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The NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program plays a key part in helping NASA maintain this important role.

The NASA STI Program provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program is also NASA's institutional mechanism for disseminating the results of its research and development activities.

Specialized services that help round out the Program's diverse offerings include creating custom thesauri, translating material to or from 34 foreign languages, building customized databases, organizing and publishing research results ... even providing videos.

For more information about the NASA STI Program, you can:

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Access to Japanese Aerospace-Related Scientific and Technical Information: The NASA Aerospace Database

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With Japan's growing R&D strength in aerospace-related fields, it is increasingly important for U.S. researchers to be aware of Japanese advances. However, several factors make it difficult to do so. After reviewing the diffusion of aerospace STI in Japan, four factors which make it difficult for U.S. researchers to gather this information are discussed: language, the human network, information scatter, and document acquisition. NASA activities to alleviate these difficulties are described, beginning with a general overview of the NASA STI Program. The effects of the new National Level Agreement between NASA and NASDA are discussed.

Although aerospace is a field in which the United States is widely regarded to be a technological leader, Japan has become an increasingly more important source of aerospace research and development (O'Toole, 1992). However, information on these developments can be extremely difficult to find for researchers outside of Japan. This paper will discuss the reasons for this difficulty and steps the National Aeronautics and Space Administration Scientific and Technical Information Program (NASA STI Program) is taking to help U.S. researchers monitor Japanese developments.

Aerospace STI Diffusion in Japan

Unlike the United States, there is no central organization in Japan with responsibility for aerospace scientific and technical information (STI). In order to understand why not, it is helpful to examine STI in general and aerospace research in Japan.

While Japan is well-known for its collaborative research between companies, there is little collaboration between universities and industry by American standards. Industry views the universities as a source of well-educated workers, not high quality research (Nishi and Kobayashi, 1993). As a result, there is low demand from industry for information on university research. Informal methods such as university professors consulting for industry, which is technically illegal but common (Dearing, 1989), and industry lecturers at universities (Nishi and Kobayashi, 1993) help provide much of the information flow needed. It should be noted that there has been a marked increase in university/industry joint research and technology transfer in recent years (Levy and Samuels, 1989).

The Japanese aerospace industry is very concentrated, with three firms controlling ninety-six percent of all prime contracting. Extensive vertical integration within companies and *keiretsu* (corporate groupings) further emphasizes this concentration. (Levy and Samuels, 1989). Along with a long history of collaborative research between companies, this reduces the need for a formal, centralized mechanism for STI dissemination between companies.

Japanese national government administration is very vertically fragmented. This sectional centralization (*tatewari gyōsei*) inhibits coordinated activity in research administration, including STI dissemination. There has historically been fierce rivalry between the Ministry of Education, Science and Culture (MESC), the Ministry of Post and Telecommunications (MPT), the Ministry for International Trade and Industry (MITI) and the Science and Technology Agency of the Prime Minister's Office (STA). (Levy and Samuels, 1989). As a result, STI dissemination activities by the various ministries focus on the research institutions under that ministry's jurisdiction, rather than being comprehensive. (Dearing, 1989). The effects of this fragmentation is heightened because of the strong central control exerted by the ministries on various research organizations, such as MESC's oversight of the national universities and many of the national research laboratories.

Expectations for information dissemination within organizations are also quite different than in the U.S. National research laboratories consider the publication of research reports to be a their mandated responsibility and not an appropriate business for the private sector. However, the national institutes are constantly struggling with budgetary limitations, which encourages dissemination of reports only to related institutions and researchers.

To summarize, aerospace research and corresponding STI activity is highly segmented in Japan. As a result, no central organization is responsible for aerospace STI in all sectors of the research community.

Two national organizations, the Japan Information Center of Science and Technology and the National Center for Science Information System, have major responsibility for the gathering and dissemination information within their jurisdictions. Historical context will help explain their current roles.

In 1957, the Science and Technology Agency founded, with government and industry funding, the Japan Information Center of Science and Technology (JICST) to collect and process worldwide STI, disseminate that information throughout Japan, and encourage scientific documentation activity within Japanese organizations. In 1969, the Science and Technology Council of the Prime Minister's Office issued a report proposing a National Information System for Science and Technology (NIST). Several years later the Standing Committee for Information in Science and Technology revised and redefined NIST, stressing computerization and an expanded role for JICST. In 1974, a more concrete NIST plan was put forward.

In 1980, the Ministry for Education, Science and Culture issued a report calling for a separate science information system for the national universities and research labs. (Congressional Research Service, 1984). This organization, the National Center for Science Information System (NACSIS), was formed as a National Inter-University Research Institution in 1987.

JICST, which is a Public Corporation under the Science and Technology Agency, is active in constructing bibliographic databases, applying machine translation to STI, and international information activities such as constructing English language databases. It provides access to a variety of databases via JOIS, the JICST Online Information System. In FY 1992, it had a budget of 15.635 billion yen (approximately \$130,291,666). (Science and Technology Agency, 1992)

JICST's main database covers journal articles and publicly available technical papers. It includes aerospace STI from these sources, although aerospace is not a specific focus of

the database. The Japanese version of JOIS is accessible via the National Technical Information Service and the English-version of JICST, JICST-E, is available via the STN information service.

NACSIS has responsibility for the STI activities of the national universities and national research laboratories under the control of the Ministry of Education, Science and Culture. In FY 1992, it had an overall budget of 2.54 billion yen (\$21.2 million) with 117.7 million yen (\$980,000) earmarked for the creation of databases at national universities.

Databases produced by NACSIS cover technical papers, theses and dissertations from the universities, including those not provided to the public. This includes aerospace material from laboratories affiliated with universities, such as ISAS, the Institute of Space and Aeronautical Science. The NACSIS database system can currently be accessed at the Library of Congress and at the National Science Foundation.

The National Space Development Agency (NASDA) of Japan, a public corporation under the STA, plays an important, but not central, role in aerospace STI. NASDA is in charge of satellite and launch vehicle development and is fundamentally an engineering institution, not a research organization. Unlike NASA, NASDA founding legislation does not assign it the responsibility of disseminating information.

NASDA is developing the Aerospace Information Reference System (AIRS), which could potentially become the central aerospace STI source for Japan. It is currently an experimental system for NASDA's internal use. It covers aerospace technical reports from the National Aerospace Laboratory, Communications Research Laboratory, and NASDA itself.

The various national laboratories have developed a variety of database systems for internal use, but there is no common system yet. The labs do send their reports to the National Diet Library (NDL). However, NDL does not have responsibility for disseminating those reports.

Gathering Japanese aerospace STI in the United States

Japanese aerospace STI has been difficult to obtain in the United States. In addition to the difficulties caused by scattering of such information even within Japan, Americans face four difficulties when attempting to gather Japanese STI.

Language

An obvious difficulty is language. Few U.S. researchers read Japanese and there is an extreme shortage of qualified technical translators from Japanese to English. As a result, translating articles is expensive and time-consuming.

Less obviously, the language barrier makes it more difficult even to identify useful Japanese materials. Because of translation costs, few databases cover Japanese materials in as timely or comprehensive fashion as they do materials in English or European languages. As a result, it is difficult even to identify which documents might be worth spending money on translating.

English language reporting of Japanese R&D is often helpful in pointing out important topics. However, often there is a loss of clarity, timeliness, and detail. Therefore, English language reporting is at best a partial substitute for access to the original Japanese language material.

The human network

Even more so than many countries, the flow of information through the "invisible college" of human contacts is a vital part of scientific communication in Japan. Because of language and cultural difficulties, few Americans are part of this network. Moreover, few Americans have spent sufficient time in Japan to make the necessary connections to take advantage of this information flow.

It should be noted however that this problem, while severe, is often overstated. Access to published material can provide much more complete information than is commonly realized.

Information Scatter

One effect of no national government organization having overall responsibility for aerospace STI is a scattering of aerospace STI. Further scattering is caused by the nature of scientific publishing and the database industry within Japan. Japan has few refereed journals compared to the U.S. and most Japanese researchers publish domestically in their university, society, or company publications. This makes it difficult to identify a core group of journals for aerospace related technologies.

This scatter extends into databases, of which Japan has many. There is no Japanese equivalent to Dialog or Orbit, offering access to a large number of databases across a range of subjects. Therefore, a researcher must identify databases individually, make subscription arrangements with each, and learn a specific search command language for each. While more databases are becoming available through international telecommunication networks, different arrangements may be necessary to connect to each database. In addition to the administrative costs involved, there may be minimum monthly fees for each database. In sum, access to a range of Japanese databases is much more time-consuming and costly than in the U.S.

Document acquisition

Once an relevant item has been identified, it may still be very difficult to obtain. Holdings of Japanese journals and reports in American libraries are sparse and few American librarians are familiar with alternative sources of Japanese documents. Until this is rectified, it will be difficult to obtain even fairly common publications.

NASA activities to address these problems

In order to understand NASA's activities to address these problems, it is useful to understand the context in which they take place. The Space Act of 1958 gave NASA two STI-related goals: "To provide for the widest appropriate dissemination of the results of NASA research and development" and "To preserve the role of the United States as a leader in aeronautical and space science technology by acquiring world-wide STI and disseminating it in the U.S."

One of the most important tools the NASA STI Program uses to achieve these goals is the *NASA Aerospace Database*. The *NASA Aerospace Database* is the world's most comprehensive bibliographic database of aerospace-related STI, containing over 2 million records from 1962 to the present. Over 70,000 records are added each year from NASA researchers, NASA contractors, other government agencies, published literature and

international partners. Because of the breadth of science and technology involved in NASA programs, the database covers not only obvious fields such as aircraft instrumentation and aerospace medicine, but also fields such as environmental pollution and solid-state physics. Documents cited in the database include technical reports, journal articles, conference proceedings and others. The database is available via NASA's RECON system, DIALOG Information Services, and in several printed versions.

The NASA STI Program gathers material from foreign institutions through several means. The most basic is a "bilateral agreement." Under a bilateral agreement between the NASA STI Program and a foreign STI-producing institution, the two institutions exchange copies of their technical documents. The NASA Center for AeroSpace Information (CAST) produces abstracts and bibliographic citations for the documents and adds them to the *NASA Aerospace Database*.

The NASA STI Program has bilateral agreements with 29 Japanese institutions, including government agencies, private companies, and universities. These agreements have been very productive, with over 58,000 Japanese documents included in the Database. Some of the organizations and journals from which input has been received are listed below.

Organizations		Journals	
<i>Universities</i>	Japan Atomic Energy Research Institute	Astronomical Society of Japan, Publications	Journal of the Japan Society For Aeronautical And Space Sciences
Chiba University	National Aerospace Laboratory	Astronomical Society of The Pacific Publications	Journal of the Japan Society of Materials Science
Hiroshima University	National Space Development Agency	Communications Research Laboratory Review	Journal of the Meteorological Society of Japan
Kyoto University	New Energy Development Organization	Communications Research Laboratory Review	Journal of the Physical Society of Japan
Nagoya University		Ishikawajima-Harima Engineering Review	JSME International Journal,
Osaka University		Japanese Journal of Applied Physics	Proceedings of the Research Institute of Atmospherics, Nagoya University
Tohoku University		Journal of the Japan Institute of Light Metals	Transactions of the IEICE
Tokyo Institute Of Technology	<i>Industry</i>	Journal of the Japan Institute of Metals	
Tokyo University (Institute of Space and Astronautical Science)	Fuji Heavy Industries Ltd.		
	Fujitsu Ltd.		
	Ishikawajima-Harima Heavy Industries		
<i>Government</i>	Mitsubishi Electric Corporation		
Communications Research Laboratory	Nippon Electric Co. Ltd.		
	Nissan Motor Co. Ltd.		

In recent years, Japanese input to the database has increased, reaching over 4,000 items in 1992. Because of this, it became necessary to find a more efficient way to gather and process material from Japanese organizations.

Therefore, in November 1992, a National Level Technical Exchange Protocol or a "National Level Agreement" between NASA and the National Space Development Agency of Japan, NASDA, was finalized and signed, introducing a new level of international STI cooperation. The agreement, modeled on other NASA National Level Agreements, is the culmination of two years of negotiation and consensus building by STI professionals in both agencies and is designed to be mutually beneficial to the aerospace communities of both countries.

When a country has a large number of organizations with bilateral agreements with the NASA STI Program, it is often most efficient to establish one organization in the other country as a focal point for STI exchange activities between the two countries. To establish such an arrangement, NASA reaches an agreement with a governmental organization with aerospace responsibility within a given country.

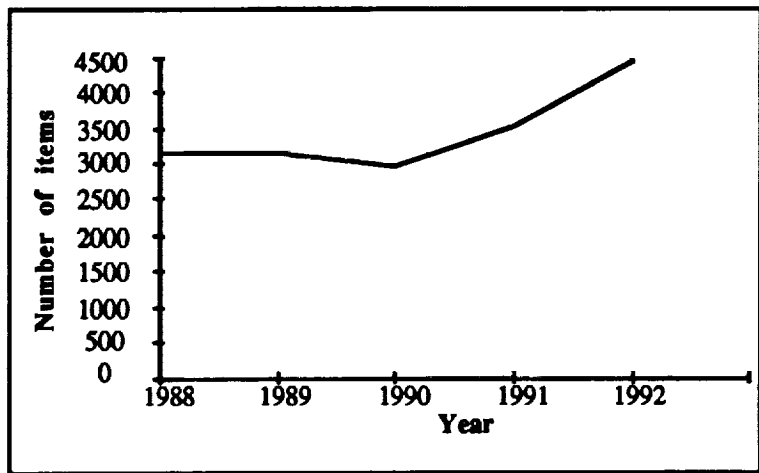
The recently signed agreement with NASDA calls for a two-phased approach to full exchange status. During the first stage of the agreement, NASA will exchange its technical reports and bibliographic literature for similar material from initial participating organizations in Japan, coordinated by NASDA. As a national partner, NASDA will seek to establish cooperative relationships with Japanese organizations which can contribute to an equitable exchange of STI. Aerospace-related STI will be collected and bibliographic records and abstracts will be prepared in English by NASDA and then forwarded in electronic form to become part of the NASA Aerospace Database.

Test-batches of such material have been received periodically since 1989 and entered into the STI Database. Center for AeroSpace Information (CASI) staff have analyzed this material and provided feedback to NASDA. These efforts should help to speed the transition to the second phase of the agreement. In the second stage of the agreement, NASDA and other participating organizations will gain electronic access to the *NASA Aerospace Database*.

A key step in establishing this arrangement was taken in June of 1993 when NASA received guests from NASDA to discuss the most recent draft of the protocol. The parties made significant progress during their talks, witnessed by the completion of the arrangement by the end of the year.

A two-day workshop at CASI provided the Japanese visitors with an overview and tour of processing

facilities and allowed for detailed discussion of cataloging, abstracting, and indexing of documents for input into the NASA Aerospace Database. Sessions between NASDA and CASI catalogers were particularly productive, helping to clarify many points of confusion, including those arising from linguistic and cultural differences. For instance, the participants discussed the differences between U.S. and Japanese corporate structures and how this affects cataloging practices for the NASA Aerospace Database. Both sides learned a great deal from direct discussion and exchange of professional expertise.



Equally important, however, were the personal contacts which were made and will assist in the smooth functioning of the agreement.

The new agreement will help overcome each of the challenges discussed above:

Language - NASDA will provide English-language citations, including abstracts, of each document added to the database. While it will still be necessary to translate some original documents, it will be much easier to identify articles worth translating.

Human network - Although it is primarily an engineering, rather than research, organizations, NASDA is an important part of the Japanese aerospace research community. Therefore, it already possesses the important connections necessary to involve organizations effectively in the information exchange. For example, it has working arrangements with important laboratories such as Communications Research Laboratory and the Aeronautical Research Laboratory. Hopefully, the new agreement will encourage American researchers to begin building their own networks by making them more aware of their Japanese peers' research.

Information scatter - The agreement can do nothing to reduce the scatter of research results in Japan. However, NASDA has the expertise to identify and gather key documents from throughout Japanese government agencies, universities, and private companies. Of course, all of these will be brought together in the *NASA Aerospace Database* greatly reducing information scatter for American researchers. Another consolidated source for information on Japanese research is the annual publication, *Japanese Aerospace Science and Technology* (NASA Special Publication 7099).

Document acquisition - By virtue of being in Japan, NASDA is more able to gather Japanese documents in a timely and cost-effective fashion. Additionally, it has the important institutional connections necessary to acquire documents not normally distributed to the general public.

The NASA STI International Program looks forward to future cooperation for the benefit not only of the U.S. and Japan, but the entire aerospace community, both international and domestic.

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