTM Programme

* Ce chiffre correspond à la contribution de 2% de la Suisse à l'ancienne phase 1 de l'élément DRS du programme DRTM.

C. The Columbus Programme

Participants	Attached Laboratory %	Polar Platform %	Precursor Flights %	Future Station %	Overall Average %
A	—	—	[1.00]	—	0-09
B	3.80	9.45	5.00	3.02	5.00
DK	1.00	1.00	1.00	1.00	1.00
F	10.00	23.60	[10.00]	[20.00]	12.74
D	38.00	17.80	15.00	35.0	31.99
I	31.00	8.80	14.00	12.00	25.00
NL	0.50	4.00	1.00-3.00	4.00	1.26–1.43
N	0.48	0.30	—	—	0.40
E	up to 3.00	up to 6.00	—	—	0–3.29
S	1.00	1.00	—	—	0.90
CH	—	—	[2.00]	—	0.18
UK	up to 1.00	22.60	—	—	4.41–5.12
TOTAL	up to 89.78*	up to 94.55	49–51.00	75.02	

* The shortfall will be covered in the following manner: a) savings representing 5% of the financial envelope of 2516.8 MAU, and b) voluntary additional contributions to bring the covered portion to 95% of the said financial envelope; it is understood also that the actual level of contributions to be paid by the participating States concerned for the period 1993–1995 shall not be affected by the increased contributions scale.

* Le déficit sera couvert comme suit: a) économies représentant 5% de l'enveloppe financière de 2516,8 MUC, et b) contributions supplémentaires volontaires visant à porter la part couverte à 95% de ladite enveloppe financière; il est également entendu que le niveau réel des contributions à payer par les Etats participants concernés pour la période 1993–1995 ne sera pas affecté par la hausse du barème des contributions.

D. The Hermes Programme

Participants	Overall Scale %
A	[0.50]
B	5.80
DK	0.45
F	43.50
D	22.00
I	12.10
NL	6.00
E	up to 4.10
S	0.50
CH	2.00
CDN	2.00
TOTAL	up to 98.95

Resolution on International Cooperation
adopted on 10 November 1992

The Council meeting at Ministerial Level,

HAVING REGARD to Resolution ESA/C-M/XCVII/Res. 1 (Final) on the European Long-Term Space Plan and programmes, adopted in Munich on 20 November 1991, which reaffirmed the need to intensify international cooperation, taking into account the evolution of the geopolitical context, with a view to achieving fully the objectives of the European Long-Term Space Plan with the best possible relationship between the requirements of cost and effectiveness, while optimising the use of European space resources available within the Agency and the Member States,

HAVING REGARD to Resolutions ESA/C-M/CIV/Res.1 (Final) on the implementation of the European Long-Term Space Plan and programmes and ESA/C-M/CIV/Res.3 (Final) on space cooperation with the Russian Federation, both adopted this day,

RECALLING the conclusions of the Report on the prospects for widening international space cooperation (ESA/C(92)74) from the Council Working Group on international cooperation set up on 12 December 1991,

HAVING REGARD to Articles II and XIV of the ESA Convention,

1. INVITES the Director General and the Member States to strengthen the coherence and coordination of their activities and programmes in the space field, and to make optimum use, in implementing these programmes, of existing resources and expertise within the Agency and the Member States.

2. INVITES the Director General to pursue his efforts to achieve synergy between the Agency's activities and those of the European Communities in areas where those activities complement each other, in particular in the area of observation of the Earth and its environment.

3. EXPRESSES THE WISH that the results of the Agency's programmes be put to the best possible use by other European space organisations such as Eutelsat and Eumetsat, under arrangements for making these available to be determined together with these organisations, in order in particular to avoid the duplication of research and development work.

4. INVITES the Director General to seek, together with those responsible for cooperation in the Member States concerned and with the appropriate international bodies, ways of making available to the developing countries, on mutually acceptable terms, appropriate data obtained through the Agency's programmes that can be of use to them, in accordance with the provisions of the Agency's Rules on information and data; and INVITES the Director General to prepare a report on the aforementioned cooperation with developing countries so as to enable Council to discuss the Agency's policy in that area.

5. EXPRESSES SATISFACTION at the extensive cooperation engaged in with Canada and Finland.

6. RECOGNISES that the execution of the Agency's programmes during the years ahead in line with the Director General's

Résolution sur la coopération internationale
adoptée le 10 novembre 1992

Le Conseil, siégeant au niveau ministériel,

RAPPELANT que la Résolution ESA/C-M/XCVII/Rés. 1 (Final) sur le plan spatial européen à long terme et les programmes adoptée à Munich le 20 novembre 1991 réaffirmait la nécessité d'intensifier la coopération internationale, tout en prenant en compte l'évolution du contexte géopolitique, en vue de réaliser pleinement les objectifs dudit plan à long terme avec le meilleur rapport possible entre les impératifs de coût et d'efficacité, tout en optimisant l'utilisation des ressources spatiales européennes disponibles au sein de l'Agence et dans les Etats membres,

VU les Résolutions ESA/C-M/CIV/Rés. 1 (Final) sur la mise en oeuvre du plan spatial européen à long terme et les programmes et ESA/C-M/CIV/Rés. 3 (Final) sur la coopération spatiale avec la Fédération de Russie adoptées ce jour,

RAPPELANT les conclusions du Rapport sur les perspectives d'un élargissement de la coopération internationale dans le domaine spatial (ESA/C(92)74) du Groupe de travail du Conseil sur la coopération internationale établi le 12 décembre 1991,

VU les articles II et XIV de la Convention de l'Agence,

1. INVITE le Directeur général et les Etats membres à renforcer la cohérence et la coordination de leurs activités et programmes dans le domaine spatial, ainsi qu'à faire un usage optimal, dans la mise en oeuvre de ces programmes, des moyens et compétences existant à l'Agence et dans les Etats membres.

2. INVITE le Directeur général à poursuivre ses efforts pour développer une synergie entre les activités respectives de l'Agence et des Communautés Européennes dans les domaines où ces activités sont complémentaires, en particulier dans le domaine de l'observation de la Terre et de son environnement.

3. SOUHAITE que les résultats des programmes de l'Agence soient utilisés au mieux par les autres organisations spatiales européennes telles Eutelsat et Eumetsat, selon des modalités de mise à disposition à définir avec ces organisations, pour éviter en particulier une duplication des efforts de recherche et développement.

4. INVITE le Directeur général à rechercher, de concert avec les responsables de la coopération des Etats membres intéressés et avec les organisations internationales compétentes, les voies permettant de mettre à la disposition des pays en développement dans des conditions mutuellement acceptables les données pertinentes obtenues au moyen des programmes de l'Agence qui pourraient leur être profitables, selon les dispositions du Réglement sur les informations et données de l'Agence; et INVITE le Directeur général à préparer un rapport sur la coopération avec les pays en développement visée ci-dessus afin de permettre au Conseil de discuter la politique de l'Agence dans ce domaine.

5. SE FELICITE de la coopération très large qui se poursuit avec le Canada et la Finlande.

proposal on the Agency's policy and programmes (ESA/C-M(92)/3) will promote a deepening of the long-standing cooperation with the United States, will make it possible to carry out joint activities with Russia, and will allow the foundations to be laid for closer cooperation with Japan.

7. NOTES with interest the achievements of many countries, in particular those in central and eastern Europe, in areas of space research and development and EXPRESSES THE WISH that the Agency continue to maintain and develop relations with those countries.

6. RECONNAIT que l'exécution des programmes de l'Agence au cours des prochaines années conformément à la proposition du Directeur général sur la politique et les programmes de l'Agence (ESA/C-M(92)/3) favorisera l'approfondissement de la coopération établie de longue date avec les Etats-Unis, permettra de mener des activités en commun avec la Russie et de jeter les bases d'une coopération plus étroite avec le Japon.

7. NOTE avec intérêt les réalisations de nombreux pays, en particulier ceux situés en Europe centrale et orientale, dans les domaines de la recherche et du développement en matière spatiale et SOUHAITE que l'Agence continue d'entretenir et de développer des relations avec ces pays.

Resolution on Space Cooperation with the Russian Federation
adopted on 10 November 1992

The Council meeting at Ministerial Level,

WHEREAS ESA/C-M/XCVII/Res. 1 (Final) on the European Long-Term Space Plan and programmes, adopted in Munich on 20 November 1991, reaffirmed the need to intensify international cooperation with a view to achieving fully the objectives of the European Long-Term Space Plan with the best possible relationship between the requirements of cost and effectiveness, while optimising the use of European space resources available within the Agency and the Member States,

HAVING REGARD to ESA/C-M/CIV/Res.1 (Final) on the implementation of the European Long-Term Space Plan and programmes and ESA/C-M/CIV/Res.2 (Final) on international cooperation, both adopted this day,

TAKING NOTE of the diplomatic note dated 28 April 1992 by which the Russian Federation explicitly declared its wish to exercise the rights and fulfil the obligations stemming from the Agreement concerning cooperation in the field of the exploration and use of outer space for peaceful purposes, signed by the Agency and the Government of the Union of Soviet Socialist Republics on 25 April 1990,

WISHING to increase the existing cooperation between the Agency and Russia and extend it not only in all the areas already referred to in the aforementioned Agreement, but also in the areas of manned in-orbit infrastructure, crew transport and the associated communication facilities,

HAVING REGARD to the joint statement signed on 12 October 1992 by the Director General of the European Space Agency and the Director General of the Russian Space Agency (RKA),

Résolution sur la coopération spatiale avec la Fédération de Russie
adoptée le 10 novembre 1992

Le Conseil, siégeant au niveau ministériel,

RAPPELANT que la Résolution ESA/C-M/XCVII/Rés. 1 (Final) sur le plan spatial européen à long terme et les programmes adoptée à Munich le 20 novembre 1991 réaffirmait la nécessité d'intensifier la coopération internationale en vue de réaliser pleinement les objectifs dudit plan à long terme avec le meilleur rapport possible entre les impératifs de coût et d'efficacité, tout en optimisant l'utilisation des ressources spatiales européennes disponibles au sein de l'Agence et dans les Etats membres,

VU les Résolutions ESA/C-M/CIV/Rés. 1 (Final) sur la mise en oeuvre du plan spatial européen à long terme et les programmes et ESA/C-M/CIV/Rés. 2 (Final) sur la coopération internationale adoptées ce jour,

PRENANT ACTE de la note diplomatique du 28 avril 1992 par laquelle la Fédération de Russie a expressément déclaré sa volonté d'exercer les droits et de respecter les obligations qui découlent de l'Accord entre l'Agence spatiale européenne et le Gouvernement de l'Union des républiques socialistes soviétiques relatif à la coopération dans le domaine de l'exploration et de l'utilisation de l'espace extra-atmosphérique à des fins pacifiques signé le 25 avril 1990,

DESIREUX d'amplifier la coopération existante entre l'Agence et la Russie et de l'étendre non seulement dans tous les domaines déjà visés dans l'Accord mentionné ci-dessus mais aussi dans les domaines de l'infrastructure habitée en orbite, des transports d'équipages et des moyens de communication associés,

VU la Déclaration commune signée le 12 octobre 1992 par le Directeur général de l'Agence spatiale européenne et par le Directeur général de l'Agence spatiale russe (RKA),

HAVING REGARD to Article XIV.1 of the Convention,

I. EXPRESSES SATISFACTION at the results obtained so far in the framework of the cooperation activities undertaken in the fields of space science, space biology and medicine, microgravity research, Earth observation and crewed space transport systems; and WELCOMES the prospects for intensifying cooperation between the Agency and the Russian Federation.

II. ENDORSES the Director General's proposals, as described in his Proposal for the Agency's policy and programmes (ESA/C-M(92)3), to widen and strengthen such active cooperation with the space institutes of the Russian Federation during the period 1993–95, in the following main areas:

(a) in-orbit infrastructure
(b) crew transport facilities
(c) communication facilities associated with the in-orbit infrastructure
(d) missions onboard the Mir station, including the flight and accommodation of astronauts and payloads, to prepare the Agency for the use of inhabited space infrastructures.

III. AGREES that all the cooperation referred to in Section II above shall be reviewed by Council by the end of 1993, on the basis of reports by the Director General.

IV. INVITES the Director General to negotiate and submit to it as soon as possible the practical procedures for the cooperation activities identified in this Resolution for the period 1993–95, which shall be laid down in implementing arrangements within the meaning of Article 6 of the Agreement referred to above, and to be concluded between ESA and the Russian Space Agency (RKA), as well as in contracts with Russian industrial or research centres more specifically concerned with each of the cooperation themes selected, all the legal instruments concerned to be approved by the appropriate Agency bodies.

V. STRESSES that space cooperation of this kind between the Agency and the Russian Federation must safeguard the interests of the space industry of the Member States, including in the launch services sector.

VI. INVITES the Director General to make sure that such cooperation over the period 1993–95 proceeds in accordance with the objectives of the European Long-Term Space Plan, to report periodically on progress made in the corresponding work, and to propose any changes or reorientation which he may consider necessary.

VII. AGREES to undertake, in due course, a review of the main results of the cooperation activities conducted pursuant to Section II, so that the complementary decisions referred to in Chapters II and VII of ESA/C-M/CIV/Res.1 (Final), adopted this day, can be taken by the end of 1995, and INVITES the Director General to take the measures needed to make it possible for cooperation between the Agency and the Russian Federation to continue beyond 1995, if so desired, under the terms of a new Agreement.

VU l'article XIV.1 de la Convention,

I. EXPRIME SA SATISFACTION devant les résultats obtenus à ce jour dans le cadre de la coopération entreprise dans les domaines de la science spatiale, de la biologie et de la médecine spatiales, de la recherche en microgravité, de l'observation de la Terre et des systèmes de transport spatial habité, et ACCUEILLE FAVORABLEMENT les perspectives d'intensification de cette coopération entre l'Agence et la Fédération de Russie.

II. FAIT SIENNES les propositions du Directeur général, telles que décrites dans sa Proposition sur la politique et les programmes de l'Agence (ESA/C-M(92)3), d'élargir et de renforcer cette coopération avec les institutions spatiales de la Fédération de Russie, au cours de la période 1993–1995, dans les principaux domaines suivants:

(a) infrastructure en orbite
(b) moyens de transport des équipages
(c) moyens de communication associés à l'infrastructure en orbite
(d) missions à bord de la station Mir, y compris l'emport et le séjour d'astronautes et de charges utiles, afin de préparer l'Agence à l'utilisation des infrastructures spatiales habitées.

III. CONVIENT que l'ensemble de la coopération décrite au paragraphe II ci-dessus fera l'objet d'un examen par le Conseil avant la fin de 1993, sur la base de rapports du Directeur général.

IV. INVITE le Directeur général à négocier et à lui soumettre au plus tôt les modalités concrètes des coopérations identifiées dans la présente Résolution pour la période 1993–1995, modalités qui devront être reprises dans des arrangements de mise en oeuvre au sens de l'article 6 de l'Accord de coopération susvisé à conclure entre l'Agence et l'Agence spatiale russe (RKA), ainsi que dans des contrats avec les centres industriels ou de recherche russes portant plus spécifiquement sur chacun des thèmes de coopération retenus, tous instruments juridiques devant être agréés par les organes compétents de l'Agence.

V. RAPPELLE que la conduite d'une telle coopération spatiale entre l'Agence et la Fédération de Russie doit sauvegarder les intérêts de l'industrie spatiale des Etats membres, y compris dans le secteur des services de lancement.

VI. INVITE le Directeur général à s'assurer que le déroulement de cette coopération sur la période 1993-1995 s'effectue en conformité des objectifs du plan spatial européen à long terme, à faire périodiquement rapport sur l'avancement des travaux correspondants, et à proposer les modifications ou réorientations qu'il juge nécessaires.

VII. CONVIENT de procéder, en temps utile, à un examen des principaux résultats des coopérations engagées au titre du paragraphe II ci-dessus en vue de permettre la prise avant la fin de 1995 des décisions complémentaires visées aux chapitres II et VII de la Résolution ESA/C-M/CIV/Rés. 1 (Final) adoptée ce jour, et INVITE le Directeur général à prendre les mesures nécessaires permettant l'éventuelle poursuite de la coopération entre l'Agence et la Fédération de Russie au-delà de 1995 selon les termes d'un nouvel Accord.

ATTACHMENT 11

P 012000Z N/A
FM USMISSION UNOG GENEVA
TO SECSTATE WASHDC PRIORITY 8942
INFO USMISSION AORC, UNCED, GEF, IBRD, UNGA, RS
SUBJECT: UNCED: ENVIRONMENTAL MONITORING FROM OUTER SPACE

1. MISSION HAS RECEIVED A LETTER DATED SEPT 27 FROM THE RUSSIAN MISSION ENCLOSING A DRAFT RESOLUTION TO BE SUBMITTED TO UNGA BY THE CIS STATES UNDER AGENDA ITEM 100 CALLING FOR THE ESTABLISHMENT OF A SYSTEM OF ENVIRONMENTAL MONITORING FROM OUTER SPACE AS A FOLLOW UP TO UNCED. LETTER REQUESTS THE SUPPORT OF USG FOR THIS INITIATIVE. TEXT OF DRAFT RESOLUTION FOLLOWS.

2. BEGIN TEXT:

JOINT DRAFT RESOLUTION OF THE CIS STATES

"IMPLEMENTATION OF THE DECISIONS AND RECOMMENDATIONS OF THE UNCED"

THE GENERAL ASSEMBLY,

--KEEPING IN MIND THE PROVISIONS OF THE "AGENDA 21", IN PARTICULAR PARAS 9.6, 9.8"C", 10.11"A" AND 17.97,

--PROCEEDING FROM THE UNDERSTANDING THAT RESPECT FOR THE BALANCE OF INTERESTS BETWEEN ALL GROUPS OF COUNTRIES, INCLUDING ECONOMIES IN TRANSITION, IS A PRECONDITION FOR SUCCESSFUL IMPLEMENTATION OF THE DECISIONS AND RECOMMENDATIONS OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT,

--ADMITTING THE IMPORTANCE OF ESTABLISHING AN ECOLOGICAL MONITORING FROM OUTER SPACE AS A KEY ELEMENT OF THE FOLLOW-UP TO THE UNCED,

1. CALLS UPON MEMBER-STATES TO EXPRESS READINESS TO PARTICIPATE ON A VOLUNTARY BASIS IN ESTABLISHING A SYSTEM FOR ECOLOGICAL MONITORING FROM OUTER SPACE, BASING (SIC) ON SPACE, SCIENTIFIC AND OPERATIONAL POTENTIAL, WHICH THEY POSSESS;

2. APPEALS TO THE WORLD BANK, GLOBAL ENVIRONMENT FACILITY AND OTHER FINANCIAL INSTITUTIONS FOR MATERIAL SUPPORT IN ESTABLISHING SUCH A SYSTEM;

3. REQUESTS THE UN ENVIRONMENT PROGRAM TO DEVELOP A DRAFT PROJECT FOR ESTABLISHING AND FUNCTIONING OF THE SYSTEM FOR ECOLOGICAL MONITORING FROM SPACE, AS A FIRST-PRIORITY ELEMENT OF ITS PROGRAM AND TO REPORT ON THE RESULTS OF THIS WORK TO THE 49TH SESSION OF THE GENERAL ASSEMBLY.

END TEXT OF DRAFT RESOLUTION

ROGERS

BT
#8942

NNNN

UNCLASSIFIED GENEVA 008942

SPACE ENERGY INFORMATION

KEI - FOUNDATION Fund

Issue № _____ Global Ecological Monitoring
Date: _____

INVITATION

Dear Mr. Rekenthaler:

An international conference entitled "International Project for Global Ecological Monitoring" will be conducted in Sochi from 2 - 8 May 1993. This conference is being organized by the Russian Worldwide Ecological Laboratory Branch (ESKOS) and by the KEI Foundation (Space, Energy, Information).

The theme of the conference will be "The Use of Military Conversion and Dual-Use of Defense Systems for the 'Global Ecological Monitoring [GEM] Project'".

Conference participants will be provided comfortable rooms at the "Green Grove" vacation facility. Meals and an interesting cultural program will also be provided.

Organization fees are 20,000 rubles cash or 25,000 rubles [check].

Account number: N467465 at the KEI bank, correspondent account 161298 at the Russian Federation Central Bank [RKTs GU MFO] 201791, KEI Foundation.

We invite you to take part in the conference and discussion of GEM Project papers.

Participants will arrive on 2 May and depart 8 May 1993.

Travel by air will be Moscow - Adler, Moscow - Sochi, with transportation by bus to the "Green Grove" facility.

Please confirm your conference participation by calling 245-31-76; 246-78-82; 245-01-63 (Valentina Borisovna Sevko), or write to 119048 Moscow, 24 Usachev Street, Apt 419.

Respectfully,

V. Dzhanibekov
Chairman, Organization Committee

International Project fo "Global Ecological Monitoring" (GEM)

Project Development Stages

Development of the basic ideas and principals of the project was initiated in 1990 at the suggestion of Dr. E. Teller, Director of Livermore Laboratory (U.S.), who suggested using the SDI monitoring subsystem "Brilliant Eyes" to resolve a number of ecological issues. In order to develop these ideas under the aegis of an international organization, "Worldwide Laboratory", working groups were formed, comprised of U.S. and former USSR experts who then conducted working meetings in Erici (Italy, 1990-91), Stanford, Livermore, Colorado Springs (U.S. 1991-92), and Dubna (Russia, 1992).

As a result of these meetings, scientific and technological principles were developed to create a single system for Global Ecological Monitoring, combining spaceborne, airborne, land- and sea-based monitoring systems, that would use a common data base and problem solving system to reduce the ecological risk to life (including humanity).

The Project actually proposes the creation of national networks of land- and sea-based standardized ecological monitoring centers and posts, varying in degree of complexity, combined to form a single worldwide network and integrated into a system of satellite and airborne ecological monitoring using a common system-wide data base. Although these posts would be located throughout regions and countries, they would form an international information network.

The creation of such a system on a global scale must occur through maximized use of military conversion and dual-use of defense systems.

The inclusion of land and air assets in ecological monitoring, integral components of the GEM system, will allow countries which do not have their own space industry to become active project participants.

During the project's various stages of development, Russian and former USSR participants included representatives from the Ministry of Ecology, Ministry of Defense, Russian Space Agency, the Committee on Water Resources, the USSR Academy of Sciences (later known as the Russian Academy of Sciences), the State Committee for Hydrometeorology, the Scientific and Production Conglomerate (NPO) Ehnergiya, NPO Mashinostroenie, Lavochkin NPO, NPO EhLAS, the Salyut Design Bureau, NPO Tajfun, Zhukovskij TsAGI, the Myasishchev EhM Factory, and others.

Representatives of state institutions, Academies of Sciences, and public organizations from Kazakhstan, the Ukraine, and Lithuania also participated in project development.

U.S. participants included representatives from the Department of Energy, Department of Defense, NASA, Environmental Protection Agency, the Bureau of Land Management (U.S. Department of the Interior), Presidential Committees on Space, the Environment, and SDI, and National Livermore and Los Alamos Laboratories.

[Text] The coordinator of all the work and conferences on the part of the former USSR and then Russia was the Ecological Environmental Monitoring Station (ESKOS) of the "World Laboratory" Branch, on the part of the United States -- the Livermore National Laboratory.

In 1992 the project received official support of the president of Russia B. N. Yeltsin (in a message to participants in the International Conference on the GEM Project in Dubna), the government of Russia (in a letter signed by the prime minister Ye. T. Gaydar), governmental organizations in the Ukraine and Kazakhstan, the prime minister of Lithuania, etc.

A committee of experts on this project was organized at a session of the Intergovernmental Council of CIS Countries (Alma-Ata, 1992).

Present-Day Status of GEM Project. Prospects and Problems

A detailed analysis of the projects implemented by military-industrial complex organizations, experimental development work and facilities now in operation which can serve as a basis for work in the ecology field, indicated that on the basis of military-industrial complex work, with additional support, it is possible to organize a real GEM system meeting all international standards.

The organization of such a system will make it possible to concentrate a considerable part of the conversion of defense-oriented (space, aerial, surface, based above and below the water surface) facilities and resources around a prestige highly intellectual project oriented on improving the state of the environment and health of the population in Russia.

In itself the project, generalizing the best achievements of our country's scientists, specialists and industrialists, will be an important practical contribution by Russia to strengthening of the bonds among the CIS countries, brought together by a unified ecological space.

Supplemented by the development work and material capabilities of the United States, the project will signify real cooperation between the United States and Russia on the basis of conversion and the joint use of the scientific-technical potential of these two countries.

For information call:
Professor Grigoriy Matveyevich Borenboym, telephone 137-23-82
Candidate of Technical Sciences Oleg Nikolayevich Pivovarov, telephone 245-31-76

Information on the international conference "International Global Ecological Monitoring Project," which is to be held at Sochi at the vacation facility "Green Grove" during the period 2-8 May 1993, organized by the Ecological Station of the World Laboratory Branch in Russia (ESKOS) and the KEI (Space, Energy, Information) Fund.

1. The GEM Project is the basis for bringing together and practical implementation of Russian ecological programs, efficient use of the environment, information collection and dissemination and integration with international programs.

2. The purpose of the meeting is the exchange of opinions, working out of uniform approaches to the project, preparation for and adoption of a draft resolution. In the course of the meeting plans call for examining the following matters:

-- scientific-methodological basis of Global Ecological Monitoring and the principles for the possible use of conversion;

-- scientific-technical level of development work in the field of global geophysical and ecological monitoring in the world and, in particular, in Russia;

-- use of military conversion and dual use of defense systems in the GEM Project;

-- development of communication systems for geoecological problems on the basis of conversion development work;

-- possibilities of the GEM Project for predicting environmental changes, working out optimum strategies for efficient use of the environment and for ensuring global safety;

-- national part of the GEM Project in Russia;

-- regional and departmental ecological programs, their interrelationship to the GEM Project;

-- concept of control of environmental use objects at federal and regional levels and technological aspects of use of conversion systems for control;

-- geoecological monitoring as a mechanism for making political-economic decisions;

-- organizational structures of the GEM Project, sources of financing, commercial aspects of the project as a whole and dual use of defense systems.

You are invited to participate in the work of the conference.

Materials for Session of Expert-Consultative Council of Russian Union of Industrialists and Entrepreneurs on Scientific-Technical and Organizational Principles for Structuring Work on Global Geophysical and Ecological Monitoring in Russia (GEM Project)

Table of Contents

Introduction

The session of the Expert Consultative Council of the Russian Union of Industrialists and Entrepreneurs (RUIE) is being devoted to the scientific-technical, organizational and international aspects of implementation of work on global geophysical and ecological monitoring (GEM), brought together under the GEM Project. The concept of implementation of the GEM Project within the framework of the International Nongovernmental GEM Program under the aegis of the World Laboratory, oriented primarily on nongovernmental forms of organization and implementation of the work, is being examined.

The problems involved in ecological monitoring and the formulation of ecological policy at the present time are at the center of attention of such organizations as the Commission on Problems in Preserving the Environment of the European Economic Community, European Space Agency, NASA, UN and UNESCO. Major international and national programs have been developed and are being implemented both in the field of ecology and in research on global changes in the environment and climate (programs "Mission to the Planet Earth," "Global Change," EOS (Earth Observing System) Project, SPOT (France), LANDSAT (US), METEOSAT and UARS (US-Canada) Projects) which provide for active use of space methods and vehicles. The Russian side will participate in many of these programs and projects. The principal direction is related to assurance of global safety despite the intensifying impact of the anthropogenic medium on environmental changes, as well as an increase in the efficiency of economic activity with allowance for environmental factors.

Governmental structures intended to ensure efficient use of the environment and to solve ecological problems have been established in Russia. A decision has been made to establish a Russian Unified Governmental Ecological Monitoring System (UGEMS) and two variants of the UGEMS concept have been conceived. Such republic-oriented programs as "Ecology of Russia," "Ecological Safety of Russia" and "Ecology and Conversion" have been developed and are being implemented. Many major enterprises constituting part of the military-industrial complex (Space Instrument Making NPO, Elas NPO, Machine Building NPO, Kometa NPO, Lavochkin NPO, Central Special Design Bureau, Energiya NPO) have presented proposals on the organization of different global ecological monitoring space systems, ecological monitoring and efficient use of the environment, warnings and informational support during extraordinary situations. Under the direction of the Russian Space Agency and the Ministry of the Environment attempts are being undertaken to bring these projects together into a unified republic-wide system.

Equally checkered and diverse is work on the solution of methodological problems, on the creation of an instrument base for surface monitoring and in general on the implementation of regional ecological programs.

Despite the scales of the developed organizational, research and practical work in the ecology field, the situation is causing great concern.

First there is the great number of global projects directed to solving similar problems (global ecological monitoring problems) or proposing the organization of large space systems for solving local problems (such as the detection of fires or earthquake precursors). Due to the impossibility of implementing all the projects, the work is limited only to the preproject stage; however, already finalized projects are in fact being implemented.

Second, concern is caused by a situation when despite failure to solve a number of fundamental problems long-term programs are being drawn up to satisfy the decisions of the moment. For example, up to the present time there is no unanimity of opinion, backed up by careful project development work and economic computations, with respect to the relative roles of surface, aerial and space monitoring. The adopted formula for the use of multilevel monitoring gives evidence of an interim compromise among the different sides, but not a solution of the problem. But this problem to a great extent determines the structuring of the Governmental Monitoring System. For this same reason until now no concept of a Unified Governmental Monitoring System has been developed and the proposed projects do not have a convincing specific content.

Third, concern is caused by the strict dependence of practical ecological monitoring work on budgetary financing. Under the conditions of economic crisis prevailing in Russia this makes it impossible either to carry out a major long-term program or to ensure the responsibility of enterprises for the final result and, in addition, orients work on the development of ecological systems for the most part by governmental organizations, thereby from the start limiting the possibilities for switching this work to at least partial self-financing.

Finally, concern is caused by the lack of a many-sided program for the long-term development of technologies with strong scientific requirements which later on will ensure successful implementation of ecological projects. All this will result in a standstill and gradual destruction of scientific-technical and engineering potential and in the long run to losses of Russia in the international system of the division of labor in the high-technology field.

The desire to solve the mentioned problems has brought together specialists in the field of systems engineering, space technology, instrument making, physicists and ecologists representing different organizations and receiving support from some commercial organizations. The possibilities of creating technical systems and apparatus in support of governmental programs and at the same time being of interest for different branches of economic activity also have been analyzed. The basis adopted for the work was

nongovernmental forms for implementing the work in which on a noncompetitive basis it is proposed that better use be made of the achievements of scientific organizations and industrial enterprises in the high-technology field and with orientation on broad international cooperation. The results of the analysis which was made also constitute a subject for examination by the RUIE expert-consultative council.

Why is preference given to nongovernmental forms of work organization?

First, this makes it possible to impart a stable, long-term character to the work.

Second, this strengthens the pragmatic direction of the work and orients it on the broad user, and also increases responsibility for the final result, providing a rigid system for selecting the most effective solutions, forces it to be oriented on such a structuring of the project which to a considerable degree will be capable of ensuring its step-by-step self-financing and the ability to pay its own way.

Third, under the conditions of political and economic crisis being experienced by Russia this will create a stable basis for international cooperation.

Fourth, this will make it possible to accelerate the introduction of the scientific-technical attainments of the project at the enterprises participating in support of the project.

Finally, fifth, this will make it possible to establish new organizational structures free of many historically developing shortcomings inherent in Russian scientifically demanding investment programs.

We will discuss the sources of the proposals presented for consideration.

The practical development of the many-sided concept of global ecological monitoring was initiated within the framework of the international project "Global Ecological Monitoring" (GEM). The Russian block of this project is being developed by the ESKOS Ecological Center, being a branch of the World Laboratory in Russia, under the direction of Professor G. M. Barenboym. By the term "global ecological monitoring" is meant the process of many-sided observations of changes in the state of the living world of the planet (biota) and the entire environment as a result of anthropogenic and in part natural processes for the purpose of ensuring normal vital functioning of the biota and global safety. The GEM project was widely discussed at a series of international working meetings (the last was held at Dubna, 8-12 August 1992) and received support from Russian governmental organizations and a

number of leading countries of the world. This project made it possible to bring together the efforts of many organizations, laid the basis for effective international cooperation, attracted the attention of the public and created positive precedents for interaction between ecologists and the administrations of regions.

In solving conversion problems and proceeding on the basis of a general systemic approach, specialists of a number of industrial enterprises, organizations and institutes (Salyut Design Bureau, Atomic Energy Institute imeni Kurchatov, Institute of Practical Problems in the Development of Society, KEI Fund, Institute of Space Information Technologies, Russian Space Industry Scientific Research Institute, Vympel MGAK, Polar Geophysical Institute, Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, Novosibirsk State University, Institute of Computational Mathematics and others), at approximately the same time there was development of a systems engineering and organizational concept for establishing a predictive information system for geophysical and ecological support (IS GEO). In this development work it is proposed that use be made of mathematical models of general circulation of the atmosphere, models of the upper and middle atmosphere, models of transport, transformation and accumulation of pollutants, on an on-line basis receiving information from the multilevel monitoring part of the system. The predictive information received as a result, supplemented by monitoring information on the state of natural resources, would make it possible to detect processes and factors forming the ecological conditions, to analyze and predict their dynamics, and on this basis solve a wide range of practical problems both in the interests of the governmental services related to use of the environment and warning of extraordinary conditions and also in the interests of specific economic activity. It is proposed that the organization and direction of such a project be accomplished by nongovernmental organizations. This work received considerably less attention, but the project was examined and received approval at a number of working conferences, including at the international working conference held in Murmansk during the period 11-13 March 1992.

The proposals presented for consideration by the expert consultative council of the RUIE were formulated as a result of filling of the GEM Project, developed by the Russian Branch of the World Laboratory, with a specific systemic content by the proposed IS GEO project, the possibilities on a noncompetitive basis of applying the attainments of Russian enterprises in the high-technology field and the Academy of Sciences and the possibilities of international cooperation. This is the essence of the scientific-technical and organizational concept of implementation of work based on new, nongovernmental forms for carrying out the work and intended for the solution of many problems characterized by effective forms for conducting such work. We will present these proposals for consideration by a nongovernmental organization and we intend, in the case of their support, to develop and present a finalized project outline and work program for consideration by all interested governmental and nongovernmental organizations.

Prediction of Technological and Social Processes

The presented GEM Project is formulated as a long-term, self-developing program. In order to develop the technical and organizational structure of such a program in its general features it is necessary to take into account the principal trends in technological and social processes which in the long run will be important for its realization.

1. The sociopolitical processes transpiring in the leading countries having the principal intellectual, technological, telecommunication and industrial resources, based on formation of a "social democracy" society, will be drawn upon. The principal features of such a community will be:

-- broadening of the level of satisfaction of the needs of human society with active defining of the reasonableness of these needs;

-- development of industrial production with maintenance of a balance with the environment;

-- assurance of global safety of both the entire community and each entity;

-- broadening of the role and place of scientific prediction and modeling with practical control at all levels of society, and as a result, an increase in the role of international, extragovernmental "intellectual elite clubs" with real control of political and economic activity, which will stand out as a factor stabilizing social processes. The influence of such a community on the remaining countries will increase primarily by means of informational and technological control levers.

2. In the technological field there will be an increase in the role of resource- and energy-conserving technologies, ensuring a minimum pressure on the environment, and there also will be an undeviating broadening of production ensuring implementation of global safety technologies, scientific development and implementation of cosmogenic projects.

An increase in the dependence of the efficiency of production on environmental changes, which requires strengthening of adaptive control technologies on the basis of prediction of such changes. In the field of preservation of the environment and efficient use of the environment the predominance of [so-called] advance tactics, predicting and warning of ecologically dangerous events prior to their onset, which will enhance the role of scientific, predictive methods for systemic ecological analysis on the basis of global predictive mathematical models.

3. In regions of strife there is a movement of the center of gravity from the area of confrontation of states and groups of states into the area of "global security" groupings, including:

-- preservation of the stability of natural cycles by means of optimum integration of technologies for use of the environment and natural environmental processes;

-- restoration of elements of impaired interaction;

-- increasing the level of protection of the human community and the results of economic activity against environmental changes and against global natural catastrophes by means of development of the technologies for their prediction and the abatement of negative aftereffects;

-- development of defense technologies, including the appearance of cosmogenic safety functions (such as the prevention of collisions with asteroids).

The material resources of society, earlier allocated for military needs, are being redirected to the development and application of technologies for the assurance of global safety and preservation of the environment as a component part of global safety. The material basis by means of which these trends will be manifested and realized, will be, first of all, global information collection and dissemination, which will make extensive use of space technology.

Matters related to new energy sources and resource-conserving technologies are becoming the second key factor. The problems involved in geophysical and ecological monitoring (GEM) and predictive informational support accordingly must be examined within the framework of the information collection and dissemination category.

The problems involved in the collection and dissemination of information are acquiring not so much a purely technical as a political importance because the efficiency in control of society under modern conditions is all dependent to a great degree on the volumes and routineness of the analysis of information and the adoption of decisions and the quality of these decisions will be determined by the degree of use of automated adaptation methods for the processing of information and the adoption of decisions and by the level of training of those specialists who will perform such work and who will objectively become participants in the political process. Moreover, we assume that there will be a continuation of the process of choice of optimum decisions on the basis of quantitative mathematical and simulative modeling methods, also including socioeconomic processes, supplanting the expert evaluations and "brainstorm" methods which at the present time are in most common use both in an analysis of economic and social activity and in the planning of ecology and the formulation of a scientific-technical policy.

By the term "global information and dissemination" [Russian "informatizatsiya"] we mean:

-- telecommunications;
-- global monitoring of natural processes, the economy, finances and the social sphere;
-- predictive mathematical models of the environment and later predictive simulation models of the economy and social processes, as well as models of global cosmogenic processes;
-- predictive mathematical models of interaction between the anthropogenic and natural environment and choice of optimum strategies for development of the anthropogenic medium;
-- global computer systems with which these models operate, the input information arriving from the monitoring part of the system;
-- technologies and levers for use of the collected information for real control.

The new scientific information obtained as a result of environmental monitoring, as well as "monitoring" of data on economic and social processes collected by such means, and the formalized models created on this basis for seeking optimum administrative decisions, will become a powerful stimulus for the development of science and new technologies and will stand out as a factor in formation of new systemic thought.

With allowance for what has been said the following distinguishing characteristics of the presented proposals stand out as applicable to ecological monitoring:

1. The technological form of global ecological monitoring must be an information system interacting with all governmental, industrial and social organizations, bringing together the multilevel monitoring part of the system, the global telecommunication segment and the surface network of information and subscriber centers. The nucleus of the information segment will be global predictive geophysical and ecological mathematical models and optimum adaptive control models, but the form of structuring of the work will be the GEM Project, not programmed planning;

2. Such informational support in the future will make possible tactics of advance detection of change in ecological conditions, will make it possible to carry out an analysis of scenarios of sanification of ecological conditions and will provide possibilities for many-sided adaptive control of all economic and social activity with allowance for natural and anthropogenic changes in the environment and will ensure solution of a variety of global safety problems.

3. In constructing social control and global safety systems it is necessary to examine such an information structure as their component part, taking into account objective principles for constructing information systems.

Special Features of Geoecological Monitoring and Informational Support in Russia

Here we will set forth the special features of Russian conditions which first must be taken into account in choosing the organizatic principles and in determining the place of Russia as a participant international programs.

First. Ecological conditions in many regions of Russia even now ar threatening. Taking into account the extent of Russian territories this constitutes a denger on a universal scale. The emergence from the economic crisis in Russia and the rise in industrial productio associated with it under conditions of a market economy may precipitously intensify the ecological catastrophe. Accordingly, e now it is necessary to create objective means for optimum control monitoring of use of the environment which are integrated with international systems.

Second. In a case if there is a renewal of the processes of transformation of Russia into a supplier of raw material and intellectual resources, an inexpensive work force and a place for t disposal of the wastes of industrial production of other countries, the expanse of Russian territories will require highly competent measures for regulating the use of the environment for the purpose preserving ecological safety on a planetary scale. The implementati of these measures will require highly competent bodies of personnel which can be organized only with implementation by the Russian side of our own ecological projects, being part of international ecological programs.

Third. In Russia, especially in the scientific-technical and engineering circles of the military-industrial complex, in institutions of higher education and in the Academy of Sciences, a high level of engineering skills and general systemic thought processes has been attained which should not be swept aside for the solution of international problems. It is likewise undesirable to destroy those technological attainments, especially in the field of unique machine building, which have been accumulated in Russia. It i necessary to consolidate the place of Russia in the international division of labor in the high-technologies field. This, moreover, will facilitate strengthening of international monitoring of the spreading of high technologies, failure to control which may become factor in the weakening of global safety.

Fourth. The great extent of the Russian territories and the underdevelopment of telecommunication structures require different technological approaches to ecological monitoring. In Japan, for example, it is possible to use surface observation points ensuring the organization of an observation network of 10 000 points. The sam can be done in the European countries and in North America. But for Russian conditions it is necessary to be oriented on combined technologies and models of solution of ecological problems which will

ensure spatial coverage by means of a combination of the surface monitoring network with contact measurement methods, methods for computing the transport of pollutants and space methods. This same model is applicable for many other countries of the world (Brazil, India, China) whose territories exert a substantial influence on planetary processes of environmental change. With predominant orientation on the organization of a surface network it must be taken into account that there is a need for creating a complex organizational structure for its servicing, and as a result, in choosing an ecological monitoring concept for Russia there must be a careful technical and economic analysis of all the aspects.

In addition, the already developing extremely serious ecological situation in individual regions of Russia can be used as a sort of "test range" for the many-sided study and perfecting of applied ecology methods.

And finally, the last. Ecological monitoring requires a well-developed technical base. For its creation and introduction the best prepared enterprises are those of the military-industrial complex, since they are high-technology enterprises. The deformations of social processes during recent decades also resulted in corresponding deformation of the most important body of military-industrial complex structures. During the last few years there has been an outflow of young personnel from the enterprises of the military-industrial complex who potentially are capable of satisfying these shortcomings. However, precisely the enterprises of the military-industrial complex have traditions of coming together when implementing major national programs. The proposed nongovernmental "shell" of the GEM project will make it possible to bring together the efforts of different enterprises, precluding groundless antagonisms, among them those arising from unjustifiable arrogance. The organizational "shell" of the GEM project will give rise to conditions for the bringing together of specific specialists through a system of scientific-technical and expert councils ensuring adoption of the technically most justified and effective decisions.

GEM Project

The technical form of the GEM project is a global information system, which brings together:
-- multilevel environmental monitoring systems,
-- integrated telecommunication networks,
-- predictive models of environmental changes and search for optimum control schemes for increasing production efficiency under conditions of a changing state of the environment and which will serve for ongoing monitoring of ecological conditions, for developing and monitoring the implementation of environmental restoration projects, for monitoring the state of natural resources and their use, for a closer study of changes in the environment and, accordingly, for development of its models, for warning of and predicting extraordinary situations (atmospheric catastrophes, forest fires, mudflows, floods).

Along humanitarian lines the GEM Project can be regarded as a component part of international nongovernmental programs for the development of new technologies, adapted to the specific conditions prevailing in Russia, directed to improvement of the system of interaction between anthropogenic and natural environments.

In addition, the high, primarily laser information, electronic and precision optical technologies, and also resource-conserving technologies for the production and transformation of energy, are dual-purpose technologies and can be regarded as means for maintaining global safety and also as new forms of force which can be applied in local conflicts. Reference is to techniques for reconnaissance and observation, communication and monitoring and new generations of systems for inflicting ultrahigh-precision damage.

The GEM project includes the following principal blocks:
-- telecommunication;
-- scientific-methodological principles and global monitoring, ecological safety and efficient use of the environment;
-- multilevel monitoring technologies;
-- informational technologies for predicting environmental changes and adaptive control;
-- technologies for restoring the environment and global safety;
-- development of governmental services, improvement of legislation for introducing ideas into the broad social consciousness.

Conceptual and Technological Aspects of GEM Project

Integrated Telecommunications System

It is proposed that an integrated communication system, combining satellite communication, mainline and local surface networks, be used in the collection, processing and dissemination of the information product to the user. It is desirable that this work be coordinated with the programmed collection and dissemination of information in Russia.

The data communication and dissemination channels, those already existing and those planned, in the final stage must be filled with economic information, information ensuring control of social processes and predictive geoecological information, in addition to financial-production and everyday information, that which at the present time dominates in communication channels. The objective process of growth in the network of information channels will create the prerequisites for generating a mass user of geoecological predictive information.

The system must be organized on the modular principle. The principal components of such a system should be:
-- systems of mainline satellite communication using geostationary satellites and high-orbit satellites for high-latitude regions. Orientation will be on the use of national systems with the coordination of new development work and data dissemination

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standards. The use of the Gorizont, Most and Ekran systems is proposed for the Russian Federation and the CIS. Surface reception stations must be integrated with the established wire and cable telephone network;
-- optical communication systems, whose creation for the time being is in the development stage, will be used for mainline information exchange between space vehicles;
-- in inaccessible regions mobile satellite communication will be used for telecommunication support of users in areas with an inadequate telecommunication cable structure. For the conditions prevailing in the Russian Federation, with an inadequate development of the telecommunication network, this may be regarded as the principal direction in broadening of the user network. It is proposed that the "Kondor" Project mobile satellite service, which is in the development stage, be used for the Russian Federation and the CIS;
-- the principal component of the surface structure must be mast telecommunication centers, which can be combined into honeycomb structures, have an output to mobile satellite service facilities with portable subscriber equipment and which will provide 100-200 users with voice communication, means for transmitting data, have a capability for automated data collection from the network of monitoring stations, ensure communication with moving subscribers with a simultaneous determination of their coordinates and have an output to local telephone networks. Active development work is being carried out in this direction in different variants: by means of licensing, coordination of this development work and market competition there will be assurance of the mass reproduction of the technically and economically most successful variant;
-- for broadening of the communication network with a limited number of mobile subscribers with minimum weight and size parameters of subscriber equipment it will be possible to use low-orbit communication systems which at the present time are being set up on a commercial basis (Gonets, Nomos, Globsat and other projects.) The efficiency of such systems in comparison with mobile communication via a geostationary satellite and mast subscriber centers is determined in the process of their operation and competition.

Under the conditions prevailing in the Russian Federation, with a low level of development of telecommunication resources, the combination of a mast subscriber center and mobile satellite communication should become the principal method for meeting the needs for telecommunication resources. At the level of the GEM project, with interaction with governmental licensing agencies, there should be coordination of activity on the large-scale production of subscriber equipment. The information block of the GEM project will be developed in close coordination with the "Information Collection and Dissemination in Russia" program.

The development and production of subscriber equipment should proceed along the following lines: free market conditions for development, production and sale. In the first stage there will be priority

introduction of imported equipment in Russia, with the simultaneous development of our own competitive production through the creation of joint enterprises, privately held and stock-holding Russian entrepreneurial enterprises. Organization of a coordinating council, which through the regulation of governmental licensing activity will reduce development work to a singl: standard and ensure support for the most successful variants.

Scientific-Methodological Principles of Global Monitoring, Ecological Safety and Efficient Use of Environment

The development work and research carried out in this direction are combined in the programs "Ecology of Russia" and "Ecological Safety of Russia." The structure of federal and territorial agencies carrying out ecological activity was defined in the formulated concepts of the UGEMS. It is necessary to supplement these programs by provisions ensuring their integration with the GEM project (appropriate proposals exist and may be presented) and to develop measures ensuring the coordination of such research and other work under the GEM project.

A number of model regional centers for ecological monitoring of the environment are being organized for perfecting methods and technical equipment for monitoring, calibration and identification of satellite observations. One of these centers will be the center in the Pereyaslavl-Zalesskiy region of Yaroslav Oblast, about whose establishment a decree was issued by the Ministry of the Environment. Regional centers are being established on the Kola Peninsula and in Krasnodar Kray.

Technologies for Global Geoecology Monitoring, Prediction of Environmental Changes and Adaptive Control

In order to understand the special character of the proposed GEM Project and its distinguishing features it is necessary to dwell on those physical premises which serve as its basis. Traditionally by "ecological monitoring" is meant the carrying out of a physicochemical analysis of the environment, generalization of these data in the form of maps and summaries and the use of this information for evaluating biological danger, state of biocoenoses, ecological risk (incidence of disease) and organization of a database and technical equipment facilitating the adoption of optimum decisions using mathematical models, ecological risk and ecological-economic scenarios, databases and other information technologies.

Virtually independently of ecological monitoring hydrometeorological monitoring is carried out and information systems are organized for weather prediction.

Also independently solved are problems involved in use of environmental monitoring methods for warning of extraordinary situations (detection of forest fires, warning of floods, mudflows),

for monitoring radiation conditions, for predicting conditions for radio wave propagation, etc. Means are being created, including space techniques, for carrying out scientific research on: the ozone layer, climatic gases, solar activity, for studying the carbon and hydrological cycles, for studying typhoon generation processes, etc. All these problems are brought together by the common physics of the processes in the environment and the use, to one degree or another, of similar measuring methods and apparatus, as well as the active involvement of telecommunication resources.

In the GEM Project it is proposed that an examination be made of a unified global information system for monitoring and predicting the state of the environment, taking in weather-forming and climate-forming processes in the atmosphere, radiation conditions, transport, transformation and accumulation of pollutants and their influence on the state of natural resources and biota. In this case not only the aspects of environmental pollution, but also the equally important aspects of the influence of weather changes on the efficiency of activity of transport, power production, mining branches, recreation industry, safety, etc. are acquiring practical importance, as are aspects associated with the development of "dynamic" scenarios of environmental change with one or another local or global processes associated with environmental change and impact on the environment.

The predictive informational nucleus of the system is mathematical models of the environment and especially models of general circulation of the atmosphere and ocean currents. The resources of space and surface monitoring systems supply information on the current state of the environment to the input of the models on an on-line basis.

In such a formulation ecological problems are regarded as a problem in transport and accumulation of pollutants from the entire ensemble of localized sources, which is solved both by the instrumentation of the direct measurement (contact and remote) networks and by computations using models and data on general circulation of the atmosphere, models of transport and accumulation of pollutants in ground water, in water basins, in soils and in the vegetation cover. The computed data are calibrated using data from the network of surface nd aerospace observations, but in this case the density of the surface network may be considerably reduced. Data on pollution sources can be certified or measured by surface remote observation instruments. In such a scheme, by computation methods breaking down the contribution of individual sources of pollution for each region, it is possible to determine the most significant sources of unfavorable impact on the environment and accordingly work out optimum tactics for preserving and exploiting the environment. The ecological monitoring problem for the specific conditions prevailing in Russia is viewed somewhat differently in this formulation. The impossibility of establishing a dense network of surface observation points is compensated for by the possibilities of collecting data on the transport and accumulation of pollutants, which are obtained

predominantly using data on general circulation of the atmosphere. These computed data make possible a more precise determination of zones of more detailed surface monitoring. In addition, the opinion has been expressed that space monitoring methods make possible direct effective detection of about 10% of the most important "pollutants." Accordingly, the conclusion is drawn that space monitoring in general is ineffective. However, in the proposed formulation in the computation monitoring method for solution of the problem it is precisely space remote sensing which will make it possible to organize the necessary network of initial data for mathematical models of global transport. In this case lidar sounding methods, which for the time being are regarded as secondary, acquire great importance. The hydrometeorological prediction obtained as a result of operation of the predictive information system, in combination with adaptive control models in different fields of economic activity (transportation, power production, agricultural production, etc.), whose efficiency to a considerable degree is dependent on weather-climate changes, will make it possible to work out optimum control at the level of an automated information system. A combination of the predictive simulation procedure with the widely used means and methods for evaluating natural resources and different types of pollutants will make it possible to organize objective surveys of natural resources and to improve technologies for the production of food products, raw material, forest products, etc.

Predictive models of general circulation of the atmosphere also can be used for predicting the occurrence of atmospheric catastrophes.

Monitoring techniques can be used in monitoring natural resources and also for detecting and many-sided warning of such dangerous phenomena as forest fires, mudflows, floods, etc.

The use of predictive modeling in the development of projects for the preservation and especially the restoration of the environment will make it possible, first of all, to determine the priorities in implementing specific projects for purification of the effluent of different kinds of production, proceeding on the basis of the degree of their many-sided impact on the environment, which will make it possible to select an optimum strategy for the financing of this work; and second, will make it possible to carry out an objective ecological expert evaluation of new projects associated with substantial pressure on the environment.

The technical and information systems brought together by the project for the first time will create a unique tool for global scientific investigations of the environment and the results of such research will constantly improve the system. Thereby the project will create a technological "shell" bringing together the processes of learning and practice.

The proposed approach will give rise to a system of criteria which will make it possible to analyze different costly projects for

organizing definitive monitoring systems, regarding them from the point of view of correspondence to the requirements, proceeding on the basis of the informational, modeling nucleus of the system and the formed information product.

Still another distinguishing feature of the GEM project is a combination of multilevel monitoring with the integrated telecommunication system. Such a combination is responsible for the special features of the economic model of the project. In the initial stages some of the profit from the operation of the telecommunication structures may be used in financing the remaining components of the project. Later the financial expenditures on implementation of the project may be recovered by economic efficiency from the dissemination of the information product formed by the system.

Technologies for Restoring the Environment and Global Safety

By this is meant the organization and implementation of programs directed to the development of methods, the creation of technical systems and the forming of special organizational forms for the efficient use of the environment. Reference is to the construction of special machines and creation of technologies for restoring the environment, technologies for the processing of wastes, technologies and systems for restoring land resources, industrial technologies of the closed cycle type and technologies for the purification of wastes. Work on the search for and introduction of new energy-conserving technologies, search for new principles for the creation of ecologically safe and highly efficient energy sources, as well as the development of such promising power sources as atomic energy, but under the condition of ensuring the safety of nuclear power plants, must occupy a special place. A detailed discussion of these matters will be the subject of an independent report.

Much has already been done and is being done in this direction. However, as for the global ecological monitoring technologies considered above, the proposed concept of the GEM project forms a basis for the ordering and strengthening of the purposeful direction of this work.

Within the framework of the project plans call not only for the development of new technologies and coordination of the activity of organizations and services applying these technologies, but also the formation of an organizational system ensuring their effective introduction and implementation of administrative decisions made as a result of functioning of the information block of the GEM project.

In the field of development of governmental services, improvement in legislation and introduction of ideas into the broad public awareness, practical work will be carried out at the level of organizational structures of the GEM, which will be discussed below.

In the initial stage of the GEM project the "test range" for the perfecting of technologies for the efficient use of the environment

should be model centers for the monitoring of the environment, the first of which will be established at Pereyaslavl-Zalesskiy.

Concept of Organizational Model of GEM Project

General Principles

The organizational model of the GEM project must provide conditions for its financing and self-development, must create conditions for the most effective solution of technical problems and conditions for effective interaction with governmental organizations.

The impact of the GEM project on Russian ecological policy will pass through participation in the formation of government programs and by means of practical participation in their implementation, providing an information product and the technical systems of the GEM project, as well as by making use of the intellectual potential embodied in the GEM project, and work on the training of special bodies of personnel.

A nongovernmental, noncommercial GEM fund is proposed as the principal structure of the GEM Project.

The organizational structure of the GEM project must be established on the basis of the following principles:

-- organization of independent expert councils for examining the finalized project proposals and setting priorities;

-- governmental organizations by means of tax concessions and centralized financing should ensure realization of these priorities;

-- organization of independent commercial organizations for systemic research, carrying out research and development work, relying on specific individuals and groups (development of author's projects);

-- separation of governmental and commercial production organizations from the project developers and coordinators;

-- organization of specialized implementation organizations;

-- orientation on military structures in the operation of "collective" elements of the system (space complexes, computer centers, communication lines, individual components of the surface monitoring system);

-- organization of permanently operating schools, seminars, etc. for examining the different problems which arise in the project.

Organizational Structures of GEM Project

It is proposed that the structures enumerated below be activated in the organizational stage of the GEM project.

Russian participation in the GEM project will occur under the aegis of the World Laboratory.

The GEM Fund is being established for implementing the project; it is proposed that the founders be:

RUIE, Atomic Energy Institute imeni Kurchatov, Ecological Environmental Monitoring Station (ESKOS) of the World Laboratory Branch in Russia, Institute of Practical Problems in the Development of Society, KEI Fund, "EKOKORDON," Kola Ecological Association, Kuban GET, Salyut-KEI-Holding stockholding company, KEI BANK, KUBAN BANK, Kondor stockholding company, Cosmonaut Training Center, Programmed Research Center, Russian Academy of Sciences, other interested enterprises and organizations.

It is planned that the structure of the GEM Fund include an Observation Council, Board of Directors, Management Office and Scientific-Technical Council.

The work of the GEM Fund will be accomplished in interaction with the Russian Union of Industrialists and Entrepreneurs, agencies in the office of the president, organizations of the Supreme Soviet and government of the Russian Federation. The tasks of the consortium will include the financial and resource support of the project, direction of the overall scientific and practical activity of the project and support of coordination of international and Russian governmental programs and work under the GEM Project.

A system of scientific-technical and coordinating councils and committees also is being organized: International Scientific-Technical Council for the GEM Project, coordinating committee for the project, responsible for interaction between the GEM project and the World Laboratory.

It is proposed that subcommittees in the following fields be organized within the framework of the coordinating council:

-- systemic-strategic research on global safety and efficient use of the environment, problems in global modeling and adaptive control;

-- problems in efficient use of the environment, restoration of the environment;

-- problems in practical ecological analysis;

-- telecommunication technologies, global monitoring technologies;

-- humanitarian problems, juridical support, means of mass communication and education;

-- conversion and development of high technologies;

-- international cooperation.

A coordinating committee on the problems involved in nuclear and alternative forms of power production is being established.

Working groups and expert councils are being established in the coordinating councils and subcommittees. Among the expert councils plans call for establishing the following:

-- expert council on space information technologies and satellite communication;

-- expert council on surface monitoring methods and instruments and apparatus employed;

-- expert council on systemic planning problems;

Implementation-coordination functions for the project as a whole are divided in the following directions:

-- scientific-methodological principles, aerospace and surface monitoring, global aspects, interaction with the structures of the Ministry of Science, Ministry of Ecology, State Committee for ChS [expansion unknown], Russian Space Agency and subdivisions of the World Ecological Laboratory;

-- surface medium and regional aspects and programs;

-- systemic planning, telecommunication system, surface monitoring facilities, surface subscriber information complexes, regional centers, coordination of work on new technologies, coordination with organizations of the Ministry of Defense and Federal Safety Agency;

-- computation complexes and systems;

-- means of mass information, organization of seminars, conferences, schools and issuance of publications;

Permanently operative seminars and conferences are being organized within the framework of the consortium. Journals are being founded.

Regional Structure of GEM Project

The GEM project is open for proposals on the organizing of regional centers and structures. The regional structures of the GEM project must operate in interaction with UGEMS organizations. With allowance for the established contacts and developments within the framework of the GEM project even in the initial stage the following regional structures are being planned:

Under the direction of the ESKOS a model regional center for environmental monitoring is being established in the Pereyaslavl -Zalesskiy region of Yaroslav Oblast. The model regional center

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center will serve for perfecting methods and the instrumental-apparatus base for physicochemical analysis and remote sensing, for working out methods for the identification of satellite observation data and determining the state of the environment (pollution of water bodies, forest diseases), including using simulation of standardized pollutants in local sectors, in working out information systems, data collection systems, for establishing a center for ecological teaching and training of personnel for making ecological expert evaluations, for working out methods for joint satellite, aerial and surface monitoring. The Pereyaslavl-Zalesskiy region, in addition, has capabilities for perfecting methods for background ecological monitoring and working out ecological reference standards. Here, in addition, there are broad possibilities for working out geographical information technologies for the processing of regional monitoring data obtained from mobile laboratories.

Work is being carried out for establishing model regional centers:

Northwestern region (Kola Peninsula) on the basis of the Kola Ecological Association.

Southern region (Krasnodar Kray) on the basis of the Caucasus Regional Ecological-Information Center (director V. V. Abrashkevich) and the Kuban GET firm.

Siberian region (Krasnoyarsk Kray) on the basis of the Krasnoyarsk State University Scientific-Technical Center and the Kristall Scientific Production Center.

Ural region, oriented on the perfecting of radiation safety methods and methods for monitoring nuclear power plants.

In addition, the Russian part of the project is open for participation to all states of the former USSR, which will make it possible to solve problems which are in common for all, which would be beyond the capabilities of individual states, and also will make possible the restoration and improvement of communications in the high-technology field. Thus, already in this stage it would be feasible to bring in the Republic of Kazakhstan, where work on the collection and dissemination of information is being developed actively. [Large part of sentence illegible] and high nonuniformity of stress of ecological conditions and presence of ecologically pure zones are making it possible to carry out broad experiments for study of the factors involved in the transport of pollutants, including carrying out model experiments in poorly exploited territories, whose danger will be incommensurably less than when nuclear tests, tests of chemical weapons and hydromeliorative "experiments" were carried out, where enormous zones were formerly alienated for the needs of the military-industrial complex. But these specifics of Russian territories are creating unique possibilities for the practical study of ecological problems which neither the European, nor North American, nor most Asiatic well-developed countries have.

Technological Support for GEM Project

In the practical realization of the GEM project it is proposed that key Russian high-technology enterprises, institutes of the Academy of Sciences and branch institutes will be involved and different small production organizations will be established and drawn into work on implementation of the project. It is planned that the use of high-technology enterprises will be within the framework of conversion with allowance for their developing field of specialization.

It is proposed that the following directions be defined within the framework of the project:

-- control of the space monitoring and communication part of the project, the global data transmission system (Vympel MGAK, Kometa NPO),

[Sentence completely illegible.]

-- space and surface ecological instruments (Elas NPO, RNII KP), multifunctional spectroscopic surface monitoring techniques (Spectroscopy Institute, Russian Academy of Sciences), surface techniques for calibration measurements of atmospheric parameters (Atmospheric Optics Institute, Atmospheric Physics Institute, Russian Academy of Sciences);

-- space platforms of light and intermediate classes (Lavochkin NPO, Central Special Design Bureau);

-- multifunctional space platforms with power plants (Mash NPO -- radar equipment, Salyut Design Bureau -- lidar equipment);

-- apparatus for lidar sounding of the atmosphere (General Physics Institute, Russian Academy of Sciences, Atmospheric Optics Institute, Tayfun NPO);

-- apparatus for remote sensing in the radio range and geophysical apparatus (Electronics Institute, Special Design Bureau of the Moscow Power Institute, Applied Geophysics Institute);

-- mobile satellite communication system (Salyut Design Bureau);

-- launching facilities (Salyut Design Bureau, Energiya NPO);

-- systems for the processing of satellite information (Planeta NPO).

[Sentence completely illegible.]

For the development, initiation and implementation of the GEM Project it is proposed that extensive use be made of defense systems, as dual-purpose systems, and also the involvement of organizations of the Ministry of Defense in participation in the project,

in particular in the organization of the launching of space vehicles, in organizing aerial monitoring and in the operation of the technical equipment for control of the multicomponent monitoring and telecommunication parts of the project. This will mean the defining of a new function of the armed forces for ensuring global safety.

A detailed determination of the organizations participating in the project and their field of specialization will be determined in the course of development of the systemic work project and program.

Economic Model of GEM Project

The scheme for financing of the GEM project assumes primarily extrabudgetary forms, realized through the GEM Fund, with involvement of the resources of commercial and investment organizations and regions and use of the profit from the step-by-step setting up of the project. The sources of profit in the GEM project will be communication systems, furnishing of subscribers with telecommunication resources and the information product, as well as implementation of local information collection and dissemination projects within the framework of the GEM project. An important source for support of the project will be its balanced participation in international programs. With respect to budgetary sources, the GEM project, having advantages over alternative projects, will make possible the more purposeful use of the allocated sums, which in combination with other sources of financing will provide advantages when carrying out governmental programs such as "Ecology of Russia," "Ecological Safety of Russia," "Information Collection and Dissemination in Russia" and Russian Space Agency programs. In addition, with allowance for international cooperation the GEM Project will ensure the development of high technologies having importance for defense.

The stage of development of the systemic work project and program, as well as the implementation of individual regional programs, are planned without drawing upon budgetary sources. Later on the GEM Project will use budgetary financing only in the event that the technical solutions and possibilities proposed by it exceed the similar projects developed within the framework of governmental programs.

It is proposed that use will be made of resources from enterprises and organizations carrying out vigorous activity in use of the environment, for example, as in the case of the ecological activity of the European Economic Community. The working out of this scheme could begin with the project for exploiting the gas deposits of the Arctic, drawing the Rosshelf consortium into participation in the GEM Project.

Thus, the scheme for supporting the GEM Project is intended for transition to self-financing as the rate of its implementation accelerates.

Priority Measures

The support of the proposed project by the international community, Russian industrialists and entrepreneurs, and also by commercial financial organizations will provide conditions for its implementation with a definite autonomy from the policy of governmental organizations.

Upon receiving support for the proposed project, first of all plans call for carrying out work in the immediate future on the final structuring of organizational forms, on providing conditions for participation of all enterprises and organizations interested in the project.

For the detailed structuring of the project, more precise determination of its general humanitarian content and technical content and more precise clarification of the distribution of participation among producing enterprises it is necessary to develop the systemic project with respect to Russian proposals and to coordinate them with international projects. As the sources of the systemic project it is proposed that use be made of materials from the EOS project, the IS GEO project and the "Global Russian Monitoring Systems" projects.

The completion of the first stage in the work will be the holding of an international conference on the Russian part of the GEM Project in April-May 1993 at which the principal problems defining the practical content of work, its rates and financing methods must be solved and put into finalized form.

Summary

In summarizing what has been said, we once again will mention the attractive features of the presented proposals:

-- for the first time a many-sided purposeful project has been proposed which is oriented on extrabudgetary forms of financing, [words illegible], bringing together the attainments and capabilities of very large Russian industrial high-technology enterprises, Academy of Sciences, colleges, [word illegible] organizations and enterprises, which is integrated into international programs and will facilitate the more efficient implementation of governmental programs in Russia;

-- this project is bringing together the best conceptual attainments in the field of model representation of global processes, interaction between anthropogenic and natural environments oriented on advance response to the onset of ecologically dangerous events, adaptive control of economic activity with allowance for natural environmental changes;

-- the conceptual structuring of this project provides for a many-sided purposeful orientation of ecological activity, involvement of

the mass user in a truly advantageous use of its results, and it will make it possible to organize forms of industrial activity and mass ecological awareness corresponding to the general world level;

-- this project offers a worthy undertaking for the participation of all key high-technology enterprises in Russia; the organizational shell of this project, proposed in the form of a consortium, will make it possible to override unnecessary competition of enterprises and the struggle of departmental ambitions due to the participation of highly professional representatives in a system of coordinating committees and expert councils, ensuring the adoption of the most objective and validated solutions. The project affords new possibilities for the purposeful participation of both Russian enterprises and specialists in the international scheme for division of labor in the field of highly scientifically demanding technologies and will make it possible to preserve and multiply the scientific-technical and engineering potential of Russia.

ПРОТОКОЛ О НАМЕРЕНИЯХ

город МОСКВА сентябрь 1993 г.

ЦНПО КОМЕТА с Российской стороны и RTA CORPORATION с Американской стороны, именуемые в дальнейшем "СТОРОНЫ" обсудили предмет возможной совместной деятельности по проекту GEES "Глобальные исследования окружающей среды и экологии" и официально заявляют о своем участии в реализации проекта и заключают настоящий протокол о намерениях в целях:

- эффективного применения разработок оборонных отраслей промышленности в интересах улучшения экологии окружающей среды и повышения безопостности обеих сторон;
- укрепления доверия и взаимопонимания между Россией и США;
- ускоренного внедрения и применения современных средств дистанционного зондирования поверхности океана, суши и атмосферы в системах двойного применения.

Стороны достигли договоренности о нижеследующим:

1. Стороны согласились с необходимостью разработки СИСТЕМНОГО ПРОЕКТА GEES на первом этапе.

2. Этап разработки СИСТЕМНОГО ПРОЕКТА выполняется Российской стороной с кооперацией и включает проведение частных летно-морских испытаний на полигонах исполнителя и возможно заказчика, направленных на уточнение ранее полученных экспериментальных данных.

3. В СИСТЕМНОМ ПРОЕКТЕ должны быть проанализированы экспериментальные данные и разработана архитектура полной системы, включая космические и авиационные платформы, информационные приборы для дистанционного зондирования, программное обеспечение и другие части системы.

4. Этап разработки СИСТЕМНОГО ПОЕКТА и предварительных демонстрационных испытаний оценивается 700 000 долларов США и финансируется через RTA CORPORATION за счет ассигнований бюджета США.

5. Американская сторона принимает все необходимые меры к скорейшему заключению контракта между RTA CORPORATION и ЦНПО КО-

МЕТА на разработку СИСТЕМНОГО ПРОЕКТА с обязательством на общую сумму 700 000 долларов США с началом оплаты по счетам за выполнения этапов сразу после подписания контракта. На каждом этапе работы должен быть представлен отчет по форме, определяемой контрактом.

6. Срок представления и разработки СИСТЕМНОГО ПРОЕКТА Российской стороной 1 год с начала финансирования.

7. Стороны отмечают необходимость немедленного создания организационной структуры, ускоряющей процесс обмена оперативной информацией и разработанной продукцией в рамках проекта GEES.

Порядок передачи документации, проведения взаиморасчетов, режим использования информации, передаваемой сторонами друг другу и другие аспекты сотрудничества Сторон, неоговоренные в настоящем Протоколе, определяются Генеральным Меморандумом по проекту GEES, к заключению которого стороны будут стремиться.

ОТ ЦНПО КОМЕТА

ОТ RTA CORPORATION

ПРЕДЛОЖЕНИЯ
ЦНПО КОМЕТА

к россиско-американскому проекту

ГЛОБАЛЬНЫЕ ИССЛЕДОВАНИЯ ОКРУЖАЮЩЕЙ СРЕДЫ И ЭКОЛОГИИ
GEES

сентябрь, 1993

ЦНПО КОМЕТА

МОСКВА, РОССИЯ

RTA CORPORATION

WASHINGTON, UNITED STATES

- 2 -

СОСТОЯНИЕ ВОПРОСА

Совместный российско-американский проект "Глобальные исследования окружающей среды и экологии" (GEES) будет направлен на создание аэрокосмических систем дистанционного зондирования поверхности океана, суши и атмосферы в интересах экологического мониторинга, исследования природных ресурсов Земли, получение новых данных для фундаментальных исследований, комплексного развития систем оборонного назначения для поддержки концепции стратегического равновесия, обеспечения безопасности США и РОССИИ от возможного нападения со стороны третьих стран.

В настоящее время обеими странами накоплен значительный опыт в разработке эффективных информационных систем и приборов для дистанционного наблюдения Земли, особенно в интересах обороны, которые могут с успехом применяться для обнаружения и исследования аномалий окружающей среды на водной поверхности, суши и в атмосфере.

Кроме того созданы уникальные космические платформы и авиационные летающие лаборатории на которых размещены датчики дистанционного исследования окружающей среды. Российскими и американскими учеными разработаны физические и информационные модели различных объектов наблюдения и контроля, которые позволяют оптимальным образом проектировать аэрокосмические датчики и платформы. Поэтому, с целью объединения научно-технических потенциалов России и США в области дистанционного мониторинга, российскими и американскими учеными предлагается осуществить совместный проект

GEES, в рамках которого должны быть решены вопросы, связанные с разработкой концепции создания систем дистанционного зондирования, проведением теоретических и экспериментальных исследований аномалий окружающей среды, созданием банков измерительной и модельной информации об информативных параметрах окружающей среды, созданием аппаратурных средств наблюдения, систем обработки и хранения больших потоков информации, осуществлении демонстрационных проектов с действующими системами, распространением полученной информации.

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ЦЕЛИ И ЗАДАЧИ ПРОЕКТА

Целью проекта GEES является проведение научно-исследовательских и опытно-конструкторских работ по созданию и совершенствованию аэрокосмических систем дистанционного зондирования Земли для решения задач экологического мониторинга, исследования природных ресурсов, контроля за распространением и применением передвижением стратегических вооружений. При разработке будут решены следующие основные задачи:

1. Разработана концепция аэрокосмической системы для обнаружения и распознавания аномалий природной среды.

2. Создана оптимальная архитектура системы, включающей космические, авиационные и другие платформы с дистанционными датчиками, обеспечивающими наблюдение за различными объектами в оптическом и радиодиапазонах спектра электромагнитного излучения с максимальными контрастами, высокопроизводительные вычислительные комплексы обработки информации, программно-алгоритмическое обеспечение.

3. Проведен анализ существующей космической информации по различным объектам наблюдения, расположенных в океане на суше и атмосфере и проведены эксперименты в различных акваториях океана, над различными участками суши и в атмосфере для уточнения этой информации.

4. Осуществлена разработка систем и их отдельных составных частей.

5. Проведены демонстрационные натурные испытания с использо-

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ПЕРВООЧЕРЕДНЫЕ ЦЕЛИ НАБЛЮДЕНИЯ ПРОЕКТА GEES.

В рамках проекта GEES будут проведены экспериментальные исследования характеристик подстилающей поверхности и атмосферы с целью демонстрации возможностей аэрокосмических систем по определению параметров аномалий в окружающей среде вызванных природными и антропогенными факторами. Демонстрационные испытания должны показать эффективность построения аэрокосмических систем для решения особо важных задач в области океанологии, гидрологии, метеорологии, климатологии, безопасности стран - участников проекта.

1. Задачи в области океанологии и гидрологии.

Задача 1.1. Исследование взаимодействий океана и атмосферы в зонах активного энергообмена.
Цель: Построение физических моделей тепло- и влагообмена между океаном и атмосферой.

Задача 1.2. Исследование пространственной структуры морского

волнения, измерение площади и температуры поверхности.

Цель: Определение границ и скорости течений, размеров и скоростей движения рингов, меандров, вихрей, водоворотов синоптического масштабов, скорости приповерхностного ветра.

Задача 1.3. Исследование взаимодействия естественных гидрофизических процессов с морской поверхностью.

Цель: Получение данных для создания моделей взаимодействия внутренних волн с морским волнением.

Задача 1.4. Исследование биопродуктивности океана, загрязнений морей органическими и нефтяными пленками.

Цель: Получение данных о загрязнениях океана нефтепродуктами и стоками производств, состояние шельфовых зон активного рыболовства и искусственных сооружений (портов, курортных зон, нефтяных платформ и т.д.).

2. Задачи в области метеорологии и климатологии.

Задача 2.1. Исследование динамики облачного покрова.

Цель: Определение верхней границы облачного покрова, скорости распространения облаков, влаго- и водосодержание, толщины, альбедо.

Задача 2.1. Исследование газовых и аэрозольных компонент атмосферы.

Цель: Получение и создание банка данных по высотному распределению и концентрации водяного пара, углекислого газа, озона, азотных соединений, хлорфторметана и других.

3. Задачи в области безопасности.

Задача 3.1. Исследование аномалий морской поверхности, обусловленных естественными и искусственными возмущениями водной среды.

Цель: Разработка и создание физических моделей аномалий морской среды, вызванных движением погруженных подводных и надводных объектов.

Задача 3.2. Исследование фоново-целевой обстановки на акваториях Мирового океана.

Цель: Разработка информационных моделей ФЦО для создания аэрокосмической системы дистанционного зондирования.

Задача 3.3. Исследование структуры поверхностных следов движущихся подводных и надводных объектов.

Цель: Создание алгоритмов классификации объектов

ЭТАПНОСТЬ РАБОТ.

Стороны договариваются о поэтапном выполнении работ, которые будут выполнены в направлении реализации аэрокосмической системы дистанционного зондирования. На начальных этапах работы прорабатываются и анализируются возможные альтернативные варианты построения систем с учетом возможной экономии средств и максимальным использованием существующего научно-технического задела в части авиационных и космических носителей и платформ, информационных датчиков, систем и программ обработки данных. По результатам рассмотрения всех вариантов и демонстрационных исследований на последующих этапах ЦНПО КОМЕТА и RTA CORPORATION создают аэрокосмическую систему, проводят демонстрационные эксперименты и эксплуатацию. Экспериментальные данные, полученные в процессе работы системы, распространяются на комерческой основе. Объемы финансирования каждого этапа должны определяться в конце предыдущего этапа.

Работа над проектом GEES проводится по следующим этапам

1-ый этап - Выработка концепции GEES и презентация проекта - 3-4 кв. 93 г.

2-ой этап - Проведение частных экспериментальных - 4 кв. 94 г.

исследований с существующими системами

3-ий этап - Разработка системного проекта аэрокосмической системы - 3 кв. 95 г.

4-ый этап - Создание авиационных и космических комплексов - 96 г. (уточняется)

5-ый этап - Проведение демонстрационных экспериментов - 97 г. (уточняется)

6-ой этап - Коммерческая эксплуатация системы - 2000 г.

ОБМЕН ИНФОРМАЦИЕЙ

При выполнении программы экспериментальных работ между Американской и Российской сторонами будет осуществляться полный двухсторонний информационный обмен в рамках совместных экспериментов. Для обеспечения совместимости информации стороны разрабатывают и используют одинаковые интерфейсы для отображения, хранения и обработки информации. Поэтому в рамках проекта СЕЕС с целью сокращения сроков создания аэрокосмической системы целесообразно использование российской и американской аппаратуры.

Опыт накопленный при летных экспериментах на начальных этапах должен быть использован при создании и эксплуатации последующих поколений системы. Для этого создается совместная группа планирования и управления.

ОЦЕНКА СТОИМОСТИ

ЦНПО КОМЕТА произвела предварительную оценку стоимости проекта GEES при которой учитались следующие основные положения:

- стоимость разработки и создания технических средств, обеспечивающих выполнение требований технического задания на проект в целом,

- стоимость проведения экспериментальных работ с учетом привлечения космических платформ, авиационных носителей, пунктов приема и обработки информации, включая техническое переоснощение, разработку программного обеспечения и дополнительных средств связи,

- стоимость разработки Программы экспериментов,

- стоимость работ кооперации, привлекаемой на отдельных этапах работы,

- стоимость изготовления нескольких комплектов аппаратуры,

- деятельность совместной группы координации и планирования в период разработки проекта.

С учетом выше изложенного стоимость проекта может составить от 115 до 190 миллионов долларов США. Эта оценка является предварительной и может изменяться как в сторону увеличения - при условии выявления дополнительных расходов, так и в сторону уменьшения - при условии оптимального использования научно-технического и технологического задела, накопленного в ЦНПО КОМЕТА.

ATTACHMENT 12

SPACE RESEARCH INSTITUTE

ACADEMY OF SCIENCES, RUSSIA

Applied Space Physics Department

Moscow, 117810, GSP-7, Profsoyuznaya 84/32,
FAX (7)095 333-10-56,
Phone 333-52-79, Telex 411498 STAR SU

FAX Number: 187 63 70

TO: D.Rekethaler, DARNAUKA, USA
Robin Armani, Budapest, Hungary

October 21, 1993

Dear Douglas, Dear Robin,
I received Douglas FAX October 19,1993.
1. I agree with all "general term" in P.3. Especialy I'd like to note that according to "Gor-Chernomyrdin Space Commerce Agreement" market sellings from Russia are limited by cost (from below!) and in numbers. Do investigate, please, this agreement in detail. Since this agreement is existing, it will be better to work through Russian space program with using American money, better through ISMA-IKI with participation Mr.Porter in ISMA at first step, and next - to establish "Geospace Foundation" with Mr.Porter as the President, and Douglas as the Vice-President. This Foundation will collect money from private and governmental organisations and work in Russia through ISMA-IKI and other similar structures.
In such frames costs can be like you want.
2. US-TM can be launched by Russian satellite during next two years by cost less than 60M (including launch).
3. US-TM can be installed on special Almaz together with 2-3 frequency SAR and mow-radiometers by cost 150M (including launch) in 3 years.
4. Russian satellite with SAR of 3 or 10 cm wave length (with the same resolution as ERS-1 but less swath) can be launched in next two years by cost 60M (including launch).
5. To start "the study progress" and to make it in 2-3 month it is necessary to get not less 200K, it will depend on particular details of your requirements and organisations which I can draw into such work.
6. Wave-lengths chosen for Almas-1B SARs according to our recomendations are optimal for several tasks:
a) soil moisture, structures of vegetation and forest can be better determinated by SAR-10 and 70 cm;
b) oil seeps and slicks on water surface - SAR-3 and 10 cm;
c) internal ocean phenomena, bottom mapping - SAR 10 and 70 cm;
d) geological survey, undersurface water detection, and mapping - SAR 70 and 10 cm;
e) determination of wind velocity/direction, sea-surface temperature and thickness of oil spots - by radiometer (multibeam) at 6 and 0,8 cm (laster with polarimeter), and polarimeter-spectrometer 0,8; 1,5; 2,25 cm.
7. Global space monitoring of Environment according to "Gor-Chernomyrdin Agreement" will be realised by state structures: NASA, NOAA, Russian Academy of Sciences, Russian Space Agency, US and Russian "Ministry" of environmental protection.

8. I think it will be much much better if you and Mr.Porter invite me (with Inna) in next two week to visit USA (we have US-visas!). I hope that together Mr.Porter both of you and some others we can in one-two week to find optimal plan for our cooperation on space and ecological problem.

Sincerely yours
V.Etkin

НПО МАШИНОСТРОЕНИЯ
НАУЧНО-ПРОИЗВОДСТВЕННОЕ ОБЪЕДИНЕНИЕ МАШИНОСТРОЕНИЯ
143952, Московская обл., г. Реутов, ул. Гагарина, 33
ФАКС: (095) 302-28-01

№ 181/344 27. 10. 1993 г.

To : Mr. Douglas Rekenthaler
RTA Corporation
Presideht

Fax: (301) 854 - 6250

Dear Douglas,

Thank you very much for the detailed comments and information about the scope of the existing in your country opinions concerning the remote sensing programs continuation.

In this letter I would like to tell you our view, first of all in regard to the third part of your fax, dated October 19,93.
We think it possible to consider the variant of creation of a commercial satellite on the base of the Almaz platform with contribution of both sides.
In this case, participation of the parties could be as follows:

Russia

Manufacturing, ground tests and launch of the satellite. Completing the spacecraft with the supporting systems, namely:

- movement control
- power supply
- thermoregulation
- onboard automatics
- telemetry

Remote sensing and data transmission systems:

- three-frequency SAR
- onboard data collector
- onboard device for radar data synthesis
- search equipment for data transmission via relay-safellite
- wide-swath data transmission channel equipment

USA

The spacecraft completing with

- remote-sensing systems of Landsat-type
- equipment of the channel for data transmission to Landsat ground stations
- equipment for correlation of signals coming from installed sensors
- data collector.

Such variant corresponds to prices and terms indicated by you.
I shall be pleased if these data are of use for you.

Respectfully yours

Pavel A. Shirokov

NOVEMBER 17, 1993

MR. DOUGLAS REKENTHALER
PRESIDENT AND CEO
RTA CORPORATION
3400 JENNINGS CHAPEL ROAD
WOODBINE, MD 21797 USA
FAX: 1-703-418-8262

AND

MS. ROBIN ARMANI
MANAGING DIRECTOR
VITRO-SAAS, LTD.
MAGYAR U. 36
H-1093 BUDAPEST, HUNGARY
FAX: 36-1-266-9225

DEAR COLLEAGUES:

I AM APOLOGIZING FOR MY TOO LATE ANSWER TO YOUR FAXES OF NOVEMBER 2, BUT CONVENTIONAL RUSSIAN NOVEMBER VACATIONS ALONG WITH PREPARING AND BEGINNING MY VISIT TO ITALY INTERFER ME TO MANAGE GIVING APPROPRIATE COMMENTS TO YOUR IMPORTANT PRESENTATION AT THE SENATE COMMITTEE.

HOWEVER IF IT POSSIBLE AND MAY BE USEFUL IN FUTURE I WOULD LIKE TO PROPOSE TO YOU ONE THING IN ORDER TO MAINTAIN EXISTING AMERICAN DOMINANCE IN THE FIELD OF REMOTE SENSING. IT WILL BE QUITE NATURAL TO SEEK FOR A GOVERNAMENTAL ASSISTANCE TO SUPPORT THE COOPERATION HAVING ORGANIZED YET BY YOU IN THE FORMER SOVIET UNION HAVING IN MIND BOTH THE TECHNOLOGIES DEVELOPED IN RUSSIA BEFORE AND A FUTURE PROSPECTIVE MARKET IN THIS COUNTRY FOR THE RELEVANT PRODUCTION. EUROPEAN EXTENSION OF THIS COOPERATION CAN BE FIXED IN THE LIMITS OF A GENERAL NETWORKING PROGRAM WITH PARTICIPATION OF KEY WESTERN AND EASTERN SPECIALISTS INCLUDING BUSINESSMEN. I THINK THAT YOU HAVE SIMILAR IDEAS BUT WE SHOULD HARRY TO FILL THE VACUUM SINCE SEVERAL PURE EUROPEAN PROJECTS ARE NOW STARTING.

YOURS SINCERELY,

KONSTANTIN I. VOLIAK
INTERNATIONAL PROGRAMS
HYDROPHYSICS COUNCIL
RUSSIAN ACADEMY OF SCIENCES

STATEMENT OF ROBIN ARMANI, MANAGING DIRECTOR, VITRO-SAAS KFT

Ms. ARMANI. Mr. Chairman, thank you.

As you know, I am the Director of an American-Hungarian joint venture corporation, and so I have quite a different perspective, being a small company and being based in Europe. I have had to make both a conceptual and a cultural leap to establish this company and to compete in Europe. I went to Europe from a background that included time in DOD. And I went to Europe looking at the systems market, the software market, and the scientific application market, including but not limited to remote sensing.

When I went to may first European remote sensing conference in Hungary, I expected to teach. Instead, I was taught.

From my perspective, having been both a user and an applier here and now serving the European market from Hungary, I think that Europe in general appreciates commercial imagery and remote sensing in a way that we in the United States do not. The American view has always been and remains as you hear today, from the national systems perspective. Historically, these commercial sensors like LANDSAT have been viewed as competitive and not complementary to our national systems. This has hindered our position in what is a growing and very important future market.

The different types of imagery under discussion today of course are complementary. The power and the synergy in this information comes when they are integrated. And as Mr. Araki pointed to one technology, the Geographic Information System area, this is the future market: the integration of different data sources to get the answer.

The commercial customers in Europe are not so much focused on what kind of image or what the resolution of the images is. They have questions—land resource questions, environmental questions—and they need an answer. They want the most bang for their buck. And it is through these technologies, integration technologies using sources, some of which are behind you today, that they get these answers. In my view, the market will be dominated not by companies who focus overly on the data or the imagery sources, but on companies who focus on supporting these information requirements.

You have a few product samples behind you, Senator. I have been impressed by the advanced nature of the applications I saw, particularly in Hungary and Russia. I would like to point just to one of them, which is behind you and also in the written testimony: it is a topographic image map produced by the Hungarian Remote Sensing Center in 1987. This was during the COCOM era, a time when our own applications were as restricted as the technology we were seeking to protect. I was very surprised to see the level of capability, knowing they had no Sun Workstations, only PCs on which to do this work. But they were doing it. And their work today is equally excellent.

Let me look briefly at the three segments of the commercial imagery market, because I was asked to address the European market specifically. In terms of multispectral imagery, of course, we hold a tremendous market share with LANDSAT imagery. This has been, for 21 years, our biggest market share. It is an important

market. It is used in Europe and in Asia for many applications, including resource applications. It is particularly important for a regional view.

Radar imagery, on the other hand, as you know, Europe, Canada, Japan, and Russia have invested significantly in commercial radar systems. This is an area where we are not playing today. The Russians in particular have taken a different approach both to the sensors and to the processing of the data—an approach which they claim is superior to our own for both military and for resource applications. I have at least one customer in Europe—in Western Europe—who is buying that Russian technology because he and we are convinced that it is superior for a particular application, which is the detection of water in deep underground locations in a desert environment.

In terms of the panchromatic imagery, of course there is a market for higher resolution data, because today our applications are limited to what can be done with SPOT, for example, at 10 meters, to sharpen LANDSAT imagery. Higher resolution imagery is especially important for cartographic applications because of the positional accuracy.

My colleagues in Europe tell me that only 17% of the world is mapped at the scale of 1:25,000, and the reason there is such a deficit is in part because the cost of flying the aerial photography is so prohibitive that it just doesn't pay to update these sources. We could contribute, of course, with higher resolution data.

We need to recognize, of course, that Russia is already in that market with two meter data from their national systems. I have an example of that data to my right, to your left—Gary Sojka is pointing to that—which a German company has processed as a digital orthophoto. The Russians have made a point to let us know that they are re-sampling their national imagery. This is far less than its potential, of course. They are talking about the release of two foot imagery in the context of the U.S. decision on commercial imagery. If we decide to release our national imagery, then of course they will re-sample their imagery differently.

Now we need to also note that the Russian two meter imagery is not selling well now. This may be partly due to the poor marketing and the distribution problems. But it also could reflect something about the price of the data and the readiness of the market to absorb it.

There is a business lesson in the Russian experience that we need to look at before we consider our own commercial systems or the viability of our own national data. Price and the ability to deliver the product to the customer is critical. It is more critical than the resolution of the data. And it is something that we have to be prepared to do, whether we do it commercially or whether the government has a role. We have to be able to keep pace with the market, consider the response—if, for example, the Russians release more capable data—to remain competitive. In short, if we are going to do it, we have to do it right and to succeed.

I was asked to address the European strengths and intentions in the commercial remote sensing market. I see five or so strengths. Europe, like the Canadians, have targeted space technology as a strategic area for the future. They have a comprehensive space pol-

icy and a long term plan that includes earth observation. And this policy that specifically includes a strong industrial policy that is targeted on making their industry—the European industry and of course the Canadian industry in the case of RADARSAT—competitive on the world market. They have a global focus. They are growing a new generation of users throughout the world.

At one conference I attended in the Netherlands, there were over a thousand representatives from 79 nations. The participating countries spanned the continents and included China, Iran, Libya, other countries in Africa, the Far East and South America.

Russia has made some overtures that are unprecedented for us in terms of offering joint remote sensing programs. They have offered to jointly develop our next generation remote sensing systems at a capability starting with a LANDSAT 6 look-alike and adding different capabilities up to a combination of a LANDSAT 6 with a three frequency imaging radar, which they believe they could launch in two to three years, for between 60 and $150 million.

One of the important questions I received was how we can assure U.S. dominance of the commercial imagery market while protecting our security interests. I think we first have to recognize that we are not pre-eminent in commercial remote sensing today, particularly when we look at the application and the ability to integrate the multiple data types. I think we have to get back in the game, re-establish our leadership. But we can probably do it best through a policy of inclusion and not of direct competition. In other words, I would like to grow the remote sensing pie instead of cutting it into smaller slices and fighting over those slices with the French, the Japanese, the Russians and so on.

I have some specific recommendations in my written testimony, which include that the United States should create and fund a joint integrated remote sensing program with the participation of U.S. industry and government and with Russian industry and government. I think we might also consider inviting Europe and the Japanese to participate, perhaps in terms of building the duplicate program we need to be sure we succeed.

It is essential that we maintain LANDSAT data continuity and add capability. This is our market today and this is an area where we risk losing our market if we don't act to restore program integrity and to replace LANDSAT 6.

We also need to shift our focus from sensor design to data use. The Europeans have changed their focus under the pressure of budget reductions. We require similar budget action.

We need to revitalize our exploitation and application technologies. These are a little bit stagnant. Today they are too expensive to compete in Europe and they are somewhat limited in production capabilities.

To summarize, I have had an exceptional opportunity to witness and work in the European environment, and I see them very committed to establishing space leadership. They have plans, policies, budget commitment, high level support. They have got their infrastructure built already. They have included industry in a key role. They have developed their own global market by training students from the Third World. They have it all, right down to glossy advertising brochures that clearly state the mission, which is to support

global environmental monitoring and sustainable development, and specifically to promote growth of the European industrial base.

Thank you.

Senator KERREY of Nebraska. I appreciate all the testimony.

I guess to open, I would like to have the three American representatives—Martin and Itek and Lockheed, if he could respond. I mean, I hear in Ms. Armani's testimony a kind of a wake up call. But I would be curious and very interested to know how you respond to the brief description that she has provided as almost a doctrinal thesis as a part of the testimony. I would be very interested to know how you respond, particularly whether or not you feel some urgency—increased urgency. You may already have had this information, but I would like to know whether or not you see this as a significant competitive challenge.

Mr. TEETS. I'd be glad to start, and I would say yes. I see it as a very significant competitive challenge. As I mentioned to you earlier, we have a joint venture company call EOSAT, which is in the process of distributing and marketing commercially data from LANDSAT. And it is imperative that the LANDSAT data stream have continuity and that we continue to be able to market it.

The competition from foreign sources is severe. And I think there is a certain time critically to get on with moving forward with solid policy that would allow us to exploit our inherent advantage we currently have with respect to the technology that the United States possesses.

Senator KERREY of Nebraska. Mr. Frey, Mr. Araki?

Mr. FREY. Yes, I would like to generally agree with that. I am reminded of an example I sometimes use that often when you hear the computer industry analyzed, IBM is thought to have established a very dominant position in mainframes and then lost the future by defending that position as technology and applications moved forward. I am afraid that could happen to us here. We have the mainframe. We are the best. We have the best technology in the world.

But we seem to be creating—we seem to be adopting the "defend the status quo" mentality that if we can just keep things the way they are, they've been pretty good for us. And you know, I think in effect we are building a protected market barrier, a trade tariff if you will, around the world, only its a reverse one. We are protecting our competitors from competition from us while they catch up. And when I listened to Dr. Armani, I hear what is going on in Europe and much of that is new to me. You know, I just sense this technology becoming disseminated and moving forward on all fronts, while we tend to maintain this national system view of it.

Senator KERREY of Nebraska. Do you hear in Dr. Armani's testimony an opportunity about to be lost? I mean, do you—

Mr. FREY. Yes, I do. Yes, I do. I had that feeling before I heard that testimony. But I hear some more dimensions of that in her testimony.

Senator KERREY of Nebraska. You were particularly concerned and eloquent about the potential for government competition and how the government, if we were to do things incorrectly, could snuff out the private sector's both interest and opportunity.

Dr. Armani, on the other hand, seemed to described a very specific way not only to eliminate the competition, but eliminate the potential for the government competing, but to do it in a way that requires initially more collaboration. It would appear to require an explicit collaboration from the beginning in order to sort out and avoid the kind of competitive efforts that I must say I fear may occur if that collaborative effort doesn't begin rather quickly.

Mr. FREY. I think there has got to be a collaborative element. We have encouraged in the draft implementation directive prepared and the government agrees that the government ought to be an enthusiastic partner and supporter of what industry is doing here.

Senator KERREY of Nebraska. Don't we have to explicitly have to say how that is going to occur? I mean, it is almost counterintuitive to say that in order to avoid having the government compete with me, I need the government more involved as a partner to begin with. Doesn't that require us, if in fact that is the case, to explicitly define what that partnership is going to be, and try to put the details of the partnership together rather quickly?

Mr. FREY. Yes, it does. I think, and I wasn't very articulate on that point, but I think if we don't very well understand what role the government is going to play, industry can't find a role, and I think it will be most effective for this country if it is a collaborative role.

The French—when I call on certain foreign customers that have shown an interest in this, we go with the story that says here's what we'd like to do for you, but we can't talk to you more about it until we get an export license for data. We are followed into that country by the French, who come with their government and pledge government support for their industry in that area. And I think this is an area where there is going to have to be government-industry collaboration.

I was talking with Mr. Jeff Grant, one of the members of the government community today, who is thinking along those same lines, and we have not been able to articulate, I think, a sufficiently detailed architecture for that so far.

Senator KERREY of Nebraska. But you think the draft policy has reasonable constraints?

Mr. FREY. Yes.

Senator KERREY of Nebraska. That the DCI's draft policy has reasonable constraints in place. All four of you agree with that?

Mr. FREY. Well, let me qualify that. The policy, it needs to be differentiated from the implementation directive that followed the policy. I think the implementation directive that's been prepared in conjunction with industry defines reasonable constraints. I think it could be more articulate on the collaboration issue, but it does call for collaboration.

Mr. TEETS. I think the policy provides a good framework from which we can proceed, but what we need are clearly defined policies and procedures, licensing arrangements, etc., that will allow technology, which has up to now been unable to be made available to the commercial market. We need the clear procedure, the clear definition of what it is that the United States government wants to protect and what is available to be put into the commercial marketplace.

Senator KERREY of Nebraska. I must say my own sense of it is given the divided nature of responsibility over technology in the U.S. government, that unless we force an explicit partnership, we're not likely to see one occur. I mean, if we simply get involved in a debate of whether or not we're going to reassign regulatory authority to the Department of Commerce or maintain the status quo, it seems to me that that's not the kind of argument that we ought to be engaging in. That the more important question is whether or not we are going to have an explicit partnership between the U.S. government and the private sector, some kind of a direct effort to promote the development of these industries.

Mr. ARAKI. I would like to make a comment on the segments of market that require government interaction and segments of market that clearly should be pursued by private enterprise. I break this market into three categories. The first category is defense and national security. The second category is geographic informaticlearly on a track that is going to lead to that. And it is a terrible time for us to give up leadership in this industry, I think.

Could I also comment on your security concern?

Senator KERREY of Nebraska. Yes.

Mr. FREY. I have given that a lot of thought, and I think that at the one meter level is without concern. And I know there's other views of that. But it is without concern for several reasons. First, one meter class data is going to be available from the French and the Russians and others. Secondly, one meter class data is not really indicative of the capabilities of the United States in either quantity or quality, I understand. And thirdly, I think just the general availability of imagery.

I think maybe one of the lessons of the Cold War is that Open Skies isn't a terribly bad idea from a security standpoint. If we provide those systems, we retain some measure of control that we don't retain if we allow foreign competitors to become the leaders in providing those systems. I think the way to protect security is to be the provider.

Senator KERREY of Nebraska. I tend to agree with you and I am anxious to hear what the Administration witnesses have to say on that. And I for one appreciate very much all four of you providing very thoughtful testimony. I think it is an extremely important area both from the standpoint of maintaining our technological edge for security reasons, and from the standpoint of making sure that we do the second most important thing that people are asking for that I hear all the time which it create increased job opportunities in America. And I think there is—obviously there is tremendous employment opportunity and job opportunities. I would add the third that I am trying to provoke some response to as well, and that is that I think it is exceedingly difficult for citizens to make decisions today. It is very hard to make decisions, given the complexity of most of the issues.

And I know that when again, when I am briefed on Somalia or Haiti or wherever else it is, my staff, either because they assume I am illiterate or because they assume that I learn faster with visual images, do it with visual. They don't provide me with 500 pages of text. I think we have somewhere in this mix a very powerful new tool that would help citizens make decisions.

Chairman DECONCINI. Senator, thank you for handling and chairing this. I appreciate it very much.

I would like to ask just a couple of quick questions. Sorry to keep you so long. But Mr. Araki, I understand that your company has this one meter capability right now, is that correct?

Mr. ARAKI. We are getting ready to build one as soon as we get the license.

Chairman DECONCINI. Now do you have any estimates of what the market is for this?

Mr. ARAKI. The one meter market, as we estimate it to be today-and a lot of it is in the aerial domain—is about $1.7 billion annually. And we are looking forward to a market which will grow into the $2 billion plus area.

Chairman DECONCINI. Now, Ms. Armani, do you have customers that would use this?

Ms. ARMANI. There are certainly customers for high resolution data. As Mr. Araki pointed out though, the market is sized now by the aerial photography market. You can't just carry those numbers over because the costs involved of course in flying an aircraft are different. And what the customers will buy is going to depend on the information content for the price.

Chairman DECONCINI. Well, what about this type of imagery, this type of photograph? I mean, a one meter?

Ms. ARMANI. It depends on the application and the price.

Chairman DECONCINI. Is there a market?

Ms. ARMANI. There certainly is a market, particularly in cartography, for that kind of product.

Chairman DECONCINI. Along that line, is resolution extremely important to your customers?

Ms. ARMANI. Resolution is less important to my customers than the answer to their questions. Their questions involve complex issues like the environment. What are the changes caused by the construction of the dam on the Danube? Are the farms drying up? Are the wetlands drying up? They are less interested in whether I use LANDSAT of whatever resolutionue the license.

Chairman DECONCINI. And Mr. Araki, do you feel that they are moving as fast as they can, or would you like to see it expedited?

Mr. ARAKI. He would like to—we would like to see it moved——

Chairman DECONCINI. How long has your application been there?

Mr. ARAKI. It has been over 120 days now.

Chairman DECONCINI. So you are due an answer under those guidelines as I recall.

Mr. ARAKI. Yes.

Chairman DECONCINI. Well, I thank you very much for your testimony. It is extremely helpful. I share the concerns that Senator Kerrey pointed out about the protection of this, but it also is clear to me that we need to be competitive, and there's got to be a way to protect our national security and yet make as much of this that is not going to jeopardize our national security as available as possible. There is such a volume as I understand from talking to some of you and reading some of your testimony. Thank you for your testimony this morning.

Mr. ARAKI. Thank you.

Mr. FREY. Thank you.
Ms. ARMANI. Thank you, Mr. Chairman.
Mr. TEETS. Thank you.
[The witnesses are excused.]
[Pause.]
Chairman DECONCINI. Our next witness will be R. James Woolsey, the Director of Central Intelligence.
And right after that, we'll have Mr. James Baker, Under Secretary of Commerce for Oceans and Atmosphere; Mr. Barry Horton, Principal Deputy Assistant Secretary of Defense—they'll all join us at this time at the witness table—and Michael Newlin, Ambassador for Export issues.
[Pause.]
Chairman DECONCINI. Director Woolsey, thank you for being with us today, and I understand that your schedule requires that you leave after your statement and that you prefer not to go into questions. Let me just comment that I hope you can be as frank and as open with us as you were with some of the news shows that I have heard you are on, escorting people through the CIA, which I wholly support. I think it is very, very important that the public know more about your agency and I believe there are many, many venues in which you can do that without jeopardizing our national security.
I need to ask you questions on the subject matter, which I had an opportunity to do in the closed session, because I am very concerned about the implementation and the rule making and the procedures. You are moving along with your leadership, and I compliment you for addressing this, as you told us you would do, both at your confirmation hearing and in the June closed hearings. You have kept your word and moved forward. I just want to encourage the Agency and the other agencies involved here to continue this progress and move toward the procedures so that some of these licenses may be approved. I think it is very, very important.
And having said that, I will yield to you now for your statement.
[The prepared statement of Director Woolsey follows:]

STATEMENT BY DIRECTOR OF CENTRAL INTELLIGENCE R. JAMES WOOLSEY

I welcome this opportunity to update the Committee on the Intelligence Community's efforts, in conjunction with our colleagues in other agencies, to support resolution of the foreign satellite sales issue. Over the summer, the Intelligence Community has been involved with developing concepts for managing reconnaissance proliferation while underscoring the policy I approved in June.
Let me briefly review the Intelligence Community's position on this complicated issue.
First, of course, I intend to fulfill my statutory responsibility to protect intelligence sources and methods. This requires a clear understanding about what needs protection and what does not. As I am sure you are aware, over the past several months the Intelligence Community has made important strides toward establishing procedures to support release of intelligence products or technology. For example, we no longer maintain a blanket opposition to the release of some substantive data and will consider the release of certain US originated technology for use by some foreign governments. By the same token, our efforts to protect what still needs protection must not diminish.
Second, the Community must retain the ability to provide unique imagery-based information to US policymakers and military consumers. We must maintain our edge in satellite reconnaissance—including capability, capacity, and technological innovation. This last item is key if we are to leave ourselves in position to address new, emerging problems.

Third, the on-going imagery relationships that we maintain with many of our allies are an important part of overall US foreign policy. Although these relationships evolve over time, it is critical and in our best interest to manage any proposed changes.

Two key points are apparent.

First, the foreign interest in satellite technology and products is real. Over time, the list of credible suppliers who have the capability to develop, sell, and exploit satellite collection technology and product has increased. Foreign capabilities need not equal ours to offer a product that meets some customer needs and also has significant national-security effects. For example, the one-meter imagery now being proposed for sale commercially would provide a great deal of information on the activities of a potential adversary. When used in conjunction with accurate positioning data, it can be used for targeting. The US role in contributing to this capability being available to any user, at any time, with or without the consent of the US Government must be carefully considered.

Second, the United States remains preeminent in remote sensing. We have substantial potential to exert leverage on the market in ways that simultaneously protect this country's national-security interests and create some increased opportunities for our US industry. The Intelligence Community shares the Committee's concerns over the US industrial base. Our US capability today is the direct result of a 40-year partnership between the Intelligence Community and the private sector. Because of resource cutbacks, we are struggling to ensure our continued technological superiority. This problem concerns us greatly. Admiral Studeman and I have been investigating a number of options in an attempt to balance the needs of the Intelligence Community, the US industrial base, and the long-term policy interests of the United States. These options are not yet fully developed.

We are working to identify those capabilities that are so sensitive that the Community must retain final authority over their use, those which are less sensitive but still require Intelligence Community involvement in any decision, and those which are so widely available that Community input is not necessary. We are exploring different ways of bringing US capabilities to bear in the international market, while protecting US security interests and maintaining a robust intelligence collection capability. Meanwhile, Intelligence Community policy allows us to make recommendations on the various commercial applications now before the government.

In sum, this issue makes new demands on the full government—executive, legislative, and judicial branches—to balance opportunities, challenges, and responsibilities that are often in conflict with each other. We all accept the need to push this country's technological prowess forward in the world commercial market. However, we must at the same time protect those intelligence sources and methods that still need protecting, avoid increasing the risk to US and allied forces, keep relations with other countries on an even keel, and preserve our edge in intelligence collection capability. This on-going process involves many participants across our government.

We have demonstrated in the past the ability to work together across organizational boundaries. The successes of the past, coupled with our mutual desire to protect the interests of the United States, including US industry, suggest that a balanced approach to this issue is achievable.

STATEMENT OF R. JAMES WOOLSEY, DIRECTOR OF CENTRAL INTELLIGENCE

Director WOOLSEY. Thank you, Mr. Chairman. I appreciate your kindness in this and many other things. And of course, at any time I am available to answer questions on this in Executive Session.

I welcome this opportunity to update the Committee on the Intelligence Community's efforts in conjunction with our colleagues in other agencies to support resolution of the foreign satellite sales issue.

Over the summer, the Intelligence Community has been involved with developing concepts for managing reconnaissance proliferation while underscoring the policy that I approved for the Community in June.

Let me briefly review the Intelligence Community's position on this complicated issue.

First, of course, I intend to fulfill my statutory responsibility to protect intelligence sources and methods. This requires a clear understanding about what needs protection and what does not. As I am sure you are aware, over the past several months the Intelligence Community has made important strides towards establishing procedures to support release of intelligence products or technology. For example, we no longer maintain a blanket opposition to the release of some substantive data and will consider the release of certain U.S. originated technology for use by some—I repeat, some foreign governments. By the same token, our efforts to protect what still needs protection must not diminish.

Second, the Community must retain the ability to provide unique imagery based information to U.S. policymakers and to military consumers. We must maintain our edge in satellite reconnaissance, including capability, capacity, and technological innovation. This last item is key if we are to leave ourselves in a position to address new and emerging problems.

Third, the on-going imagery relationships that we maintain with many of our allies are an important part of overall U.S. foreign policy. Although these relationships evolve over time, it is critical and in our best interests to manage any proposed changes.

Two key points are apparent. First, the foreign interest in satellite technology and products is real. Over time, the list of credible suppliers who have the capability to develop, sell, and exploit satellite collection technology and product has increased. Foreign capabilities need not equal ours to offer a product that meets some customer needs and also has significant national security effects. For example, the one meter imagery now being proposed for sale commercially would provide a great deal of information on the activities of a potential adversary. When used in conjunction with accurate positioning data, it can be used for targeting.

The U.S. role in contributing to this capability being available to any user at any time, with or without the consent of the U.S. government, must be carefully considered, to put it mildly.

Second, the United States remains pre-eminent in remote sensing. We have substantial potential to exert leverage on the market in ways that simultaneously protect this country's national security interests and create some increased opportunities for U.S. industry. The Intelligence Community shares the Committee's concerns over the U.S. industrial base. Our U.S. capability today is a direct result of a 40 year partnership between the Intelligence Community and the private sector. Because of resource cutbacks, we are struggling to ensure our continued technological superiority. This problem concerns us greatly.

I might add parenthetically here, Mr. Chairman, a year ago last summer when I chaired a review for then-Director Gates of the satellite reconnaissance capability for the country, my panel spent a great deal of time focusing on the importance of the industrial base and conferring with the relative parts of the aerospace industry on this important subject. It is something—it is an obligation—that I and the other members of the Intelligence Community who work on this issue take very seriously.

Admiral Studeman, the Deputy Director of Central Intelligence, and I have been investigating a number of options in an attempt

to balance the needs of the Intelligence Community, the U.S. industrial base, and the long term policy interests of the United States. These options are not yet fully developed. We are working to identify those capabilities that are so sensitive that the Community must retain final authority over their use; those that are less sensitive but still requiring Intelligence Community involvement in any decision; and those which are so widely available that Community input is not really necessary. We are exploring different ways of bringing U.S. capabilities to bear in the International market, while protecting U.S. security interests in maintaining a robust intelligence collection capability.

Meanwhile, Intelligence Community policy allows us to make recommendations on the various commercial applications now before the government, and we are doing that in each case now, Mr. Chairman.

In sum, this issue makes new demands on the full government—Executive, Legislative, and even Judicial branches—to balance opportunities, challenges and responsibilities that are often in conflict with each other. We all accept the need to push this country's technological prowess forward in the world commercial market. However, we must at the same time protect those intelligence sources and methods that still need protecting, avoid increasing the risk to U.S. and allied forces, keep relations with other countries on an even keel, and preserve our edge in intelligence collection. This ongoing process involves many participants across our government. Three central ones other than the Intelligence Community are represented at this table.

We have demonstrated in the past the ability to work together across organizational boundaries. The successes of the past, coupled with our mutual desire to protect the interests of the United States, including U.S. industry, suggests that a balanced approach to this issue is achievable.

Chairman DECONCINI. Director Woolsey, thank you. I am not going to ask any questions in accordance with your request. I am going to state, however, that I appreciate your being here today and also urge you to devote the time and efforts and energy to see that the new policy and procedures are carried out, and I have no doubt that you will meet the maximum responsibility of your directorship to protect the security of the United States. Having said that, I am really at the point that I feel that we need to move on this; it needs a higher priority. I hope my concerns will be dispelled by the other witnesses before us here today, that they will testify that everything is being done that possibly can be done and that there is no action that can be taken that hasn't been taken because of time and restraints and national security concerns. I have a feeling, and much of it comes from industry, that more could be done to move along on these licenses that are pending and implement the procedures that you have set forth. However, I understand it is new and there is some trial and error and caution here. I urge you to continue your leadership in that area. And I will yield to the Ranking Member, Senator Warner.

Vice Chairman WARNER. Thank you, Mr. Chairman. First I tender to you and others my apology for being late. We had the Defense Authorization Bill—that is another hat I wear here.

I join in the comments made by the Chairman and point out that I joined last year with Senator Kerrey in putting the amendment on the intelligence bill which led, I think, to much of the developments we are listening to today. And I would say also, Director Woolsey, that I would hope that you would view this policy statement that you have just given in much the same context that the Department of Defense is now viewing its responsibility to preserve America's industrial in, say, the heavy technologies industries, primarily submarine building and shipbuilding.

Here is an industrial base that has contributed to—candidly in my judgment—the success of the Cold War policy. And we know not when we may have to turn to them with the same degree of intensity as we did during that period. Nevertheless, I think we can view this policy as in the nature of preserving an industrial base for future contingencies that might face this nation.

Director WOOLSEY. Thank you, Mr. Chairman and Senator Warner. I agree with what you said. We will continue to work hard with our colleagues in the Executive branch on this extremely important and, I might say, also extremely complex and difficult subject, and of course, either I or experts from the Community are available at any time to answer questions on these issues in Executive Session.

Chairman DECONCINI. Thank you, Director; we appreciate your being here.

Director WOOLSEY. Thank you.

Chairman DECONCINI. Ambassador Newlin, thank you for your patience in waiting for us. You may proceed with your statement.

STATEMENT OF MICHAEL H. NEWLIN, ACTING DEPUTY ASSISTANT SECRETARY, BUREAU OF POLITICAL-MILITARY AFFAIRS, DEPARTMENT OF STATE

Ambassador NEWLIN. Thank you very much, Mr. Chairman, Senator Warner. I am pleased to have the opportunity to discuss the issue of reconnaissance satellite transfers, and give you an update on the Administration's efforts to develop a broad policy on this important subject.

The Department of State has been working in conjunction with other agencies to formulate a policy on the transfer of reconnaissance satellites. Such a policy will enable us to apply consistent criteria to individual transfer requests, thereby assuring that U.S. policy interests are served. A central issue is the extent and nature of United States involvement, either official or commercial, in foreign satellite reconnaissance programs.

I would like to begin, with your permission, by providing the Committee with a brief background, followed by a discussion of the foreign policy and national security challenges faced by the Department and the Administration in developing this new policy.

The United States operates space-bound reconnaissance systems for intelligence and military purposes. These systems are among the most valuable United States national security assets because of their unique capabilities to collect data for military and intelligence purposes.

For many years, only the United States and the Soviet Union possessed sophisticated reconnaissance space systems. Now, other

nations throughout the world are seeking to acquire their own capability through indigenous efforts, direct purchases, and cooperative activities. Many countries have discovered the value of these capabilities, especially after seeing how the United States forces integrated products and data derived from reconnaissance space systems into military operations during the Persian Gulf War. In addition, global diffusion of this technology has led other countries to undertake projects to build their own systems for military and civilian purposes.

Many countries also have access to imagery products through commercial services such as LANDSAT. Moreover, Russia and France through its SPOT system are currently selling imagery of much higher quality than is available through LANDSAT. Although of substantially lesser quality and timeliness than U.S. space reconnaissance systems, this imagery could have military and intelligence utility. Private U.S. firms also plan to build and operate remote sensing space systems and sell imagery on the open market. These private systems would have substantially better ground resolution than is currently available in civilian systems.

The growing number of nations seeking to acquire satellite reconnaissance capabilities, and the increased availability of high-quality commercial imagery poses potentially more sophisticated threats to United States national security interests. In developing a policy which addresses these new realities and safeguards U.S. national security, serious issues needed to be resolved. More specifically, we review how transfers of reconnaissance space capabilities would affect U.S. forces, foreign policy, multilateral control efforts, intelligence relationships, and of course, the U.S. industrial base. I would like to briefly touch on these issues.

First is military implications. United States, allied, and friendly nations' forces may have to revise or alter their military strategy and operations to be able to protect themselves against space reconnaissance capabilities. Providing such a capability to a country could affect regional balances of power and, if not properly managed, could also create friction between the United States and some of our military partners. However, in certain circumstances, exports and other forms of cooperation could lead to greater interoperability with allied or coalition forces greater access to foreign technology, and new and improved security relationships.

Second is diplomatic consequences. Transfers of satellite reconnaissance capabilities could require a carefully integrated foreign policy strategy and appropriate diplomatic consultations. Relations with a recipient country may need to be adjusted and diplomatic measures may be necessary to assuage concerns among U.S. friends and allies. If properly managed, the United States could use transfers to strengthen alliances and strategic friendships. Satellite reconnaissance systems and imagery products could, in some cases, have a stabilizing effect in some regions. Arms control and confidence building measures could be facilitated by the ability to monitor and verify other countries' military activities. However, the introduction into a region of such systems could also be destabilizing.

Third is the impact transfers would have on multilateral efforts to control the spread of this capability. Managed exports will only

work in a multilateral approach to controls. Some foreign producers may not share United States foreign policy and security concerns, and may be inclined to transfer such capabilities to nations unfriendly to the United States. I believe that it would be essential to approach other potential suppliers of remote sensing space capabilities to discuss and develop multilateral export controls.

Fourth, Mr. Chairman, is the effect on U.S. intelligence relationships. The sale of such systems, technology or product by the United States would mean a significant degree of cooperation in other countries' programs. Sales could lead to potential new intelligence relationships, although it could strain others. Moreover, a more forward-leaning policy could open the door for cooperative measures, building on existing intelligence-sharing arrangements.

Finally, we looked at our domestic industrial base. The United States satellite industrial base is undergoing significant restructuring because of reduced expenditures in U.S. programs. Exports of satellite reconnaissance capabilities can help sustain the industrial base needed for our national security requirements.

Lastly, Mr. Chairman, I would like to touch on the ongoing policy review. The Administration has undertaken an in-depth review of transferring satellite reconnaissance capabilities. The fundamental goal of this review is to balance foreign policy and national security concerns about the spread of satellite reconnaissance capabilities with opportunities to support U.S. foreign policy, national security, and economic objectives in order to advance overall United States national interests. We are awaiting a Deputies Committee meeting on this issue, which will hopefully result in the adoption of a broad policy. With a broad policy in place, we will be able to process outstanding license applications, and deal effectively with new requests.

This concludes my statement, Mr. Chairman. I'll be glad to answer questions.

Chairman DECONCINI. Mr. Newlin, I am just going to take the Chairman's prerogative here and ask you a question, as I am going to have to leave in about 15 minutes. As you probably gathered from my opening statement, I feel strongly about the need for our government to move forward as quickly as possible in adopting changes to the current licensing process on the sale of satellite imagery and systems. Nevertheless, I fully understand the pressures on and the workload of the new Administration and the fact that, at least on this particular issue, little if anything had been done before this year to change the current process. I am told that DOD and CIA have set in place a set of criteria—and I will ask General Horton to confirm that—for recommending for or against the sale. But the State Department has not, as you mentioned.

What I would like to know is, if that is true, why can't you go ahead and do this? Will the State Department finalize its position and allow the government to reach some consensus on such criteria?

Ambassador NEWLIN. That is the object of the policy review, Mr. Chairman. I agree completely with your statement that we have not been able to grapple with the idea of formulating a governmentwide policy on the sale of satellites.

Chairman DECONCINI. What is holding the policy review up? Can you give me your opinion?

Ambassador NEWLIN. It is now as a result of intensive negotiations that have taken place within the various departments and agencies, I would date this from about the time of the June hearings here and the important announcement that was made by Director Woolsey at that time. That then I would say unlocked, created a new situation within the government. Before that, quite frankly, there was no use even discussing the—there were discussions. Industry would come to us and say we would like to sell a certain thing or we would like to enter this, and we had to tell them quite frankly the position of the United States Government is that we will not do that. That is all prior.

We are now, I would say that the situation has fundamentally changed and the various departments that are here today at the table are coming together. I think it is fair to say that we have a high degree of consensus on the policy. It is now I think has been taken as far as it can at the level that I represent, and it is going to be now escalated to the senior policy level at the deputies. And I am hopeful that that will result in a policy. The policy, once it is adopted, will, as I say, permit us to address these individual questions.

Chairman DECONCINI. What is your—and this may be an unfair question because it is going to be out of your hands, so to speak, but what is your best guess on when the State Department will be able to make a decision on, say, a license like Litton Itek to sell a satellite to a friendly foreign government. I mean, it has been almost two years since that application was submitted. What is your best guess, without pinning you down or committing you that that is when it is going to happen? I am just seeking some kind of idea for the Congressional side of when is this going to come about.

Ambassador NEWLIN. I would say when this policy has been enunciated and has been adopted, there will have to be, of course, as has been recognized before, there will have to be certain procedures that we will have to follow, but hopefully in such cases as this one, this would enable us to deal with this application very, very soon. I can't tell you when the policy will——

Chairman DECONCINI. You don't have any guesstimate? You don't know if in your best guess you think it is six months or two months or two years or what?

Ambassador NEWLIN. I—we discussed this before coming up here and it is my personal hope—please don't hold me to this——

Chairman DECONCINI. I will not hold you to it; I promise I grant you total immunity. [General laughter.]

I am truly looking for what your personal opinion is on it, realizing that it is not your decision.

Ambassador NEWLIN. That's right. On that basis I would say I hope to have a policy adopted and we would be started on implementation before the end of this year.

Vice Chairman WARNER. If I could just superimpose my observation, the taxpayers are meeting the payroll of the policymakers. Industry is meeting the payroll of their highly skilled workforce. And there are two different bottom lines. And the industry has a term

limit on their bottom line. Unfortunately, taxpayers don't get a strong enough voice on their bottom line in my judgment.

But we're going to—some of us are going to get a little tougher around here. There are means by which to hold up nominations, do a lot of other things, flush out a policy decision. And I am prepared to join with those to make that happen.

Just pass that back in a friendly way. Thank you very much.

Chairman DECONCINI. Well, Senator Warner, let me tell you, I hate to get into that area, but I feel the same way. I am extremely disappointed and extremely frustrated. That is one of the purposes of these hearings, to try to find out just when, if ever, we are going to see some of these sales.

Now we'll go on to the next witness.

Dr. Baker.

Vice Chairman WARNER. We thank you, Mr. Ambassador, for a very candid appraisal and your personal opinion.

Chairman DECONCINI. And Dr. Baker, while you are in your statement, I haven't read your statement, but I am going to ask you that question if I am still here, about when the Commerce Department hopes to make a decision on the license to Lockheed.

Vice Chairman WARNER. Well, Mr. Chairman, given the fact that you are about to leave and we join in the same question, let's just put it right now, and if you have to depart, they can go ahead with their testimony.

Chairman DECONCINI. Yes, I think that is a good idea, unless it is in your statement, Dr. Baker. Maybe you could answer that for us.

Dr. BAKER. Let me say, Chairman DeConcini, thank you for that opportunity. I agree with Ambassador Newlin. I think that we will have, thanks to your leadership and push and thanks to the fact that we have, I think, some real action for the first time under this Administration in this topic, within the next two or three months we should expect that.

Chairman DECONCINI. That is encouraging.

Dr. BAKER. Let me also say that we are making a special focus to look at those applications like the one by Lockheed so that we don't necessarily have to have all agreement on every aspect of a broad policy, but we can move to the extent that we can on the specific license as soon as possible.

Chairman DECONCINI. On some of the ones that are pending. It is only fair, is it not——

Dr. BAKER. Absolutely.

Chairman DECONCINI [continuing]. For them to be given some priority given that they have been there for a long time.

Dr. BAKER. I wanted to point that out.

Chairman DECONCINI. Let me interrupt you, too, if I can. Who can tell me who ultimately makes this policy? Who signs the policy?

Dr. BAKER. This kind of policy would be made by the President.

Chairman DECONCINI. The President will sign an Executive Order of some nature, is that what will happen——

Dr. BAKER. That's right.

Chairman DECONCINI. And who is going to recommend—who is the last group that sends the recommendation to the President?

Vice Chairman WARNER. It would have to be the NSC, Tony Lake.

Dr. BAKER. The NSC.

Chairman DECONCINI. That would be Mr. Lake.

Dr. BAKER. With the Deputies meeting.

Chairman DECONCINI. And that is where it is, Ambassador Newlin, now, from your standpoint?

Ambassador NEWLIN. Yes, sir.

Chairman DECONCINI. It is at NSC?

Ambassador NEWLIN. It is above my pay grade, sir.

Chairman DECONCINI. Thank you. And Dr. Baker, excuse me for interrupting you and asking the questions ahead of time, but that is very helpful, and I am going to have to leave.

Dr. BAKER. Not at all. Thank you.

Chairman DECONCINI. Thank you. Please proceed with your statement.

[The prepared statement of Dr. Baker follows:]

TESTIMONY OF DR. D. JAMES BAKER, UNDER SECRETARY FOR OCEANS AND ATMOSPHERE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. Chairman and Members of the Committee: I am pleased to testify before this Committee on the Department of Commerce's activities related to the licensing of private remote-sensing space systems. I believe that this activity is important to the national and economic security of the United States and the development of a global commercial imagery market.

The Department of Commerce has had the authority to license private remote-sensing space systems since the passage of the Land Remote-Sensing Commercialization Act of 1984. It retained this authority under the Land Remote Sensing Policy Act of 1992, which repealed the 1984 Act. The Department has authorized the National Oceanic and Atmospheric Administration (NOAA) to grant licenses for the operation of remote-sensing systems by domestic companies. The export of ground station technology is licensed by agencies other than NOAA.

Since the passage of the Land Remote Sensing Policy Act of 1992, NOAA has received four license applications to operate private remote-sensing space systems. These applications were from WorldView Imaging Corporation, Earth Observation Satellite Company (EOSAT), Lockheed Missiles and Space Company, and Orbital Sciences Corporation. We have issued licenses to WorldView and EOSAT, and are currently processing the license applications from Lockheed and Orbital Sciences. We expect to receive additional applications in the near future.

NOAA published regulations for this licensing process in July 1987. These regulations primarily set forth the procedures an applicant should follow to apply for a license but did not significantly define the substantial licensing criteria specified in the 1984 Act. We are in the process of revising these regulations to make them consistent with the licensing provisions of the 1992 Act. The new regulations will also add some definition to the revised licensing criteria, particularly with respect to national security provisions, as discussed below. These regulations have been reviewed preliminarily by the relevant agencies including the Departments of Defense and State, NASA and the ICA and we anticipate publishing a Notice of Proposed Rulemaking in the Federal Register upon completion of the preliminary review and a formal Administration review. It is important to note that the application process remains unchanged and will continue to be as "user friendly" as possible.

Under the 1992 Act, potential licensees must demonstrate to United States Government satisfaction that they will operate their system in a manner that preserves the national security and observes the international obligations of the United States. Further, they must make unenhanced data from their system available to the government of a sensed state and to the National Satellite Land Remote Sensing Archives. And, they are required to notify us of any agreements they intend to enter with foreign nations or entities.

The 1992 Act includes a significant change to the previous licensing provisions with respect to data availability; namely, the relaxing of the requirement that all operators, even if funded solely by private investors, must make their unenhanced data available to all users on a nondiscriminatory basis. While we encourage appli-

cants to adhere to a nondiscriminatory data policy to promote the broadest possible use of the data, we recognize the rights of the operator of a privately funded system to develop a data policy based on market considerations. We credit this change in the 1992 Act to the private sector's increased interest in the commercial remote-sensing imagery market.

In reviewing a license application, NOAA is required by law to consult with the Department of Defense on all matters dealing with national security, and with the Department of State for all matters affecting international obligations. These agencies provide the conditions to be included in a license necessary to meet the concerns in their respective areas of responsibility. NOAA also coordinates with the intelligence community on these issues. When this information is concluded, NOAA incorporates these terms and conditions and issues the license. We believe that the Government can satisfactorily resolve national security and international policy concerns through conditions in a license rather than by denying it, except possibly in the case of systems with ground resolution of better than one meter. Even for these systems, the Government shall make every effort to resolve these concerns by conditioning rather than denying the license.

We believe that conditions in a license for national security and foreign policy purposes should be the least burdensome possible to a licensed operator. For example, operations should be restricted only during defined periods; and restrictions should be limited to the smallest area affected and to the shortest period of time consistent with the given situation. Furthermore, once a license is issued with the appropriate restrictions, the Government should not impose additional restrictions in other licensing processes (e.g., on the export of the data and images that would create another layer of licensing).

The commercial sale of high resolution images from space is a rapidly growing and potentially significant sector. According to the Office of Air and Space Commerce in the Department of Commerce, U.S. companies currently lead the world in remote-control. It would be unwise to impose on our own companies restrictions that do not apply to foreign competitors.

The technology is rapidly emerging to provide imagery data at resolutions as low as 1 meter through commercial sources. Over the next few years, systems capable of providing such data could be flown by foreign nations or foreign commercial entities. Licensing the operations of such systems, rather than having them licensed by and operated in foreign nations provides the United States needed control over these systems to protect its national security and economic interests. In addition, it will establish our leadership in the international commercial imagery market.

By giving U.S. companies the flexibility to offer products of greater quality than those of their foreign rivals, it allows them to meet the future commercial demand for images. In granting licenses for sophisticated and effective domestic systems, and maintaining export control, we will foster economic development as well as serve and protect the citizens of the United States.

The Department will be participating in a senior-level interagency review of the national policies concerning remote-sensing space capabilities. Further the Department will seek early resolution of the issues that apply to its licensing responsibilities.

Mr. Chairman, this concludes my testimony. I would be pleased to respond to any questions.

STATEMENT OF DR. D. JAMES BAKER, UNDER SECRETARY FOR OCEANS AND ATMOSPHERE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Dr. BAKER. Thank you Chairman DeConcini and Senator Warner. Thank you for your leadership on this issue. This general activity is important to both the national and economic security of the United States and the development of a global commercial imagery market.

The Department of Commerce has had the authority to license private remote-sensing space systems since the passage of the Land Remote-Sensing Commercialization Act of 1984. It retained this authority under that Act of 1992, which repealed the 1984 Act. The Department has authorized the National Oceanic and Atmospheric Administration, NOAA, which I head, to grant licenses for the op-

eration of remote-sensing systems by domestic companies. The export of ground station technology is licensed by agencies other than NOAA.

Since the passage of the Land Remote Sensing Policy Act of 1992, we have received four license applications to operate private remote-sensing space systems. These applications were from WorldView Imaging Corporation, Earth Observation Satellite Company, EOSAT, Lockheed Missiles and Space Company, and Orbital Sciences Corporation. We have issued licenses to WorldView and EOSAT, and as you know, are currently processing the license applications from Lockheed and Orbital Sciences. We expect to receive additional applications in the near future.

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In reviewing a license application, we are required by law to consult with the Department of Defense on all matters dealing with national security, and with the Department of State for all matters affecting international obligations. We also coordinate with the intelligence community on these issues. When this information is gathered, NOAA incorporates these terms and conditions and issues the license. We believe that the Government can satisfactorily

resolve national security and international policy concerns through conditions in a license rather than denying it, except possibly in the case of systems with ground resolution of better than one meter. Even for those systems, the Government shall make every effort to resolve these concerns by conditioning rather than denying the license.

We believe that conditions in a license for national security and foreign policy purposes should be the least burdensome possible to a licensed operator. For example, operations should be restricted only during defined periods; and restrictions should be limited to the smallest area affected and to the shortest period of time consistent with the given national security situation. Furthermore, once a license is issued with the appropriate restrictions, the Government should not impose additional restrictions in other licensing processes—for example, on export of data or imaging that would create another layer of licensing.

The commercial sale of high resolution images from space is a rapidly growing and potentially significant sector. According to the Office of Air and Space Commerce in the Department of Commerce, U.S. companies currently lead the world in remote-sensing technology, and some who are considering entering this market estimate the market potential for such images to be in the neighborhood of $5 billion, with projected growth to $15 billion by the end of the decade. The commercial applications, both in this country and in many emerging markets abroad, for fast, accurate images include infrastructure management, city planning, mapping, mineral exploration, land and water use, taxation, agriculture and forestry management, flood control, fire prevention, and a host of other uses. We see this as a conceptual leap, taking imagery together with the new national information infrastructure and putting this together for cities and counties and individual users to use in a whole new way of doing business. And as was mentioned in the other panel, the connections with the GIS—the Geographical Information Systems—is an enormous new potential for this system.

However, the spatial resolution of data now commercially available raises legitimate national security concerns and questions regarding what kind of restrictions should be appropriately placed on U.S. operators that are facing foreign competition capable of selling comparable imagery. The SPOT Image Corporation of France currently has the capability of 10 and 20 meter commercial resolution, and the new Russian institute that is being privatized, NOP Energia, is now marketing images in this country with 2 meter resolution. Therefore, any commercial remote-sensing policy that this country adopts must balance our legitimate national security needs with our need to promote and extend our economic lead in an area where we already have a technological edge. We should not impose restrictions on our companies with regard to the acquisition or distribution of data that are otherwise known or generally available from similar foreign non-governmental systems with comparable capabilities over which the U.S. has no control. It would be unwise to impose on our own companies restrictions that do not apply to foreign competitors.

The technology is rapidly emerging to provide imagery data at resolutions as low as 1 meter through commercial sources. Over the next few years, systems capable of providing such data could be flown by foreign nations or foreign commercial entities. Licensing the operations of such systems, rather than having them licensed by and operated in foreign nations provides the United States needed control over these systems to protect its national security and economic interests. In addition, it will establish our leadership in the international commercial imagery market.

By giving U.S. companies the flexibility to offer products of greater quality than those of their foreign rivals, it allows them to meet the future commercial demand for images. In granting licenses for sophisticated and effective domestic systems, and maintaining export control, we will foster economic development as well as serve and protect the citizens of the United States.

The Department will be participating in the senior-level interagency review of the national policies concerning remote-sensing space capabilities. Further, we will seek early resolution of the issues that apply to its licensing responsibilities.

Secretary Brown has a strong commitment to promoting and helping U.S. industry. This is one way for us to build partnerships and we are looking forward to doing this.

Mr. Chairman, this concludes my testimony.

Vice Chairman WARNER. I want to indicate that all witnesses are requested to submit for the record any additional information they wish to offer, particularly concerning conditions placed on operating licenses. That is both to this panel; and previous panels.

Mr. Horton, I thought I would lead off with a few questions to you first, and that is, can you give us a timeline on where the rest of the world is rapidly moving towards taking over this $15 billion market that Mr. Baker described?

[The prepared statement of Mr. Horton follows:]

STATEMENT BY FRANK B. "BARRY" HORTON III, PRINCIPAL DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE

Mr. Chairman and Members of the Committee: I appreciate the opportunity to appear before the Committee today. Dr. Perry and Mr. Paige send their regrets at being unable to be present. You will recall that Mr. Paige testified before this committee last June 10 on essentially the same subject as is being considered today—the sale or transfer to foreign governments or other foreign entities of U.S. made or produced remote sensing systems, technology, or products.

As Mr. Paige related to you then, the commercial sale of medium resolution imagery from space systems produced by U.S. contractors is of intense interest to the Department of Defense. The subject also relates to a wide variety of interests beyond Defense. In fact, from the Administration's broad perspective, as can be seen by our representation here today, national defense, foreign policy, intelligence, and commercial interests will all be affected by the U.S. policy concerning the sale of such imagery.

In our evaluation of this matter, we have found that it is more important for us to keep a broader perspective than to consider only commercial sale of imagery. Such sale, which can proceed in accordance with the Land Remote Sensing Policy Act of 1992, is but a piece of the broad subject of foreign acquisition of, or access to, imaging remote sensing space capabilities. (In this context, we consider imaging remote sensing space capabilities to refer to all remote sensing systems, technology, products, and data providing utility for military and intelligence applications.) Our approach to the question of sale must be integrated with our approach to: (a) exports by U.S. companies of remote sensing systems and major components for such systems; (b) intelligence cooperation programs, which take place under government-

to-government agreement; (c) potential declassification of imagery from U.S. classified space systems; and (d) any discussions the United States might have with foreign governments about their approach to these same topics. We also believe our policies must cover foreign access for the complete range of imagery remote sensing space capabilities (such as different levels of image resolution); the lowest levels of capabilities will likely pose few problems for foreign acquisition, while the most advanced levels will only be available for government-to-government cooperative programs. Further, our policies must consider the degree of control of output we wish to wield. For example, other things being equal, we would look to increase our control as we moved from peace through crisis to conflict in areas or issues impinged upon by the item or product being licensed.

The Administration is currently developing a national policy on the general subject of foreign acquisition of, or access to, remote sensing space capabilities. This policy will integrate all of these topics. As the Administration and Congress work together to consider our future course on this subject, we need to continue to assure that all these various issues are fully addressed. For my part here today, I will focus primarily on the defense issues.

Remote sensing space capabilities are increasingly available in the international commercial marketplace. Foreign acquisition of, or access to, such capabilities cannot be denied solely through U.S. export controls. Furthermore, there are substantial potential benefits for the United States in supporting foreign sales or other transfers of capabilities produced in the United States: there are obvious benefits for U.S. industry, where DoD is particularly concerned that the major industry involved here is a key part of the defense industrial base; if the United States establishes a strong presence in this market, we can take the lead in guiding and shaping the market's evolution, allowing us to understand the development of foreign capabilities better and helping us to avoid the most significant potential problems; when foreign sales take place in the context of government-to-government agreements, we could enhance existing security relationships with our allies and friends, and could develop new relationships.

In the Department of Defense we are concerned with foreign access to remote sensing space capabilities primarily because of the wide spread military and intelligence utility of those capabilities. In fact, many foreign nations recognize the value of imagery from space systems and are seeking access to such imagery through indigenous efforts, purchases of goods and services, and cooperative efforts. The proliferation of such capabilities could increase the susceptibility of forces of the United States, as well as those of Allied and friendly nations, to enhanced foreign intelligence collection. This, in turn, could increase the vunerability of those forces and reduce their effectiveness. These concerns are heightened when the spread of foreign remote sensing space capabilities is combined with the proliferation of weapons of mass destruction, missile technology for delivery systems, and advanced conventional systems.

After weighing these various factors, we have concluded that the United States should support carefully managed exports and other measures to transfer remote sensing space capabilities produced in the United States to foreign recipients. The process for carefully managing these exports and other measures should be built on a case-by-case review of requests for transfers of systems (including major subsystems), where the same process could apply for transfers to both foreign governments and foreign private entities. As a part of this review, DoD will take certain considerations into account, some of which may result in limitations. Among these considerations are the following: The effect of any transfer on the balance of military power in the region; its affect on our relationships with our allies, both within and outside the region; the potential for unwanted transfer of sensitive U.S. technology; the nature of controls which the recipient is willing to accept on the dissemination of products and data from the remote sensing system (including limiting any adversary's access and supporting assured U.S. access in the event of crisis or conflict); whether a government-to-government agreement might be needed with the host government to help protect our national security interests; and the extent to which we might need to develop additional countermeasures (e.g., changes in strategy, doctrine, organization, training, equipment, and operations and other appropriate countermeasures) to deal with the potential military implications of the transfer.

Exports and other transfers of different types of remote sensing space capabilities pose different problems for us. Thus, we see a range of alternatives for possible response to requests for transfer. Our preference in most situations would be to offer products and data from U.S. remote sensing systems (commercial systems or U.S. Government sytems, depending on the circumstances) to meet the foreign need. Next, we would be willing to transfer whole systems or major subsystems; for this alternative, we favor the sale or transfer of so-called turn key systems (complete

systems ready to use). Our least preferred approach is sale or transfer of sensitive technology, because it would assist foreign nations or entities in attaining autonomous capabilities. The sale or transfer of sensitive technology should be considered only in exceptional cases, and then made available only through a government-to-government agreement.

Before I close, I would like to address the decision making process within the Administration on subjects related to today's hearing. The Committee is interested in how DoD contributes to setting criteria for licensing of such sales and about the DoD role in the license decision process. DoD participates in several processes within the Executive Branch which are related to possible commercial sale or other transfer of space imagery:

(1) The Department of Commerce oversees a process for reviewing license applications to operate commercial remote sensing space systems in accordance with the Land Remote Sensing Policy Act of 1992. DoD has participated in reviewing all such applications. Furthermore, that Act specifically makes the Secretary of Defense responsible for determining the conditions for acceptable system operation that are necessary to meet U.S. national security concerns.

(2) The Department of State oversees a process for reviewing export license applications for items specified on the U.S. Munitions List (USML). This list includes certain remote sensing space capabilities. By statute, DoD participates in reviewing all such licenses.

(3) The Department of Commerce oversees a process for reviewing export license applications for items specified on the Commodity Controls List (CCL). This list also includes certain remote sensing space capabilities. By agreement between the two departments, DoD participates in reviewing those licenses which involve such capabilities.

(4) The Department of State has overseen a process for reviewing the USML to identify dual-use items that can be transferred to the CCL (if the transfer would not jeopardize national security). Certain remote sensing space capabilities are among those dual-use items. DoD has participated in this review process from its inception.

(5) DoD has participated with the Intelligence Community in recent months to draft a national policy covering foreign acquisition of, or access to, remote sensing space capabilities. The NSC Staff is managing the process to prepare for the Deputies Committee to address the draft policy in the near future.

Mr. Chairman and Members of the Committee:

While commercial sales and other transfers of medium resolution imagery from remote sensing space systems poses certain risks for the United States, overall national interests are best served by allowing carefully managed sales and other transfers. The Department of Defense expects to continue working with other agencies of the Executive Branch, as appropriate, to assure that these sales and other transfers proceed in a manner which, in fact, support overall U.S. national objectives.

STATEMENT OF FRANK B. "BARRY" HORTON III, PRINCIPAL DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE

Dr. HORTON. Also described, of course, by the industry witnesses as well. I would associate myself with the general thrust of the comments both of the previous witnesses on the government panel as well as with the industrial panel, that we see an acceleration among the industrial powers of the West and of Asia and the Former Soviet Union, and their ability to compete with the United States at least with the kinds of resolutions we are talking about here for U.S. industry to possibly offer under license to commercial users. So there is an increased——

Vice Chairman WARNER. You have restated the question. Now let's have the answer. What's the timeline? We know they are out there. We can hear them running in the distance. How long before they are here? Is much of what we are debating today is just rendered neutral.

Dr. HORTON. Some of it is here already, as has been pointed out with Russia being willing to release some of its imagery that it has acquired through national technical means at the two meter level.

We see the French with the HELIOS system in the mid 90's being able to offer in the one meter level if that system comes about in that timeframe with that kind of capability. And there is no reason to doubt that they wouldn't have that capability. The schedule may slip a bit depending on the ability of France to be able to underwrite the cost of that system, and so on.

So we are within the two to five year period in which we will have direct competition.

Vice Chairman WARNER. And if our government is successful in enunciating a policy to give a clear guidance to our industrial base, have we still got a little time left that'll be on our side?

Dr. HORTON. A little time left but time is short and it is time to get on with it and we are getting on with it, Senator.

Vice Chairman WARNER. Have you expressed those views in the interagency conferences? I presume you have been a participant.

Dr. HORTON. The Department of Defense has been represented certainly and has expressed those views.

Vice Chairman WARNER. Are you working on any policy by which you will possibly go into your archives and sell some classified material, or declassify some material for——

Dr. HORTON. There is an on-going study within the Intelligence Community on that subject, but I would defer to the DCI and his witnesses to elaborate on that. That study is not yet complete.

Vice Chairman WARNER. Wouldn't that be a joint study with DOD and——

Dr. HORTON. It is a joint study with DOD as we are part of the Intelligence Community, certainly.

Vice Chairman WARNER. And is that study likely to terminate and reach some conclusion at about the same time as the major thrust is——

Dr. HORTON. In a matter of a few months, certainly. As was indicated, we are expecting that we might have a national policy on the subject at hand in that same time frame.

Vice Chairman WARNER. And do you have a timeline on the enunciation of that policy as consistent with that of Ambassador Newlin?

Dr. HORTON. I express the same personal hope that he has that in the next month or two that we might, have that policy.

Vice Chairman WARNER. That is a little shorter, I think, than Mr. Newlin's.

Dr. HORTON. By the end of the year.

Vice Chairman WARNER. All right. Well, that's good.

Why don't you proceed then with your other statement?

Dr. HORTON. Thank you, Senator Warner.

I am certainly happy to be here before the Committee. This is my first appearance in my current capacity as Principal Deputy Assistant Secretary of Defense for C3I, but is not my first time to meet with this Committee, its Members and its staff. In the past I have met with you while on active duty in the Air Force. I just retired this past summer. And it is my pleasure and privilege to be here today and talk to this very important subject.

Dr. Perry, the Deputy Secretary of Defense, and Mr. Paige, the Assistant Secretary for C3I, send their regrets at being unable to be present here today.

My oral statement will be brief, since I have separately provided a longer statement for the record——

Vice Chairman WARNER. If I can interrupt you. In my conversation with Dr. Perry, whom I know very well and over many, many years, I think he is a strong supporter of the direction which we are moving.

Dr. HORTON. Yes, sir, he certainly is

Vice Chairman WARNER. All right.

Dr. HORTON. You'll recall that when Mr. Paige testified before this Committee last June, on the 10th, on essentially the same subject as being considered today, i.e., the sale or transfer to foreign governments or other foreign entities of U.S. made or produced remote sensing systems, technology or products, that he outlined where we are attempting to go. And in summary, since then the Defense Department has been moving forward over the past several months on a program that is much as Mr. Paige described to you in June, developing and defending policy positions and making recommendations on individual license applications.

Some of the decisions involved are still tentative, as indicated by some of the previous witnesses, and are waiting approval of a new national policy that is still in the process of being made final, and we have had some discussion of that already.

As is evident by the various witnesses appearing before you today, the topic of this hearing involves responsibilities of the Department of State and Commerce and the Director of Central Intelligence, as well as those at the Department of Defense. And I will only be discussing the Defense role.

Protection of our national security is of course the basic Defense Department responsibility, and that, in turn of course, includes continuing recognition of the need to maintain a U.S. industrial base that is adequate to sustain our national security. How these two matters interact is the focus of my comments here today.

On the one hand, we are concerned with the proliferation of remote sensing systems and foreign access to imagery from space, primarily because of the potential military utility of such imagery. The proliferation of foreign military forces having access to high quality imagery could increase potential risks and vulnerabilities of U.S. military forces, as well as those of allied and friendly nations. Increased vulnerability could equate in turn to increased costs and reduced effectiveness to our own forces.

Our concerns about the spread of foreign based imagery capabilities is heightened by the recognition that we live in a world that is faced by the threat of proliferation of the weapons of mass destruction, of high technology conventional weapons, and of the advancement of missile and aircraft technology for delivery of such weapons.

On the other hand, we know that remote sensing capabilities are becoming increasingly available in the international commercial marketplace, as we have just talked about. Foreign acquisition of or access to such capabilities cannot be denied solely through U.S. export controls. Recognition of this situation has led us to carefully consider potential benefits that could come to the United States from active U.S. participation in this international market.

Weighing the factors involved, the Defense Department has concluded that the United States should support, but carefully manage, arrangements for the export, on a commercial basis, of remote sensing systems, selected U.S. technology, and imagery products. It is our conclusion that the process for government approval should be based on a case by case review of implications for national security arising from the licensing of such exports.

To elaborate, the Department of Defense position can be characterized as follows. Reconnaissance systems and satellites are among the most sensitive U.S. military related technologies because of their unique capabilities to monitor events and influence the effectiveness of military forces around the world. More and more nations have discovered the value of these remote sensing systems, especially after seeing how U.S. troops integrated imagery data from space into military operations effectively during the Persian Gulf War. Some of these nations have expressed interest in acquiring their own systems and imagery. Our past practice was to refuse to permit commercial export of remote sensing systems of either high or medium resolution imagery. Now we have conducted an in depth review on this issue, spurred not only by foreign interests, but also by the recognition that declining U.S. military budgets could put at risk the health of the elements of the U.S. industrial base involved with remote sensing matters. And of course, also spurred on by the interest of this Committee.

The Defense Department has concluded that in certain cases——

Vice Chairman WARNER. Let me stop you on that point, because we have to make a major decision and it is going to be made on the Floor when the Defense Authorization Bill is passed. It is whether or not to continue in operation a submarine base and to build possibly a third type of submarine, which is questionable to our national security needs. There is no comparable question about the need for this industrial base in our national security scheme today, tomorrow, or in the future. So it is the clearest of all industrial base cases, this one that is before us today, and that is why you have got to move and move expeditiously.

Dr. HORTON. I agree with you sir.

The Department of Defense has concluded that in certain cases, when current and future national security would not be put at undue risk, it would be in the national interest to allow transfers or sales of remote sensing systems, non-sensitive technology, or imagery products of up to and including medium resolution. This would permit a graduated and tailored U.S. response to express foreign needs and support the health of the U.S. industrial base. As you pointed out, Senator, an extremely important, perhaps the most important in many ways, part of that industrial base.

We recognize that risks would be involved, but consider that these risks are manageable. When we propose to make these risks and to manage these risks is to calibrate what we agree to license in relation to the degree of control we are able to exert over the result. Thus a preference for licensing product and then turnkey systems and lastly and probably least frequently, specific items of technology. And further, we would anticipate some increasing degree of control of output as we move from peace through crisis to

conflict in areas where imagery would put important U.S. interests directly at risk.

Such flexible responses would not only better support U.S. industries than past policies, we believe, but would also assist the United States in maintaining its present predominant position in this field of such military importance. It is our hope that a flexible response program will help us maintain friendly relations with nations whose support we value. And by our participation in overseas developments, we should be able to enhance our influence on shaping what otherwise might become militarily troublesome developments. By being responsive to legitimate U.S. industry needs, we'll be acting to preserve the U.S. industrial base.

These are matters which are admittedly easier to talk about than to put into effect, but we are bending every effort to put them into effect today.

We will never forget the protection of U.S. national security is the basic DOD responsibility. But we also recognize that a healthy economy is essential to that security. Thus we will support on a flexible basis those actions we consider reasonable, acknowledging that what the Defense Department does must be fully mindful of the responsibilities of other government organizations in the field of foreign policy, commercial activities, and intelligence.

That concludes my formal statement and I would be glad to answer any questions.

Vice Chairman WARNER. I would like just to make an observation and I am going to turn over the Chairmanship to the man who probably has been the most significant leader in this effort, Senator Kerrey.

But I judge that when the Administration makes this policy determination and it will then lead to another hearing, I think, Senator, of this Committee, to assess that policy in view of the needs of the industry, and to determine whether the industry feels that that policy has met its specific needs. And therefore, if there is a meeting between the industrial base and the policy of the DOD, then the matter will move forward. If it doesn't, and there is a significant number of us here in the Congress who feel that the government policy has fallen short, we may have to go to a legislative route to see that it is done.

Senator Kerrey, we thank you for joining us. Again, I acknowledge, as did the Chairman before you arrived, of your leadership on this matter. We thank you.

Senator KERREY of Nebraska. Thank you, Senator.

I know we still have three of the earlier witnesses are here and if there are ways to pull the chairs up so we can get a small discussion here at the tail end of this, I know Mr. Frey, you are obviously still here, Mr. Araki is here. I don't know if Dr. Armani is still here.

What I would like to do, Mr. Frey and Mr. Araki and Dr. Armani, give you an opportunity to respond to what you have heard. It seems to me that the Administration is making a statement of saying that they recognize the policy needs to be changed, and then they are in the process of changing that policy. And I would like to give you an opportunity to respond as to whether or

not you think they are heading in the right direction. Knowing that you almost have to say yes in order to——

Mr. FREY. I certainly wouldn't want to make a flat no to that statement. I think there is progress. I have to confess, I am somewhat disappointed in the progress since the last hearing. I think at the last hearing a step was made forward where the DCI did announce his intent to do something different, which he described as forward leaning in the foxhole. Eventually we are going to have to get out of the foxhole and fight, and you know, I know this is a very complex issue, but we seem to be re-airing the same set of concerns over and over. It is not entirely clear to me that we are converging. In some of my discussions with government people outside of this hearing I feel better in some regards. I know there is a lot of very good people with very legitimate concerns in this area, working very hard on it. Sometimes I despair whether we are ever going to get to the end of the process.

Vice Chairman WARNER. I think you have gotten some reassurance today from those of us here on the Senate Intelligence panel. And there are many colleagues who are not on this Committee who share the views of those of us who are. So I hope— don't carry despair.

Mr. FREY. I was very encouraged by——

Senator KERREY of Nebraska. Leave the despair to us.

Mr. FREY. I am very encouraged by the view of the Committee and I think it is just an ideal example of the government working, because you folks sit in a different perspective than any of us and can bring some sense of balance to this and some sense of perspective that the world is changing. We have our own parochial views in industry. I am very concerned about saving some people's jobs. That may not be the most important thing in the world for this country, particularly the number of jobs.

Vice Chairman WARNER. I think it is. I think jobs are, and I mentioned clearly that your payroll is your business, you've got to meet it. Taxpayers are paying for the policymakers.

Senator KERREY of Nebraska. Mr. Araki.

Mr. ARAKI. The only comment I would like to add to Mr. Frey's is that I believe that the fundamental policies pertaining to levels of performance and types of operating characteristics are permissible for commercial remote sensing have been established between industry and the government through the process that we have gone through since the last hearing.

It seems to me that what remains to be done, if I can speak in general, is a final discussion among all of the agencies in the government to coalesce on a common position. So I think that I am hopeful that as the meetings that are currently scheduled in the near term can come together and establish an agreement which will allow industry to obtain the licenses that are necessary.

Vice Chairman WARNER. So you have received some encouragement today.

Mr. ARAKI. I have received some encouragement.

Ms. ARMANI. Senator Kerrey, Senator Warner, as you know, I have not applied for a license yet to build or operate a satellite, but I do have some views based on what is happening in Europe and Russia. And that is related to what Senator Kerrey said earlier

about partnership. There is a very close partnership between the government and industry in Europe. They work together hand in glove. If you go to Russia and go to their national imagery center, on one side the business card reads chief of national imagery center, on the other, it reads distributor of the following commercial technologies, which happen to be INTERGRAF. That is how close it is in the East.

But the West is not far behind. You will find the CEOs and the ministers working together to secure jobs for their industry. I think it is critically important that we move forward. I think we have to do something about the LANDSAT 6 situation to recover our lead in that area.

And government concerns about the security implications are very important, of course. But there is another side to that that hasn't been addressed, and that is what are the intelligence and national security implications of our failure to understand what you can do with the Japanese data, for example, which is very close to LANDSAT, except it has certain technical differences. I think we have got to better understand what the competition is doing, if you will, as well as going forward with our own programs.

Senator KERREY of Nebraska. Well, let me just, for your own information, declare how I see this thing. I mean, I see first of all, that we have developed this technical capacity as a consequence of the United States policymakers needing to know certain information in order to make strategic and tactical decisions. And without that information it is awful hard to make the decision. We may still louse up the decision, but we aren't going to be able to say we loused it up because we didn't know. And particularly at an age where proliferation has become a very big and frightening issue, and an age where narco-trafficking is also a very big and difficult issue, where we have different kinds of considerations.

In addition to a continuing strategic concern, we also have the need to make sure that we have the tactical capacity to provide battlefield commanders with the best that they can possibly have in order to be able to fight whatever wars this nation may end up having to fight.

And we have a different set of responsibilities, in short, than France and Russia have. With all due respect to the French and all due respect to the Russians, our responsibilities are much different, both in the world and here at home.

So I think it is very important to put that piece out there because as Senator Warner alluded to, the effort to make sure that we keep that technological edge, I think is at risk, frankly. I mean, I think it is at much greater risk today than it probably was four years ago. So that is issue number one and I think we always have to keep that out there, because that is the most important piece of business.

The second thing I would say is that there are obviously jobs at stake here. And I—you know, one cannot disconnect one from the other. There are real jobs at stake and there are tremendous job opportunities here. And we shouldn't lose them. And we have got to, I think, move with all deliberate speed to develop the procedures under which we can maintain the first and do the second. And I emphasize with all deliberate speed.

I do not think this is similar—although they resemble one another, I do not think this is similar to the very difficult decision that the Administration just had to make in regards the allowance of exportation of computers. The change in that policy that occurred in October is in some ways similar, but I think the similarity ends in relatively short order.

There is a real urgency to do this in my judgment, or we are going to lose jobs. Listening to what the Europeans are doing, it is not going to be long before we find ourselves saying once again we missed an opportunity. So this is not one where delay is advised.

Last thing that I see as you may have gathered a couple of times here, in a government of, by, and for the people, our capacity to make decisions rests upon not just the ability to inform 536 people who happen to get elected and serve in both the Congress and the White House, but our capacity to make a decision rests upon the citizens acquiring information and making good decisions as a consequence.

And so I see a third area very closely connected to the second, where the informing and educating of our citizens is possible as a consequence of this technology. And I don't want to deny the citizens the opportunity to take advantage of that, particularly since they have made the investment to begin with. And that is not to say that I want the government to do the sorts of things that you all have described as being essentially competing with the private sector and making it difficult for the private sector to develop. I mean, I think we can separate that out in the second effort if we move with all deliberate speed.

I just—I see 120 million households out there, citizen households, and this technology allows me to go right into their household and deliver information, or at least make information available. And as I indicated in my opening statement, we spend tens of billions of dollars already on an annual basis at the state and federal level trying to assemble this information for the citizen. Unfortunately, it is not in very useful form, and it seems to me that we have in this imaging area the potential to be able to change that.

So I see this as a very, very important issue, for strategic reasons, for tactical reasons, for the security of the United States of America and the Free World. I also see it as very important for our desire, strong desire to produce jobs in America, particularly higher paying jobs, because most of the jobs you are talking about in these industries are apt to be higher paying jobs.

And lastly I see it as very important because I believe the citizens' capacity to make good decisions, informed decision, is at risk, unless we change the way that we make information available to the people of this country.

So I appreciate the witnesses coming forward. I assure you that the Committee is going to be moving on this again and working with the Administration and making sure that this policy gets set down right.

Vice Chairman WARNER. In other words, one word, we're going to dominate this industry, come hell or high water.

Thank you.

Senator KERREY of Nebraska. Thank you.

[Thereupon, at 1:39 o'clock p.m., the Committee was recessed.]

PREPARED STATEMENT OF DR. WALTER S. SCOTT, CHAIRMAN OF THE BOARD, WORLDVIEW IMAGING CORPORATION

Mr. Chairman and other distinguished members of the Committee, it is a pleasure and an honor to have the opportunity to comment on commercial remote sensing. I will offer my observations on two areas: the licensing of commercial remote sensing systems, and the impact of a release of U.S. Government archival imagery on the commercial remote sensing industry.

I would like to take a moment to introduce you to WorldView Imaging Corporation. WorldView was founded roughly two years ago with the objective of being the first information services business to be a profitable supplier of satellite imagery to rapidly growing markets such as Geographic Information Systems, mapping, resource management and environmental monitoring. We were enabled by the tremendous advances in small satellite technology that have moved the cost of space remote sensing within reach of private capital sources. We were encouraged by a changing world and the growth of our target markets. Our receipt of the first private space remote sensing system license issued under the 1992 Land Remote Sensing Policy Act was instrumental in enabling us to raise venture capital financing.

WorldView is building a pair of lightweight satellites to collect its digital earth imagery, and is in the process of creating an electronic ordering and distribution network to put this imagery in the hands of customers quickly. Our ability to build these satellites affordably is a direct result of technological advances over the past decade under the sponsorship of SDIO (now BMDO), DARPA, and other parts of the DoD. WorldView is thus an excellent example of "dual-use" technology fulfilling the objectives of defense conversion.

WorldView's satellites will provide our customers with high-resolution (3-meter panchromatic and 15-meter multispectral) over head digital images of any place on the planet. These images will offer resolution that is 3x–10x better than any commercial satellite imagery available today, and will be more current and less expensive than aerial photography. WorldView has begun the process of applying for a license to offer 1-meter resolution imagery.

The first WorldView satellite launch is planned for 1995, and with the second launch to follow within one year. In light of the unfortunate loss of Landsat 6, the launch of WorldView's satellites should help ensure that, during the gap before the launch of Landsat 7, the U.S. retains worldwide remote sensing leadership.

WorldView is a new information bridge between remote sensing and Geographic Information Systems (GIS). The U.S. currently enjoys a leadership position in the heavily competed GIS market worldwide (currently a $5 billion per year industry, projected to grow to $15 billion by the end of the decade). The raw data that fuels GIS growth is derived mainly from aerial photography taken by local sources worldwide, a $2+ billion market. WorldView will be the first commercial satellite system that can provide imagery on a global basis that is competitive with local aerial photography suppliers. Our projections show that WorldView will be able to compete directly for several billion dollars in revenues now mostly out of the reach of U.S. firms.

A significant step for WorldView was forming a strategic partnership with CTA Incorporated and its subsidiary Defense Systems Inc (DSI). As part of this partnership, DSI—which has built and launched 19 successful lightweight satellites to date—will build the first two WorldView satellite buses. CTA is also an investor in WorldView. While the downturn in defense spending has created difficult times for the aerospace industry, CTA has helped ensure its future by this investment in commercial space.

WorldView is also backed by investments from the established Silicon Valley venture capital firms of Burr, Egan, Deleage and Co. and Technology Venture Investors (TVI). The two firms manage over $1 billion of investment capital and have financed many of the most successful high technology companies in the U.S.[1]

LICENSING OF REMOTE SENSING SYSTEMS

On the whole, the experience of WorldView in applying for and receiving its remote sensing license has been a good one. During the review of our application, the Departments of Commerce, Defense and State identified a number of issues and concerns, provided us with an opportunity to address these, and worked with us to

[1] including Microsoft, Sun Microsystems, Tandem, Compaq, Federal Express, Genentech, and others

find solutions. We have a continuing dialog with representatives of these Departments, and expect to continue to work closely with them as we move forward with implementation of our remote sensing system in accordance with the provisions of our license.

As the first to experience the review process, we feel it worked well. As we move forward with our plans for a 1-meter resolution system, we hope that the review process will not undergo changes that will interfere with its demonstrated ability to effect a proper balance between the goals of fostering U.S. international economic competitiveness and protecting national security.

RELEASE OF U.S. GOVERNMENT ARCHIVAL IMAGERY

We understand that the U.S. Government is contemplating a policy that would allow the release of high-resolution imagery from its archives. The arguments offered in support of this proposal range from the need of the environmental research community for baseline data, to the increased openness of the post cold war world, to the desire of the Government to recognize additional revenue.

While understanding these arguments, WorldView cannot help but view any release of imagery as a threat to the existence of the newly emerging U.S. commercial remote sensing industry. It places government in a position of competing directly with industry, an action counter to existing U.S. national space policy.[2] Given strong government encouragement of defense conversion—and specifically of commercial remote sensing, as evidenced by the 1992 Land Remote Sensing Policy Act—government action to compete with businesses resulting from this defense conversion telegraphs a lack of policy stability to both potential customers and investors. At a time when U.S. industry has the potential to dominate a multi-billion dollar world market in commercial remote sensing, release of archival data by the U.S. Government would have a chilling effect on private investment, delaying the development and growth of a U.S. remote sensing industry and paving the way for foreign competitors such as France, Russia, and Japan to dominate the world market.

WorldView would recommend against allowing any release of high-resolution Government archival overhead imagery into the marketplace. If an outright restriction proves to be infeasible, then such imagery should at a minimum be released under severe restrictions, e.g., only imagery older than ten years should be considered for release, and this archival image data should be provided only for scientific research, with criminal penalties for its redistribution similar to those applied to software piracy. Since the bulk of the revenues of the commercial remote sensing industry will initially come from newly collected imagery, releasing only old Government data will have less of an impact on the industry. By restricting the recipients of this data to be accredited researchers, the commercial customer base of the remote sensing industry will not be undercut.

As the commercial remote sensing industry begins to build its own archive of imagery, it is in the interest of the industry to make this archival imagery readily available to the scientific community, as this is an excellent way of helping develop new applications for the data. This parallels the efforts in the computer industry to make technology readily available to universities. WorldView is already pursuing cooperative projects with several research institutions, and intends to make selected imagery available at little or no cost to researchers as part of these projects. In the long term, we feel that these cooperative efforts can be combined, for example, with data vouchers provided to researchers by their Government sponsors, to address the needs of the scientific community for data without harm to the remote sensing industry.

Thank you for the opportunity to express my views.

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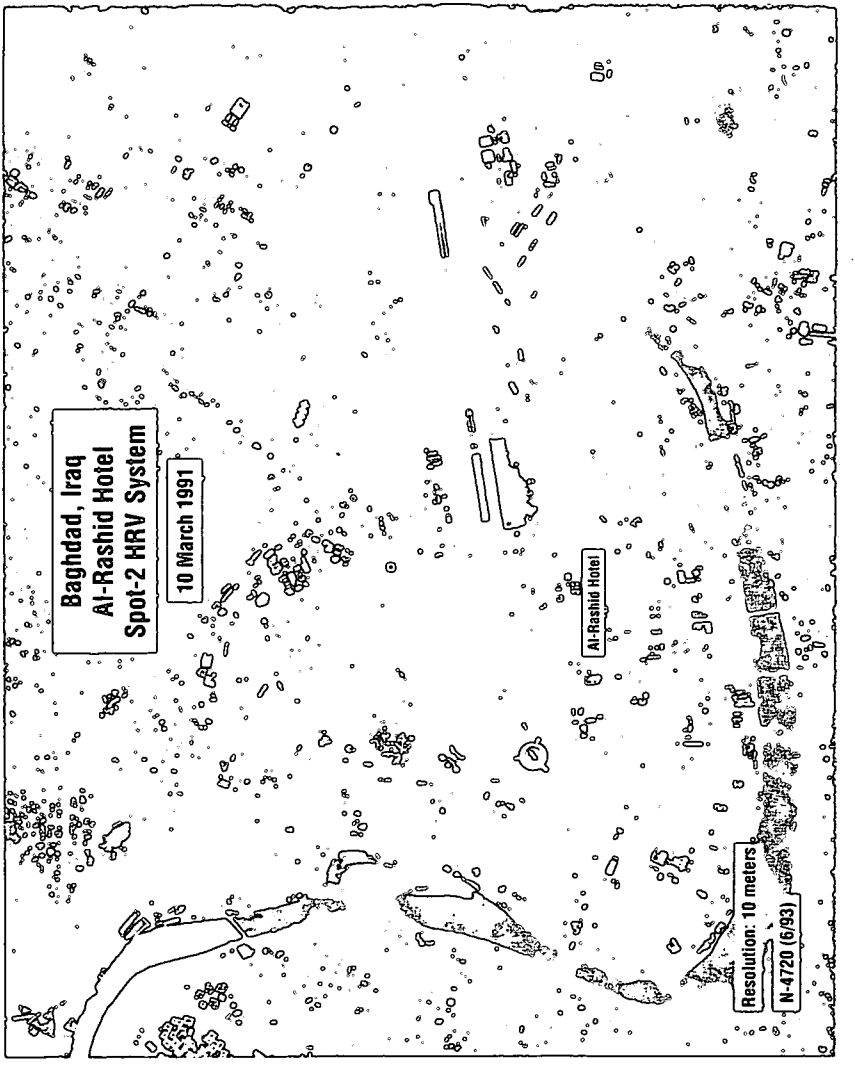
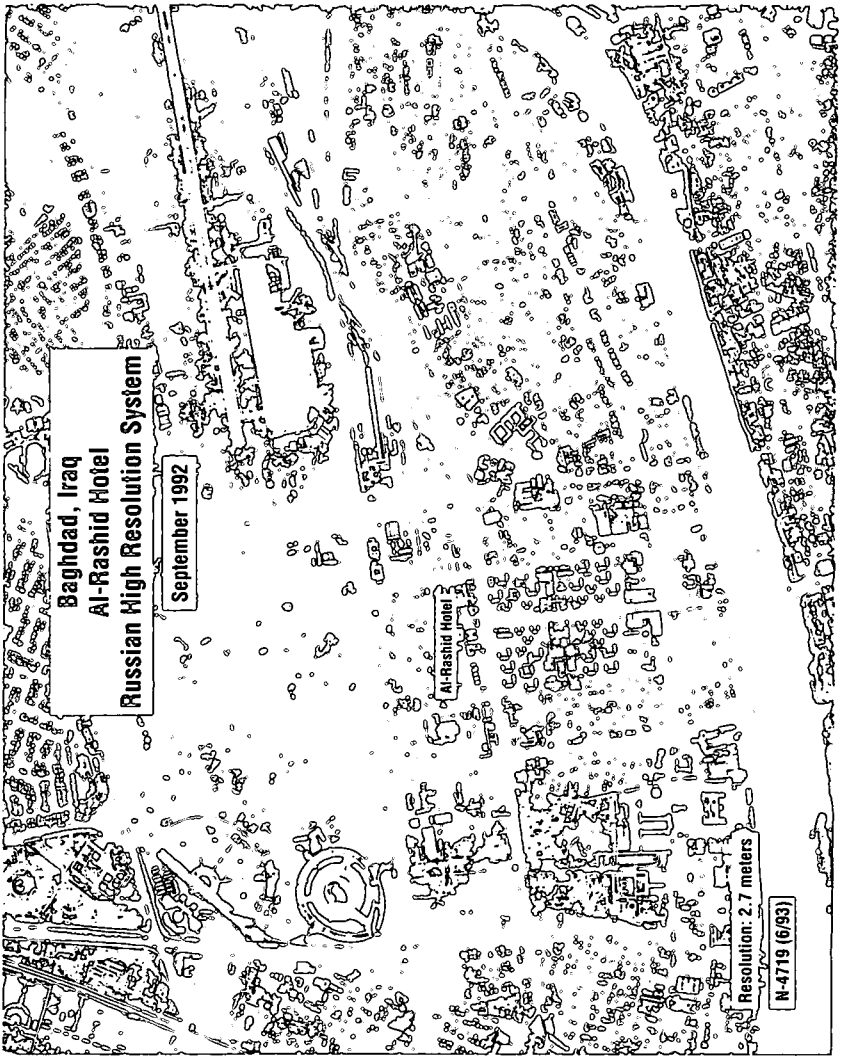
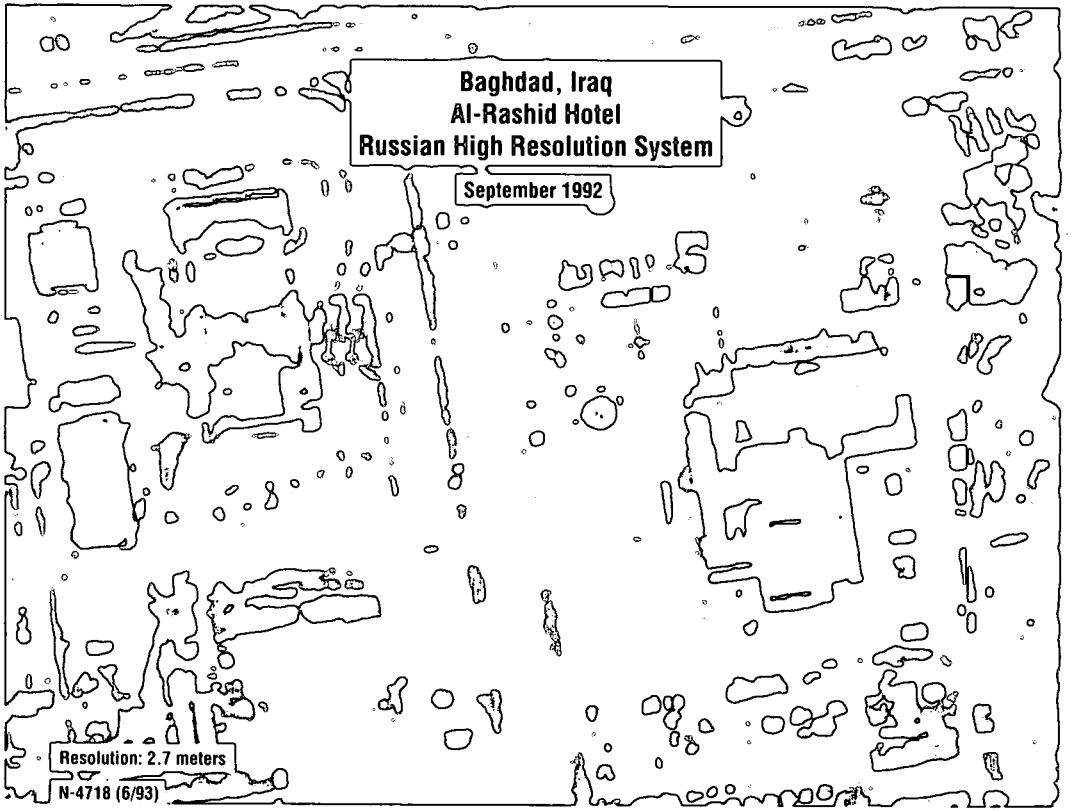
[2] National Space Policy, approved by the President, specify that "Governmental Space Sectors shall purchase commercially available space goods and services to the fullest extent feasible and shall not conduct activities with potential commercial applications that preclude or deter commercial space activities except for national security or public safety reasons." (November 2, 1989 U.S. National Space Policy).


Baghdad, Iraq
Al-Rashid Hotel
Spot-2 HRV System
10 March 1991
Al-Rashid Hotel
Resolution: 10 meters
N-4720 (6/93)


Baghdad, Iraq
Al-Rashid Motel
Russian High Resolution System
September 1992
Al-Rashid Hotel
Resolution: 2.7 meters
N-4719 (6/93)


Baghdad, Iraq
Al-Rashid Hotel
Russian High Resolution System
September 1992
Resolution: 2.7 meters
N-4718 (6/93)

ISBN 0-16-046800-0