NATIONAL SECURITY AND NATIONAL COMPETITIVENESS: OPEN SOURCE SOLUTIONS

NASA REQUIREMENTS AND CAPABILITIES

Gladys A. Cotter
Scientific and Technical Information Program
NASA Headquarters (Code JTT)
Washington, DC 20546
USA

THE CONTEXT

In the world of science, two significant trends have a direct bearing on the importance of obtaining the results of foreign R&D:

- Foreign competitors are increasingly challenging U.S. leadership in critical technologies.

- Budget pressures both here and abroad have increased the necessity for international cooperative science projects.

In both situations, it is critical to know what potential partners or competitors can offer us from their technology base.

The NASA STI Program was established to support the NASA R&D mission through effective information acquisition and management. It has developed a knowledge base of foreign R&D intelligence that can contribute to the development of NASA international cooperation in science and technology as well as provide R&D results from abroad to be used as input to domestic program objectives.

When NASA was created under the National Aeronautics and Space Act of 1958, part of its enabling legislation recognized the importance of documenting the results of R&D investment and of the value of information transfer when it required NASA to "provide the widest practicable and appropriate dissemination of information concerning its activities and the results thereof" (P.L. 85-568). This provision laid the groundwork for the creation of a database of worldwide aerospace information, known today as the NASA Aerospace Database (NAD).

That was a time when U.S. leadership in aeronautics was uncontested. Today we have very different economic and social conditions[1]. The U.S. high technology industries have lost world market share in most areas. Many national commissions tell us that our nation has lost its ability to compete internationally. Some give evidence that American productivity, which is at the heart of national competitiveness, has been surpassed by many other industrialized nations. A notable exception has been the aerospace industry which continues as the leading positive contributor to the U.S. balance of trade. Overall productivity in the commercial aviation sector of the U.S.

[1] Supporting information was obtained from input from the Computer and Information Technology and Aerospace Knowledge Diffusion project, directed by Thomas C. Pinelli (NASA Langley Research Center).

aerospace industry has grown more rapidly than other U.S. industrial areas since WWII. Thus, the aerospace industry holds a special position for the U.S. However, this industry is in the midst of major changes and significantly more challenging competition. Aircraft manufacturing is becoming a target industry in some foreign companies and many enjoy a special supporting relationship with their governments. In a recent issue of Science magazine (October 16, 1992), a technology policy article states, "With mounting anxiety, U.S. commercial aircraft builders have been looking over their shoulder as foreign competitors erode their traditional lead in the global aviation market."

In addition to the aeronautical environment, NASA also has a national mission in astronautics. Here the technology preeminence competition is similarly heating up. On the other hand, due to the costs of major missions like the space station, international cooperation is imperative.

HISTORY

It is in this environment that we are now operating and doing our strategic planning for acquiring, managing, and disseminating scientific and technical information resources.

Over the past 24 years, the NASA STI Program has built the world's de facto international aerospace database. What does this database contain, how have we built it, and where are we going? In the next 20 minutes I'd like to briefly give you an overview.

First, what does it contain? As of 1991, the NASA Aerospace Database (NAD) contains more than 2.3 million summaries of worldwide research results as they are documented in journals, technical reports, conference proceedings, books, dissertations, among other publication forms. The subject scope is broadly defined as aerospace science and technology and other subjects related to NASA's mission such as life sciences, computer and information science, earth observation and global change, and social science including economic analysis.

This scope is detailed into 76 subject selection areas that are grouped into eleven major categories:

- Aeronautics
- Astronautics
- Engineering
- Life sciences
- Space sciences
- Mathematical and computer science
- Chemistry and materials
- Geosciences
- Physics
- Social sciences
- General

The breakdown of the database in terms of subject areas is given in Figure 1. Figure 2 shows the percent of U.S. versus foreign input to the database in 1991. Figure 3 gives a breakdown of the 1991 foreign input to the database by country of publication. In total, NASA receives annual input from some 60 countries and international organizations. In terms of international coverage, it is interesting to note that 15 percent of the R&D covered is documented in non-English languages. The STI Program adds English language citations and summaries to the database.

The NAD is built through the acquisition of material from three major sources:

1. NASA funded R&D results from its decentralized R&D program

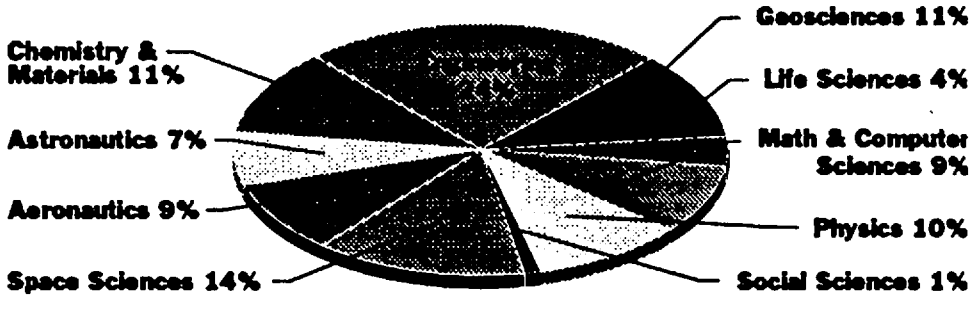

Figure 1. Breakdown of the NASA Aerospace Database by Subjects

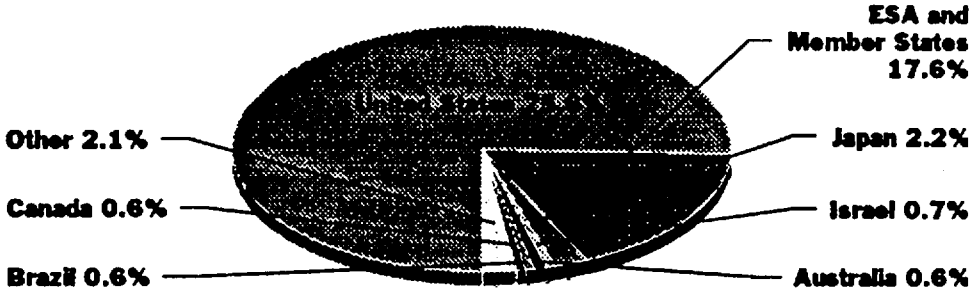

Figure 2. Percentage of U.S. versus foreign input to the NASA Aerospace Database

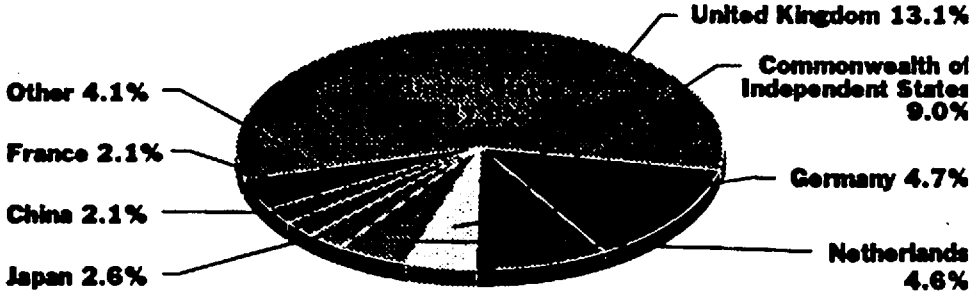

Figure 3. Percentage of input to the NASA Aerospace Database by country of publication

organization through required deposit of materials in the NASA system.

2. International exchanges of information. Here we have three models: nation-to-nation agreements; tripartite agreements among NASA, ESA, and organizations in ESA member states; and bilateral agreements with specific institutions, generally where there is no coverage through the other two arrangements.

3. Purchase of information and documentation analysis through government procurement channels (State Department), contractors, and commercial vendors.

Although I have been focusing on the NAD, let me just note that, in addition, the NASA STI Program builds and/or maintains some 15 other databases of interest to the scientific and technical community. These include descriptions of research in progress funded by NASA, limited document collections, and technology briefs in support of technology transfer.

We also keep contact with opportunities for cooperation abroad through special international program relationships. I'd like to just highlight four of these:

1. North Atlantic Treaty Organization/ Advisory Group on Aerospace Research and Development/Technical Information Panel (NATO/AGARD/ TIP). Under the NATO umbrella, AGARD/TIP is concerned with all aspects of the management of STI as an integral part of aerospace and defense R&D. The Panel's main objectives are to improve the management of STI in NATO nations, foster the exchange of STI, and provide advice to AGARD and NATO in the development and management of information services.

2. Commerce, Energy, NASA, National Library of Medicine, Defense Information Managers (CENDI). CENDI is an interagency group of senior STI managers who have agreed to cooperate by exchanging information and ideas, sharing resources, and undertaking joint initiatives. Since the agencies have overlapping technical interests such as materials science and engineering, global change and the environment, and biomedical impacts of technology, exchanging information acquired from foreign relationships helps to leverage resources.

3. International Council of Scientific Unions/International Council on Scientific and Technical Information (ICSU/ICSTI) and Committee on Data (CODATA). These organizations provide for the exchange of information and the sharing of experience among international peers. They provide a special advantage to participants because they bring together the scientific and information communities under the ICSU umbrella. Scientific needs for information are stressed and problems are addressed to provide better overall information services to the R&D community.

4. U.S. Japan Committee on STI. Under this protocol, which was signed in 1988, a Task Force on STI was

established to improve the awareness and understanding of organizations and systems to improve the access and use of STI by both communities. Particular interest has been paid to access to the grey literature and to developments in machine translation.

RECENT CHANGE FACTORS

In recent years new developments have changed the way we do business:

1. The NASA STI Program's technical advisory panel (comprising senior NASA scientists and R&D managers) found that our database lacked comprehensive coverage of foreign developments, and recommended that we aggressively pursue foreign acquisitions.

2. In the aerospace information arena, a number of NASA's counterpart information organizations have begun to take more aggressive steps in information collection and database building to reflect both industry and competitive directions as well as in response to an historical lack of NASA responsiveness to their input regarding the NASA Aerospace Database (which, remember, is a NASA product, but is the de facto international database on aerospace science and technology). Two of these efforts are the European Aerospace Database, being built by ESA and the German national database known as DELURA, being built by the Fachinformationszentrum in Karlsruhe.

3. The changing political environment has opened up new opportunities for the STI and the open source intelligence communities to more freely discuss opportunities for cooperation.

4. The NASA STI Program technology infrastructure used to process and disseminate information products has been aging (it was assembled in the mid 1960s to late 1970s) while modern information technology developments have advanced at a very rapid pace. At the same time, user expectations and requirements have increased. NASA management has recognized the need to modernize the STI infrastructure to better serve the aerospace user community needs.

5. Budget constraints have forced all of us to rethink our requirements and methods to determine the most cost effective plans for the future. This has meant looking for partners and finding ways to leverage scarce resources through others working on similar objectives.

In response to these changes and with particular relevance to the theme of this symposium, the NASA STI Program has undertaken a number of initiatives. I'd like to highlight just four of these in the limited time we have today:

1. We have sponsored two interagency foreign acquisitions workshops where ideas and projects were shared. One of the highlights of these was that both the traditional STI agency staff and the intelligence community staff

came together to explore areas of mutual interest. As a result of the workshops and communications they encouraged, both bilateral and multilateral, NASA has become involved in a number of cooperative foreign acquisition efforts. I'll note these shortly.

The workshops doubled in size from 1991 to 1992. We are expecting to plan a third one for 1993 with the Air Force Foreign Aerospace Science and Technology Center taking the co-chairmanship.

Since we began these, a number of non governmental commercial companies have expressed interest in attending. Our 1993 workshop will be opened to the broader community interested in the acquisition of foreign, open source STI.

2. The NASA STI Program is working with international partners more cooperatively and more aggressively, to make them active participants in the future development of an international database. As a result, the database should become more comprehensive and more timely. There will also be a more equitable sharing of costs and benefits from the development and use of the resource. Specifically, instead of using contractors to purchase and process technical material for the database, we will increase our exchange relationships, the ultimate goal being that each participating country will provide its national "open source" literature in exchange for that of the other participating nations. NASA already has nation-to-nation agreements in place with Australia, Canada, and Israel. We also have an agreement awaiting signatures with Japan and we are holding preliminary negotiations with Germany, China, and Russia. For the major Western European aerospace nations, NASA has an agreement with the European Space Agency to operate as our agent in this regard although, as we noted in the case of Germany, some countries have expressed interest in working more directly with the NASA STI Program on this and other information system developments. In the case of Russia, because particular uncertainty exists and the potential information has considerable value, special efforts are being made. A NASA STI delegation went to Russia to meet directly with some of the key aerospace institutions. Out of that some direct negotiations for the exchange and purchase of information are being negotiated. In addition, we continue to talk with some commercial vendors who are taking major initiatives to obtain and process Russian STI for sale to the U.S.

3. We have targeted certain developing areas with special interagency cooperation. NASA is working with the Library of Congress, which through long standing gift and exchange relationships has a wealth of foreign technical reports. They also have an acquisition infrastructure in countries such as Brazil and India. Also in the case of India, we are working with NTIS to see if joint inroads can be made for acquisition

and processing of technical aerospace literature.

4. Finally, NASA is working closely with the Air Force FASTC program at Wright Patterson Air Force Base to see how the NASA STI Program can more effectively use open source acquisitions for their major CIRC database to avoid duplication of effort and increase comprehensiveness of data coverage. By comparing input for a 2-year period we have found areas of unique coverage. For example, a number of journals from China are covered in CIRC that are not covered in the NAD.

So what are our expectations for the future in the open source area? We already see a change in the composition of the NASA Aerospace Database. The historical NASA Aerospace Database, which consisted of some 2.3 million research summaries covering 1962 to 1990, included 27 percent coverage of foreign R&D results originally published abroad. In 1991, 37 percent (26,000 out of 70,000 records) came from abroad. The foreign proportion of the annual input is increasing. I believe this is a result of acquisition processes, but it also reflects an increased proportion of the knowledge base being developed abroad.

ACCESS AND MODERNIZATION

Until now, I have been discussing the resources that the NASA STI Program acquires. The program makes these resources available to the aerospace community using various information technologies, including print products, microforms, and electronic information systems. The NASA RECON system was an early leader in the evolution of today's online information industry and one that has enabled the further development of other electronic products such as CD-ROM. However, the one thing in this world that is clear to me after 3 years as manager of the STI Program and 15 years in the STI business, is that the pace of technology development and change increasing ever more rapidly. Both user expectations and producer methods have changed profoundly in the short 15 years since the introduction of the personal computer. The shifting paradigm that we are now seeing with the telecommunications and networking revolution will have no less an impact years from now.

From an information content perspective, technology has exacerbated the problems of information overload. Or as some have said, we are overloaded with data, but starving for information. In the famous words of "the ancient hacker,"

> Data data everywhere
> and nothing helps you think!

We know the intelligence community has invested considerable attention to providing advanced information technologies to aid the analyst in information access and analysis, but we also know the requirements still largely outpace what is available.

In conclusion, I have a few thoughts about our technology future. The NASA STI Program has recently been given some resources to embark on a modernization program for its information technology infrastructure to aid in the management, access, and analysis of information. The NASA modernization effort is a combination of a short-term upgrade of its retrieval system

and user interfaces along with a long-term modernization strategy designed to transform the program into a multimedia, global "information center without walls." Critical pieces of the long-term strategy include streamlining access to sources of STI by using advanced computer networking and graphic user interfaces; creating and disseminating information in various electronic media including optical disks, video, and full text; and establishing a Technology Focus Group to maintain a current awareness of emerging technology and to plan for the future.

I hope it is clear from this brief overview of "NASA Requirements and Capabilities" that the traditional scientific and technical community — with its primary orientation the support of the research and development missions of science agencies and the transfer of its technology to U.S. industry — shares many interests with the open source intelligence community. We are opening many avenues of discussion and closer cooperation as we see the issues of national security and national competitiveness become increasingly intertwined. This meeting is a useful step in this process.

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Previous	OSS '92 Kurt Molholm, Defense Technical Information Center, The CENDI Paradigm: How Some Federal Managers Have Organized to Improve Scientific & Technical (S&T) Information Use,
Next	OSS '92 Gladys A. Cotter, NASA Open Source Intelligence Requirements & Capabilities (Slides),

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