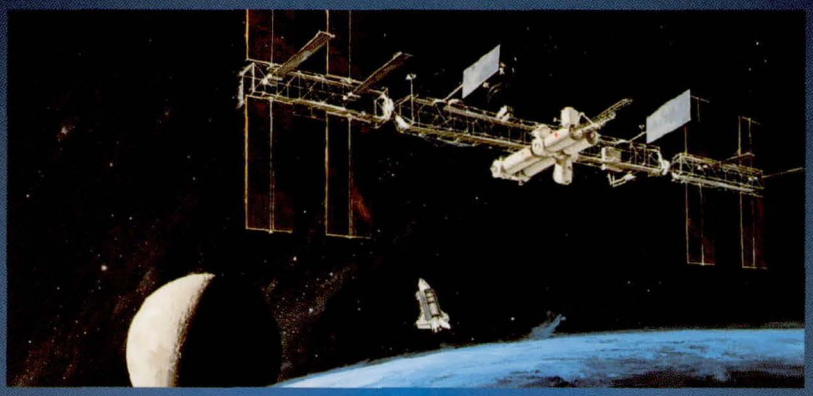
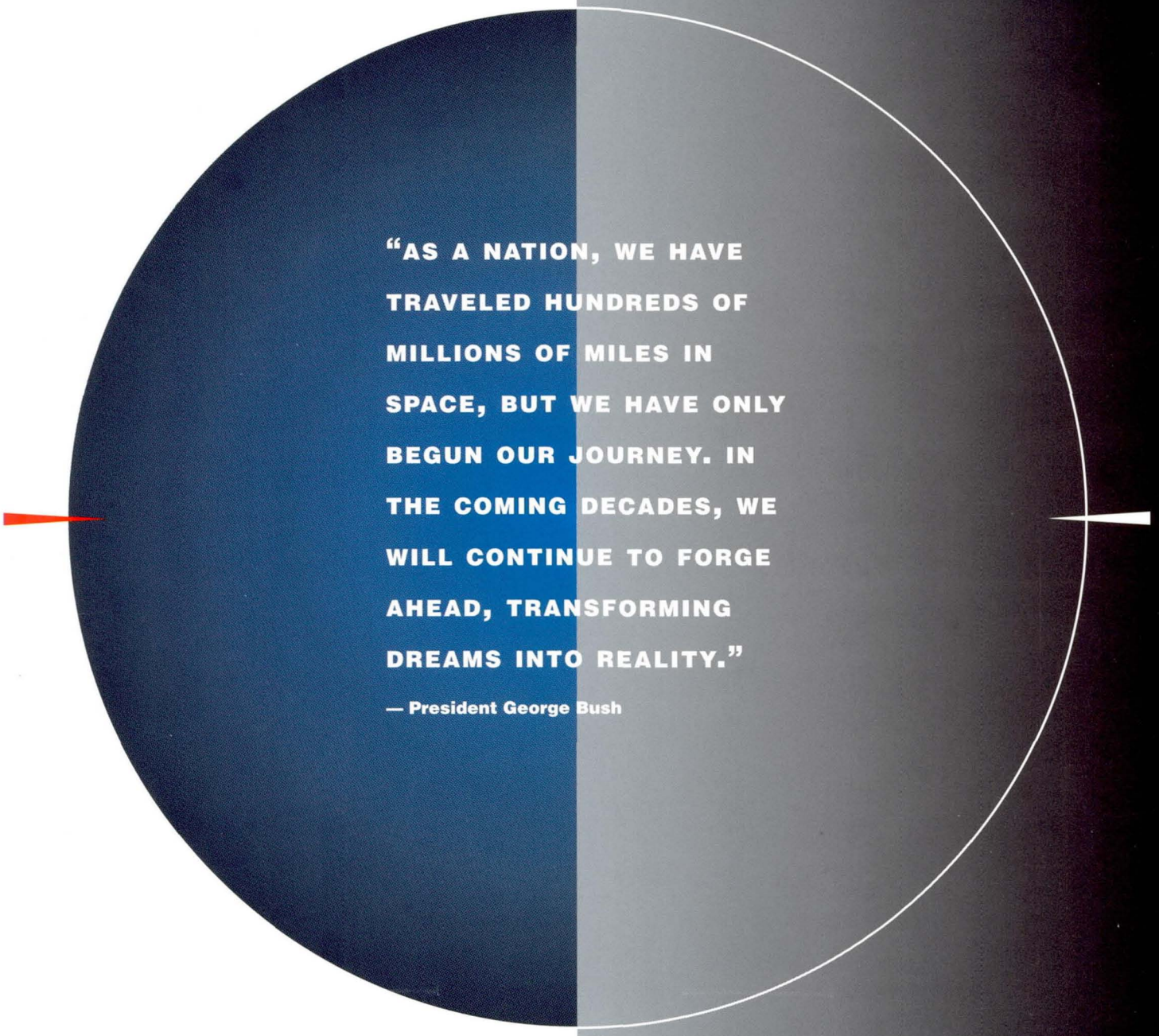
The NASA Scientific and Technical Information Program



Prologue to the Future



"AS A NATION, WE HAVE TRAVELED HUNDREDS OF MILLIONS OF MILES IN SPACE, BUT WE HAVE ONLY BEGUN OUR JOURNEY. IN THE COMING DECADES, WE WILL CONTINUE TO FORGE AHEAD, TRANSFORMING DREAMS INTO REALITY."

— President George Bush

On the Cover

As NASA journeys into a future highlighted by two missions — the Mission from Planet Earth (here represented by Space Station Freedom, top) and the Mission to Planet Earth (here represented by an Earth Observing Satellite, bottom) — the NASA STI Program will be supporting NASA researchers every spectacular step along the way.

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Gladys A. Cotter
Director, NASA STI Program

The value of a strong Federal scientific and technical information (STI) initiative is well-known. It is documented, for example, in the 1990 seminal report of the Office of Technology Assessment entitled *Helping America Compete: The Role of Federal Scientific & Technical Information.*

As an important component of that initiative, NASA's STI plays a vital role in aeronautical and space science research and development (R&D) in the United States — and the world. The STI Program is the mechanism through which NASA institutionalizes its scientific and technical information ... and supports the information development process.

This review of the NASA STI Program will give you a better understanding of what the Program does — by giving you an "inside look" at our operations.

As the first review of the STI Program, historical background is appropriate. We'll start with the prelude to our Program in the National Advisory Committee for Aeronautics (NACA), and move through our Program's expansion following NASA's birth in 1958. After detailing more recent changes, we'll examine the STI Program today and look at our growing list of products and services.

Then we'll take you on a tour of NASA STI Program operations around the United States ... and the world.

Finally, we'll assess this Program's future and the exciting opportunities it offers our users.

As you'll see, the fundamental need for NASA's STI Program hasn't changed since the Program's founding. What has changed — and what continues to change at an almost blinding pace — are the dimensions of that need.

At NASA, we are striving to keep pace with the information explosion, mindful of how it will affect the work of NASA scientists and engineers on such projects as the Mission from Planet Earth, and the Mission to Planet Earth — which is already under way.

We at the NASA STI Program are proud to be part of the team contributing to the success of such vital missions — some of which are pictured throughout this publication — as well as the seemingly limitless range of scientific and technical work carried on outside NASA.

We'll continue supporting these efforts by strengthening our ties to information sources and end users. This is only logical, particularly in the international arena.

These are the 1990s, and the Cold War is over. Many barriers that kept nations apart have fallen or, at least, are eroding. It's in our national interest to capitalize on these dramatic new opportunities for a mutually beneficial exchange of scientific and technical information.

In the months and years ahead, we'll enlarge on these gains by seeking out new partnerships in science and engineering — both foreign and domestic — and by building our user base.

Guidance in achieving these and other goals will come from the recently established STI Council. All of us at the STI Program welcome and value the Council's input. The Council's unique perspective and insights will bring new energy and effectiveness to the Program.

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Similarly, input from our users through our new User Services and Outreach Program will produce significant benefits ... and make us better able to identify and meet user needs.

But no matter how successful the NASA STI Program becomes, the motivating force behind what we do will always be the same — to help researchers gain quick access to the scientific and technical information they need in their day-to-day work. Whether researchers use this information to eliminate a redundant project, as background when starting a new project, or to answer questions about research in progress — the NASA STI Program is there to assist users in any way we can.

You'll see examples of that in the pages that follow, along with ways we can provide an even broader range of services for our users in the years ahead.

Finally, we are fortunate to have a highly skilled and dedicated work force nationwide. They are both the backbone and lifeblood of the NASA STI Program. They are the principal reason why I'm more certain than ever of the success of this Program — and those we serve. ●

For more information about the Program, contact:

NASA STI Program
NASA Headquarters
Code JTT
Washington, D.C. 20546
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Fax: (703) 271-5665

The NASA STI Program offers researchers an infrastructure of people and systems that facilitates access to STI — worldwide. The Program is also NASA's institutional mechanism for disseminating the results of its research and development activities.

For the NASA STI Program, 1991 was a year of notable achievements and new beginnings. One of those beginnings is this publication, the first Overview of the NASA STI Program. It tells the Program's story and offers facts and figures that can serve as benchmarks for future progress.

STI Council Gives Users a Voice

The newly established STI Council, made up of senior program- and support-office representatives, offers the STI Program a high-level forum for discussing Program requirements and initiatives. Currently, the Program is working several very important issues identified by the Council.

Plan for the Future Formalized

Through discussions in 1991 among NASA Headquarters, NASA Centers, other Federal agencies and international exchange partners, the STI Program formulated its Strategic Plan. The plan gives the Program a renewed sense of direction by focusing on future opportunities, customer requirements and Program goals — along with the changes needed to achieve those goals.

The Need Is Clear

The value of a strong Federal STI Program is well-known. See, for example, the seminal 1990 report of the Office of Technology Assessment entitled *Helping America Compete: The Role of Federal Scientific & Technical Information*. As an important component of that program, NASA has much to contribute to reach its own goals and to help many of our nation's businesses and political partners reach theirs.

The appropriate position of the Program was verified by an ad hoc Review Committee of Headquarters and Field Installation executives, which was chaired by NASA's Deputy Associate Administrator for the Office of Aeronautics and Space Technology (OAST). Their finding — solid value, on the right track. It has been more than a decade since the NASA-wide component parts of the Program were as well-aligned with NASA's mission needs. The Program remains dedicated to continue meeting those needs.

At NASA, the need is clear. As NASA researcher and astronaut Dr. James Bagian says, "To understand where you're going, you have to understand what's already been done. It's the only sensible, efficient way to proceed. That means I need rapid access to the literature, and that's what the Medical Sciences library here gives me."

Of course, the multifaceted NASA STI Program encompasses literature searches — and much more. The value of its varied offerings is attested to by the scope of its users.

Registered users include NASA staff and contractors, other government agencies and their contractors, universities in the U.S. and around the world, and international partners. The Program also offers a number of products and services to the public in the U.S. and abroad.

Currently, the Program has 4,200 registered users, including RECON users requiring more than 75,000 searches annually. This number does not include searches of the publicly available database carried out for the general population.

The Program provides users access to a massive flow of STI which, in fact, represents the largest collection of aeronautical and space science information in the world. In June 1990, with the accession of *Earth System Science: A Program for Global Change*, the Program's database citations crossed the three million level.

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STI Program Products and Services

The lineup of NASA STI Program products and services offered to these users in 1991 was designed to meet a broad range of needs.

Products include announcement publications, current awareness products, STI handbooks and tools, NASA technical report series, continuing and special bibliographies, and special publications.

STI Program services include reference and literature services, training, translations, online assistance, microfiche and hardcopy document supply services, document distribution subscription services, and current awareness services.

NASA Centers

Activities at our Centers are dynamic and diverse. Not surprisingly, each Center's STI Program accomplishments are closely tied to its role within the larger NASA family.

In 1991, many Centers responded to a record number of requests for products and services, streamlined and upgraded their operations, and found new ways to do more — with less — *without* sacrificing quality.

Among the year's highlights was the NASA STI Conference and Workshops '91, held at Marshall Space Flight Center and attended by representatives from NASA Headquarters, the Centers, and numerous contractors. NASA Deputy Administrator J.R. Thompson was among the Conference speakers who offered attendees new insights and motivation.

International Operations

Through the European Space Agency (ESA), NASA has an umbrella relationship with the major Western European countries that dates back more than 25 years. In 1991, activities with countries and organizations with which we have bilateral or ESA tripartite agreements was vigorous.

Further, we have stepped up our efforts at the nation-to-nation level. To date, we have national level agreements with Canada, Israel and Australia. Negotiations are continuing with Japan, and fruitful, early discussions have begun with Hungary. We are carefully monitoring developments in the republics of the former Soviet Union. We will explore new opportunities with these sources as evolving social, political, and economic conditions allow.

TQM Drives NASA-Wide Program Developments

At the STI Program, the revolutionary management tool of Total Quality Management (TQM) is the force that unifies and powers our efforts to improve the STI Program NASA-wide.

A long-range process with many interim successes, TQM operated on numerous fronts in 1991. For instance, the Program is applying TQM principles to improve our communications with current users at NASA Centers, and to develop new users at our Centers and elsewhere. Upgraded or, in some cases, new approaches to Marketing, Outreach and Program Office support are strengthening these efforts.

Our Operations area is developing better ways to shorten our response time for filling orders, as well as innovative approaches to ensure our products and services are timely and of unwavering quality. Several current projects address these needs.

Framework Set for Future Gains

As the following pages detail, the NASA STI Program is using its resources as effectively as possible to meet the mission needs of NASA. Proactive policies overseen by the STI Council are now in place, and the Program remains poised to exploit new opportunities in support of NASA mission programs as they arise. ●

What on Earth Is the NASA STI Program?

Strictly speaking, of course, the NASA STI Program is *on* earth. Its activities are centered in Washington, D.C. — and reach around the globe.

But the STI Program is *about* much more than earth. The Program, in fact, extends light-years beyond our planet ... to encompass a universe of information on aeronautics and space science.

The NASA STI Program offers researchers an infrastructure of people and systems that facilitates access to scientific and technical information — STI — worldwide. The Program is also NASA's institutional mechanism for disseminating the results of its research and development activities.

The progress of the NASA STI Program has been marked by milestones. Following is a brief history of those events.

History...

History teaches us why it's so important to pause and look backward. Not just to satisfy our feeling of nostalgia, but because the past can tell us a great deal about what we can become.

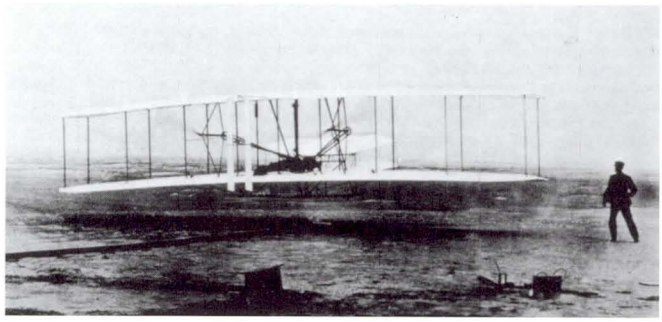
And so it is with NASA and the STI Program. Perhaps the most important lesson of this history: In aeronautics and space science, every major achievement has been built on those before it.

The windswept beaches of North Carolina's Outer Banks are a convenient starting point for this history. That lonely location was the setting for the Wright brothers' investigation of man's ability to fly.

The Wright brothers' initial flight at Kitty Hawk spanned only 120 feet, lasted 12 seconds and reached a height of 10 feet at the speed of 35 mph. Nevertheless, the brothers' brief but bold venture transformed America's fascination with flight from fantasy into fact. And with it, the possibility of America's journey toward the stars also took flight.

The NACA: Its Roots and Realization

Despite the success of the Wright brothers, the European view of aviation as a technological phenomenon differed somewhat from America's. European governments and industry tended to be more supportive of "applied research."



On December 17, 1903, the Wright brothers made the first powered, controlled flight in an airplane.

The outbreak of war in Europe in 1914 became America's transforming event. With it, we quickly realized the need for a national agency to coordinate our progress in aviation.

The Congress ratified this sentiment on March 3, 1915, when it passed the Naval Appropriation Bill (P.L. 63-271), with a rider establishing an independent Advisory Committee for Aeronautics. The prefix "National" was adopted soon thereafter, and thus was born the National Advisory Committee for Aeronautics or the NACA, NASA's parent organization.

The committee was charged "to supervise and direct the scientific study of the problems of flight, with a view to their practical solution."

Not surprisingly, in a wartime environment the NACA was busy from the outset. Its first published technical report was written in 1915, in the earliest stages of government-sponsored R&D in aeronautics.

Early on, the NACA identified the need for proper procedures in gathering, analyzing and disseminating scientific and technical information. (Many of these guidelines are still followed today.) For instance, NACA policy mandated thorough reviews and approvals prior to the release of any reports describing R&D results.

Limited Bibliographic Tools Available

Researchers of that era didn't have access to the broad range of bibliographic tools available to today's NASA researchers. The starting point for NACA bibliographic resources was a Smithsonian Institution publication, *Bibliography of Aeronautics*, published in 1910. This

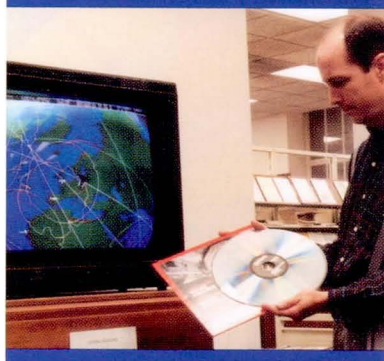
What is STI?

That's a simple question... without a simple answer.

Scientific and technical information — STI — is basic and applied research results from the work of scientists and engineers. It includes new theory and information in the form of text, numeric data, or images obtained from experiments, observations, instruments or computers.

To enhance its usefulness, STI may be further transformed, described, evaluated and/or synthesized and recorded in a variety of media, including print, digital and magnetic.

For more than 30 years at NASA, STI has meant the documented results of NASA R&D activities from every area of NASA's comprehensive mission — plus related information from international sources.



Videodiscs store enormous amounts of audio and visual information for NASA researchers. Each side of a videodisc can provide random access to up to 54,000 individual video frames.

formidable volume of nearly 1,000 pages listed some 14,000 works of aeronautical interest.

Several years later, the NACA commissioned the work's author, Paul Brockett, to enlarge and update his earlier effort. Published in 1921, *Bibliography of Aeronautics, 1909-1916*, was nearly 1,500 pages and offered some 30,000 citations.

The early library system went to elaborate lengths to acquire documents listed in these citations. When needed, NACA library professionals acquired materials from sources at all points on the globe.

From 1921 through 1936, the NACA issued fourteen *Bibliographies of Aeronautics*, covering the years 1909 to 1932. Essentially a dictionary catalog, each edition contained main entries, subject entries, cross references, corporate sources, names and designations of aircraft and airships, as well as the initials of unknown authors.

Civil and Military Aviation Progresses

Progress in offering NACA engineers diverse bibliographic resources was mirrored by progress in civil and military aviation, and aeronautical research. The design characteristics of the 1920s — fabric covered biplanes with radial engines — gave way to truly sophisticated airplanes in the 1930s, with streamlined shapes, metal construction, retractable landing gear, and high performance.

Captain Charles "Chuck" Yeager piloted the X-1 into aeronautical history on October 14, 1947, when he took the world's first supersonic flight.

And though the national economy sagged during the Great Depression of the 1930s, the aviation industry reached unprecedented levels of excellence. In so doing, it played a key role in the aeronautical revolution taking shape.

From 1936 to 1941, the Works Progress Administration offered NACA researchers a new resource with an old title, *Bibliography of Aeronautics*. This 50-volume series dealt with specific subjects rather than taking the comprehensive, chronological approach of the earlier *Bibliography of Aeronautics*.

To many NACA engineers, this period seemed the most remarkable to date. Streamlined aircraft were commonplace. But once again, it was war — this time, World War II — that spurred innovation. Scientists and engineers developed an impressive line-up of modern combat planes. Perhaps even more significant, in retrospect, was the emergence of rocketry in warfare ... since it would help pave the way for American space travel.

The years during and immediately following WWII witnessed such other technological breakthroughs as radar, antibiotics, radio, telemetry, the computer and the jet engine.

As for progress in scientific and technical research, the NACA published its first bibliography to contain abstracts in June 1951 — the *National Advisory Committee for Aeronautics Research Abstracts and Reclassification Notice*. (The abstracts are similar to what appears in today's *Scientific and Technical Aerospace Reports, STAR, and International Aerospace Abstracts, IAA*).

During this period, the established NACA technical information processing system — designed for internal NACA use only — evolved into:

- A card catalogue collection of 1,800,000 cards
- Two index-announcement publications: *Technical Publications Announcements, Index to NACA Technical Publications*, and an accession list.
- A collection of NACA and other technical reports.

The fruits of the R&D facilitated by these and other STI collections made it possible for America of the 1950s to enjoy its rightful share of credit and profits from the technological boom. That all changed — abruptly — on October 4, 1957, when Sputnik I made its historic journey. America's deeply held belief in its global technological supremacy would be severely jolted.

There was no doubt — America now needed a competitive, national space program. The program's military component fell under the Department of Defense. But the civilian side required a new agency.

The Birth of NASA

On October 1, 1958, the new agency was born. In June, President Eisenhower had signed into law P.L. 85-568, the National Aeronautics and Space Act of 1958.

Under the Act, two of the new agency's key functions were:

1. To provide for the widest appropriate dissemination of the results of NASA research and development.

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2. To preserve America's role as a leader in aeronautics and space science by acquiring worldwide scientific and technical information and disseminating it in the United States.

As noted, the NACA had acquired and disseminated STI for decades. Now these same activities would be greatly enlarged. Their chief purpose: to promote the highest R&D quality and productivity, and to minimize R&D duplication.

In May 1960, NASA took the first large step to create a comprehensive scientific and technical information program by establishing an "Office of Technical Information and Education Programs." Melvin S. Day, the Director of Technical Information at the former Atomic Energy Commission, was hired as Deputy Director of that office.

The need for an STI Program was obvious, as later stated in NASA Management Instruction (NMI) 2220.5: "Scientific and technical information is an intrinsic element of every NASA scientific and technical endeavor and as such is subject to supervision and control through program management."

Under NMI 2220.5, Program objectives are to:

- Formulate STI policy and procedures (control dissemination and approve deviations).
- Provide for the functional management of STI activities.
- Ensure NASA publications meet the highest standards of quality.

ORIGINAL PAGE
COLOR PHOTOGRAPH

When NASA entered the new field of space science, it continued to investigate aeronautics. The X-15 helped bridge the gap. With its ability to fly 6.7 times the speed of sound at altitudes of more than 350,000 feet, the X-15 contributed greatly to the development of many aeronautical and space flight systems.

- Operate consolidated STI facilities for the Program's agency-wide, government-wide, national and international interests.
- Ensure the compatibility of all STI systems.
- Develop new services and systems.

One way for NASA's new STI Program to ensure better program management was to establish a strong, central information resource. And so, in 1961, the agency opened the Scientific and Technical Information Facility, located in the Washington, D.C. area. The Facility would become the chief repository of Program information. In 1962, Mr. Day was named Director of the newly organized Office of Scientific and Technical Information.

Two Important Developments

During this same period, the STI Program initiated two important relationships.

The first of these began in 1963, when NASA established a contract with the American Institute of Aeronautics and Astronautics (AIAA). We asked AIAA to process international aerospace journal literature into our NASA database using the NASA standard terminology.

AIAA had close ties with aerospace corporations as well as similar societies in other countries, which were very beneficial in acquiring information. The AIAA staff for this contract had foreign language and technical backgrounds that proved vital to our work.

The second important new relationship began in 1964 with the European Space Research Organization (ESRO), today known as the European Space Agency (ESA). The NACA and NASA had already participated in document exchange programs with hundreds of laboratories, universities, and other institutions in more than 40 countries. But the ESRO arrangement proved to be a major, new opportunity.

In exchange for selected bibliographic data tapes and computer programs, ESRO agreed to send us tapes and aerospace reports from European sources — all in a form suitable for direct entry into the NASA database.

STI Program Goes High-Tech

As the 1960s unfolded, and the U.S. and the Soviet Union competed for the public's attention in the race to conquer space, a much less-publicized frontier was being blazed in the STI Program.

While an awed public watched our missiles and spacecraft with such names as Saturn, Titan and Gemini blast off, the STI Program witnessed an explosion of its own — an information explosion of space-age data.

The computer and related technologies would soon come to prominence by invading — and transforming — a world traditionally devoted to paper and printer's ink.

Representative Citation and Abstract Available on NASA /RECON

On Microfiche

NASA Sponsored

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Publication Date

***STAR* Numbers**

No. of Pages

Report Numbers

Title UTTL: Computational structural mechanics: A new activity at the NASA Langley Research Center
AUTH: A/KNIGHT, N. F., JR.; B/STROUD, W.J.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL:NTIS

Price Code SAP: HC A03/MF A01

Country of Origin COI: UNITED STATES Presented at 22nd Ann. Tech. meeting of the Soc. of Eng. Sci., University Park, Pa., 7-9 Oct. 1985

Major Terms MAJS: /*AIRCRAFT STRUCTURES/*COMPUTER AIDED DESIGN/*COMPOSITE STRUCTURES/*SPACE STATIONS/*STRUCTURAL ANALYSIS

Minor Terms MINS: /AIRCRAFT DESIGN/NUMERICAL ANALYSIS/PARALLEL PROCESSING (COMPUTERS)

ABA: E.A.K.

ABS: Complex structures considered for the late 1980's and early 1990's include composite primary aircraft structures and the space station. These structures are much more difficult to analyze than today's structures and necessitate a major upgrade in computerized structural analysis technology. A major research activity in computational structural mechanics (CSM) was initiated to develop advanced structural analysis technology. This technology will exploit modern and emerging computer capabilities such as vendor and/or parallel processing. The three main research activities underway in CSM include: (1) structural analysis methods development; (2) a software testbed for evaluating the methods; and (3) numerical techniques for parallel processing computers. The motivation and objectives of the CSM activity are presented and CSM activity is described. The current CSM research thrusts, and near and long term CSM research thrusts are outlined.

RECON citations include a wide variety of bibliographic information.

The basic concept behind this revolution was the same one that had always driven the STI Program: Offer a convenient tool to NASA scientists and engineers that makes it possible to quickly identify information on a given research topic.

The computer would soon make that information search faster and more comprehensive than anyone dared to imagine.

Research and development begun in 1963 and funded by Lockheed Missiles and Space Company helped pave the way. Their Information Sciences Laboratory conducted the research. The aim? An interactive information retrieval system that combined direct user interaction with large direct-access storage, and used coordinated index search techniques.

In 1968, NASA awarded a major contract to what is now DIALOG Information Services to design a computerized document collection for our STI Program. This system would be named RECON (REsearch CONnection), and RECON would become the Program's large-scale, online information retrieval system.

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NASA tested online retrieval at 23 workstations located at six different installations. In 1969, online retrieval became available throughout NASA.

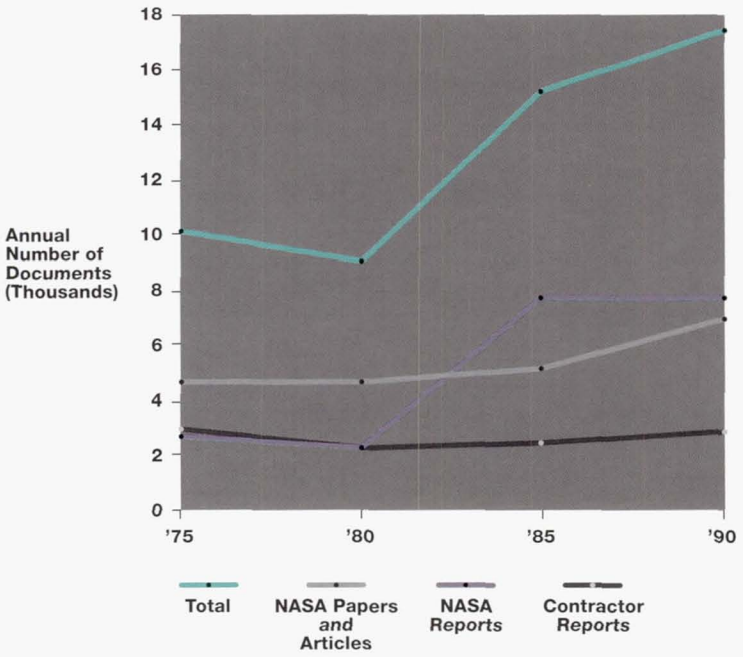
Meanwhile, the STI Program continued building its computerized aerospace database in the Scientific and Technical Information Facility. The database was a prerequisite for a system based on the electronic searching and retrieval of bibliographic information. The automated production of abstract journals was a related landmark development.

Yet another format for capturing data had also been added — microfiche, to be integrated with the storage and distribution of paper documents.

No brief history of the NASA STI Program is complete without mentioning the vital cooperation among NASA and other U.S. government agencies. To share resources, avoid duplication of effort and improve our effectiveness, the Program has established arrangements with numerous federal agencies, including the U.S. Departments of Defense, Energy, Commerce, and Health and Human Services.

These mutually beneficial relationships continue today and will be discussed in more depth in our examination of domestic operations.

NASA Originated and Sponsored Documents



Source: NASA STI Program

These figures include meeting papers and journal articles published through the private sector, as well as chapters and papers printed in books and conference proceedings (individually indexed and recorded in the NASA database).

A New Issue: Intellectual Property

In recent years, U.S. government policies have changed to encourage, if not actually require, more intellectual property rights protection of federally funded R&D activities.

These changes affect the production of scientific and technical information at NASA and numerous other federal agencies. The three main forms of intellectual property rights protection for this information are patent rights, copyrights and trade secrets.

The unifying reason for this shift: ensuring U.S. competitiveness in the international arena.

NASA has adjusted to changes in the law and federal government policies governing intellectual property rights and the transfer and commercial use of federally funded technology. These adjustments, however, have not and will not alter NASA's fulfillment of its statutory obligation to provide for the widest practical and appropriate dissemination of the results of NASA research and development.

An Ongoing Mechanism for R&D Dissemination

Efforts begun decades ago to formalize the distribution of NASA R&D through the STI Program remain more vigorous and vital than ever. The current bimodal distribution of NASA researchers, which began with the end of the Apollo missions, further strengthens the need for the Program. Now, invaluable institutional knowledge gained in past years is preserved and easily accessed through the NASA STI Program for the benefit of present — and future — NASA researchers. ●

Current Operations...

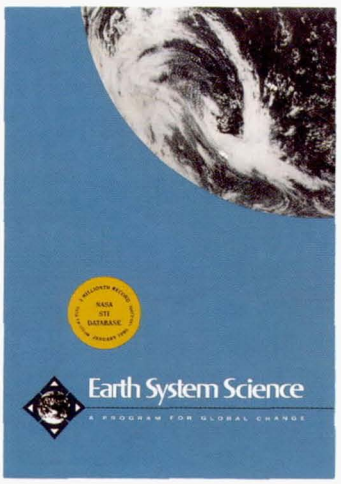
To NASA, it is difficult to exaggerate the importance of the groundbreaking ideas driving its R&D. With approximately 90 percent of its funds directed toward contract research and engineering, the agency's commitment to R&D is enormous.

But while *ideas* provide the spark, *information* sustains the fire. And much of that information comes from the NASA STI Program.

The NASA STI Program provides access to a massive flow of scientific and technical information which, in fact, represents **the largest collection of aeronautical and space science information in the world.**

The Program's main information resource is its powerful database containing *more than three million* citations to journal, report and related aerospace literature from around the world. Most cover NACA and NASA R&D activities from 1915 through the present. Topics in this unparalleled resource are as comprehensive as the agency's mission, including all aspects of engineering, chemistry, physics and mathematics.

This database is housed in the Center for AeroSpace Information (CASI), formerly known as the NASA Scientific and Technical Information Facility. To reflect the facility's new role as envisioned by the STI Council, the Council oversaw this name change in the spring of 1991.



In June 1990, with the acquisition of *Earth System Science: A Program for Global Change*, the Program's database citations crossed the three million level.

Records come to CASI from a variety of sources in more than 70 countries. Most of the documents represented in the database are in English — or they can be translated into English, on request.

Input Processing

New STI arrives — as either paper, microfiche or computer tape — from a variety of sources, including NASA Headquarters, Centers and contractors, universities, other government agencies, foreign sources, the aerospace industry, and the public.

We also scan over 1,500 open literature sources (journals, published conference proceedings, etc.) monthly for articles of interest to the aerospace community. And we acquire new documents from additional worldwide sources through an active acquisitions program.

When documents and electronic records arrive, they are checked to make sure that they are not already in the database and that they are relevant to NASA's research and development interests. Each document is assigned to a subject category and any distribution limitations are noted.

Next the bibliographic details of each document are entered through cataloging procedures. These details include such data as authors, title, report numbers, pages, and journal citation.

The next step is called abstracting and indexing. An abstractor either writes an abstract or reviews and edits, if necessary, the abstract already provided. (Use of author-provided abstracts is subject to copyright limitations.) An indexer then assigns each document a set of indexing terms that describe the subject content of the document. This step is supported by Machine-Aided Indexing (MAI).

The last step in the process is quality control (QC). Although quality is checked at each step along the way, this final check is designed to catch any remaining errors.

At CASI, incoming NASA-supported reports go through one final step — they are filmed to produce microfiche copies, according to NASA micrographic standards. These are distributed to NASA Centers and provided to other organizations and registered CASI users.

Getting the Documents Out

The NASA STI database at CASI is available through RECON, the online, time-shared system mentioned earlier. Users have access to RECON from computer terminals at locations nationwide, including NASA Headquarters, each NASA Center, numerous corporations in the aerospace industry and leading universities.

Using one of these terminals, a researcher can query the computer by date, subject, author, contract number, etc., to find specific citations or bibliographies for a whole field. Only a brief introduction to the system is required. The inexperienced user can neither disrupt the system nor interfere with users on other terminals.

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For most citations in the computer, a printed abstract is published in one of two semimonthly NASA journals already cited: *STAR* and *IAA*.

STAR covers worldwide report literature on aeronautics and space science, and *IAA* provides similar coverage of scientific and trade journals, books, and papers presented at conferences. Using the computer to search and locate, and the published abstracts to evaluate the potential usefulness of a document, a researcher can select items to examine in full.

To order full-text documents, many users go through their library and simply request them. CASI can receive orders online via RECON, but also by telephone, by mail and by fax. Orders are sent out for delivery by regular mail, express mail, or fax.

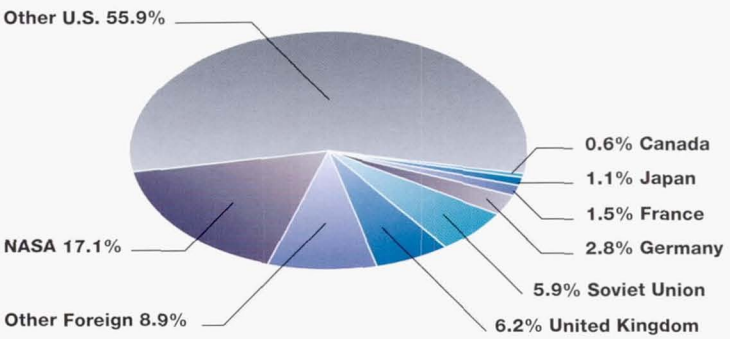
Nearly 20 percent of the material online is of foreign origin. Unclassified, unlimited technical reports are available to the general public through the National Technical Information Service (NTIS), and the Aerospace Database — available online through the DIALOG Information Service.

Some universities, other government agencies, government contractors and the Government Printing Office also distribute STI Program information.

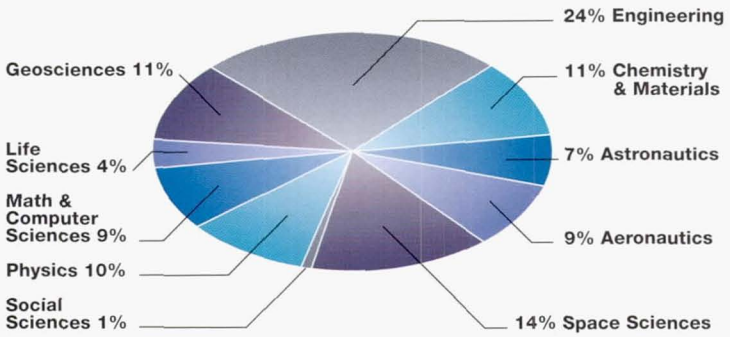
Sources and Subjects of NASA STI Database Additions

Based on Calendar Year 1990 Accessions

Sources



Subjects



Sources and subjects of NASA's STI database in 1990 were directly related to NASA's research and development mission. The heavy representation of foreign STI was a result of steady growth in foreign acquisitions over the past few years.

European requesters may access portions of the database through the ESA Information Retrieval Service.

The Key to The Program's Success Today

Against this backdrop, the key to the NASA STI Program's success is tied to people and technology.

Which is more important? President George Bush said it best: "Technology may be the key to the future, but people are the key to technology."

Stated simply, the STI Program provides a vast infrastructure of information professionals who are skilled in using traditional and advanced technologies to meet user needs.

Systems analysts and programmers ... specialists in communications, technical information and language ... librarians ... editors ... their skills are as diverse as the services they offer.

These services include: systems design, information processing, database management, information storage and retrieval and library support — to name just a few.

The STI Program's registered users include NASA management and contractors, other government agencies and their contractors, universities in the U.S. and around the world, and international partners. The Program also offers a number of products and services to the general public in the U.S. and abroad.

Currently, the Program has 4,200 registered users, including 789 key RECON users requiring more than 75,000 searches annually. This number does not include searches performed for the general public.

A Mutually Enriching Information Cycle

The NASA STI Program provides a two-way exchange of information with a large audience. Here's a look at every stage of this cycle, from input (raw information) to output (new STI).

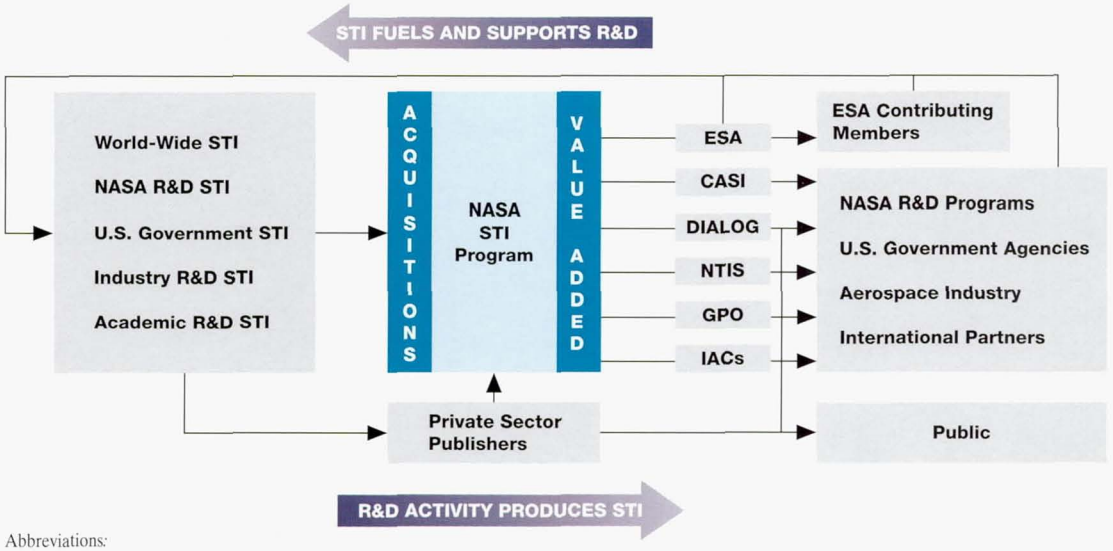
As you can see, the STI Program is vital to R&D — and R&D is vital to STI. They're both part of the same life cycle of information. The chart demonstrates why the Program involves not only knowledge production, but knowledge transfer: STI fuels R&D, and R&D produces new STI.

STI flows into the Program from a variety of sources: NASA R&D Centers, numerous U.S. government agencies, industry, academia, and governments and their affiliates from around the world.

The Program then adds value to the STI by preparing then disseminating it via a broad range of products and services (many are explained in the next section of this report).

Users realize that value through the quantity and quality of available information and the time and money they save when they participate in the Program.

Flow of Scientific and Technical Data



Abbreviations:
NTIS: National Technical Information Services
GPO: Government Printing Office
IACs: Industrial Application Centers
ESA: European Space Agency
CASI: Center for AeroSpace Information

Other disseminators of NASA STI include the European Space Agency (ESA), DIALOG (a publicly available information service), the National Technical Information Service (the U.S. Department of Commerce), the Government Printing Office, and numerous Industrial Application Centers (IACS), re-configured in 1992 into Regional Technology Transfer centers, and managed by the NASA Technology Utilization Program.

Research professionals in NASA R&D programs, U.S. government agencies, U.S. private industry and foreign governments and their affiliates worldwide use this STI. Often — by agreement — they communicate their research results back to the Program ... for possible inclusion in the STI system. And the cycle continues. ●

A Few Words About Scientific and Technical Information...

It seems nearly every business or activity today has a specialized vocabulary. The world of STI is no exception. Following are working definitions of a few common STI or STI-related terms mentioned in this publication.

Abstract — a summary or condensation of the main points covered in a document.

Application — the use to which a data processing system is put; for example, a payroll application, or a network application.

Bibliography — a list, often with descriptive or critical notes, of writings on a particular subject.

CD-ROM — Introduced in 1986, this optical recording media stands for Compact Disk-Read Only Memory. CD-ROMs can store 300,000 printed pages on one disk and put a database in your control ... without telecommunications or the time factor of online retrieval.

Citation — a statement of reference relating to other sources of data, usually containing an abstract.

Data — a general term for numbers, digits, characters or symbols that are suitable for processing by human or automatic means.

Database — a collection of interrelated or independent data stored together to serve one or more applications.

Document — a data medium and the data recorded on it, that generally has permanence and can be read by a person or a machine.

Field — the smallest unit of data that can be referred to in a record.

Gateway — a link between networks.

Information — when data are explained and interpreted so they become meaningful, they also become information — and are subject to retention and dissemination.

Information processing — the organization, manipulation and distribution of information. Sometimes referred to as "data processing."

Knowledge — the NASA STI Program is dedicated to presenting information to NASA researchers in such a readily useable way that it will be added to their store of knowledge. Knowledge refers to the range of one's information and applies to facts or ideas gained by investigation or experience.

Micrographics — the storage of documents on, for example, microfiche or microfilm, by a process of photographic miniaturization.

Network — in communications, a collection of resources used to establish and switch communication paths between its nodes and various input or output devices, such as terminals, printers or facsimile devices. The interconnections can include line telecommunications, satellites and microwave communications.

Online — pertains to a user's ability to access and interact with a computer. NASA/RECON is NASA's online information search and retrieval system.

Record — a collection of related data or words, treated as a unit.

Products and Services

Here are just some of the many outstanding products and services the STI Program offers its users.

Products

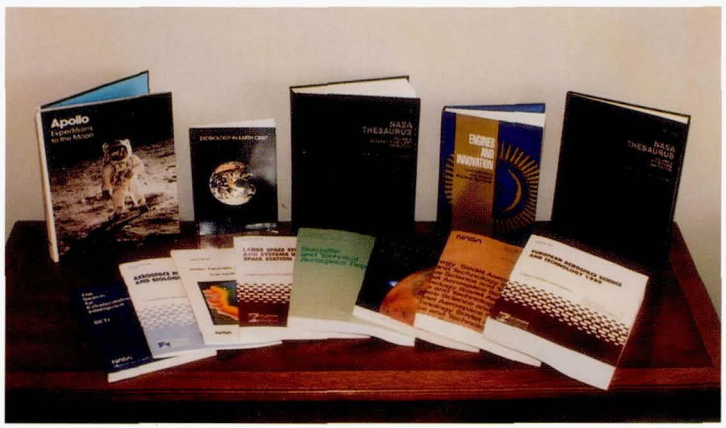
Announcement Publications
STAR (Scientific and Technical Aerospace Reports) and *IAA* (International Aerospace Abstracts) are semimonthly journals containing announcements of R&D reports and journal articles in 76 aerospace-related categories.

Other publications include the *STI Bulletin*, a newsletter sent to all registered users of the STI Program; *NASA News Releases and Speeches*; and the *STI Telephone Directory*.

Current Awareness Products
SCAN (Selected Current Aerospace Notices) and *CURRENTS* are citations and abstracts of R&D reports and journal articles distributed soon after their availability online in the STI Database. Entries are announced in 191 aerospace-related topic areas in *SCAN*. *CURRENTS* consists of five of the *SCAN* topics, but includes classified and limited documents as well as unclassified. It is available only to NASA Centers.

In addition to *SCAN* and *CURRENTS*, the NASA STI Program offers *Updates*, another customized current awareness product. For *Updates*, reference analysts perform searches relevant to NASA contracts, and offer continuous, automatic monthly search output to the principal investigators and technical monitors of the contracts. The NASA Center libraries offer a similar service to their patrons.

ORIGINAL PAGE
COLOR PHOTOGRAPH



These are only a few of the wide range of NASA STI Program publications.

STI Handbooks and Tools
These are a series of printed products that give users access to the tools used for processing records into the database. Included in this series are:

- *Acronym Dictionary*, a compilation of acronyms used in the database
- *Combined File Postings Statistics*, a report of the frequency of usage for index terms assigned to records
- *Corporate Source Authority List*, *CSAL* lists the accepted names and locations of corporate entities and maps the names to their corporate source codes
- *Corporate Source Authority List Updates*, periodic updates to the *CSAL*
- *NASA Thesaurus*, produced triennially in three volumes and representing the controlled vocabulary used to index records in the database. The three volumes are the Hierarchical Listing, the Access Vocabulary, and the Definitions.

NASA Technical Report Series
These series include: *Conference Publications* (CP), *Contractor Reports* (CR), *Reference Publications* (RP), *Technical Memorandums* (TM), *Technical Papers* (TP), *Technical Translations* (TT), and *Special Publications* (SP).

Continuing Bibliographies
These include a series of print products produced at frequencies varying from monthly to annually on special areas of interest stored in the database. Examples are the monthly publications *Aeronautical Engineering, Aerospace Medicine and Biology,* and *Management.*

Three other bibliographies that have been produced annually since 1987 are *Japanese Aerospace Science and Technology, European Aerospace Science and Technology,* and *Soviet Aerospace Science and Technology.*

Special Bibliographies
Bibliographies that are produced as one-time products or those produced irregularly are known as special bibliographies. These generally are produced on topics of current interest, such as *Implementing Total Quality Management.* They are created at the request of a particular NASA program office or code.

Special Publications
Special Publications vary greatly in substance and format from the other technical reports. They are narrative summaries on areas of particular scientific or technical interest, or chronologies of NASA missions or eras.

Special Publications are sponsored by NASA program offices, and are written by NASA and NASA contractor scientists, engineers and managers. Frequently they contain detailed descriptions, illustrations, photographs and charts from the projects they describe.

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Among the most popular titles are *This Island Earth* and *Apollo Expeditions to the Moon. Engines and Innovation: Lewis Laboratory and American Propulsion Technology* and *First Among Equals: the Selection of NASA Space Science Experiments* were the new titles introduced in 1991.

RTOPS

Research and Technology Objectives and Plans Summary or *RTOPS* is an annual guide to NASA-sponsored research in progress. It represents the NASA research and technology program for the current fiscal year. RTOPS includes the technical summaries and indexes of all Research and Technology Objectives and Plans submitted by the NASA Centers to the NASA Headquarters Office of Aeronautics and Space Technology for management review.

A Sampling of Program Productivity — Fiscal Year 1991

Number of	
Items Cataloged	90,952 STI Database items 47,338 ARIN library items
Items Filmed	4,633, not including items received on microfiche
RECON Searches	75,569
Terms Added to Thesaurus	149 terms
Bibliographies	68 distributed to 2,337 users
Special Publications	2 distributed to 870 users
Documents Delivered	1,597,636
Hard Copy	860,274
Microfiche	737,362

Source: NASA STI Program

Services

Reference and Literature Services

STI Program staff members perform searches on the STI Database, outside databases, or ARIN in response to user inquiries from NASA Centers throughout the nation or NASA Headquarters.

Other reference and literature services include:

- Telephone calls and letter requests — received from users asking for assistance in identifying or ordering documents
- Search assistance inquiries — responses to users with questions about the functional operation of one of the STI Program's online systems. Answers are often instructional in nature.

To support reference and literature services, the Program staff mails hundreds of sets of printed output each week from searches performed by RECON users in the field.

Training

Training classes for use of the RECON retrieval software are offered at two levels: basic and advanced.

In basic training, students learn how to conduct simple look-ups and how to develop RECON strategies. Some knowledge of using online retrieval systems is assumed.

In advanced training, students learn about RECON's more complex searching features.

Training classes are offered in the use of the ARIN system (see page 22) both for the cataloging and circulation functions.

Translations

The STI Program oversees the translation into English of foreign language documents written in any of 34 foreign languages. The staff also attempts to locate English-language versions of foreign language documents.

Online Assistance

The Program receives a wide variety of user inquiries, most often by phone. Reference inquiries are responses to users who call with requests for information about such items as technical reports, journal articles, and NASA contracts that are available by searching the database, or from another outside source.

Microfiche and Hardcopy Document Supply Services

The Program produces microfiche for archiving and distribution. For document requests not received under subscription, staff generates paper copies ("blowbacks") from microfiche. In some cases, users receive photocopies from a paper copy original.

When CASI can't provide a document, those requesting the document are referred to other suppliers. Usually this happens either when we are not authorized to distribute the document in question, or when we aren't able to supply a high-quality copy of the document.

Document Distribution Subscription Services

Copies of new research reports are available on an annual subscription basis through the Automatic Document Distribution Service (ADDS). ADDS distributes more than 1.5 million documents annually to our users (822,000 in paper copy and 724,000 in microfiche). Reports are distributed by any combination of subject divisions and categories that cover all aspects of aerospace interest ... from aeronautics through the social sciences.

A Standing Order Service is available for users who prefer a pay-as-you-go approach. Instead of paying an annual subscription fee for documents — as in ADDS — the user is sent a monthly invoice for items received.

All manner of technical report literature and other NASA STI publications are stored at the Program's Center for AeroSpace Information (CASI).

Current Awareness Services

Current awareness services include the online current awareness search MANAGERS, which may be executed by RECON users at any time. MANAGERS is a service in which each week, staff selects 20 citations of interest to NASA managers and makes them available online through the execution of a stored search sequence. These citations are available through MANAGERS several weeks prior to their publication in *STAR*. ●

The Program ... in Practice

As you have seen, the NASA STI Program collects and packages scientific and *technical information* to meet user needs. But what, in practical terms, does that mean?

Program professionals provide a broad range of services ... from the basic searching and retrieval of information, to database building, cataloging, customized bibliography production — or perhaps a combination of these services, and many others.

Here are a few examples of the Program in action. Each story is different, yet each is the same ... united in the common purpose of Program professionals doing whatever is needed to meet user needs.

Research That Suits an Astronaut

Jim Bagian, an astronaut since 1980, says the path between his office and the Medical Sciences Library at the Johnson Space Center is well-worn.

As an M.D. who also has a degree in mechanical engineering, Bagian's specialty, not surprisingly, is aerospace medicine. His broad academic background has fostered his broad interests as an astronaut and researcher.

"Fluorescein angiography," "capillary permeability in the retina," and "cerebral edema" are just a sampling of the kinds of topics Bagian typically investigates ... usually with the able assistance of STI Program research specialists.

"For the projects I work on," he says, "to understand where you're going, you first have to understand what's already been done. It's the only sensible, efficient way to proceed. That means I need rapid access to the literature, and that's what the Medical Sciences Library here gives me."

Space Suit Technician Al Rochford tries on a launch/entry suit. One of the many factors Bagian and his colleagues tested the suit for was "reach performance," or your ability to handle routine movements and tasks during ascent — when the force of gravity is at its most extreme.

The process is simple enough. Bagian gives the STI Program librarians key words for them to do an online search. Then they send him abstracts of related citations, and he tells them which paper documents he wants.

Bagian says one of his most important projects to date was as the astronaut office lead in the design and development of the shuttle launch/entry suit (LES). As an astronaut with two shuttle missions to his credit, the doctor knew the critical need for such a suit.

"The suit is particularly important if we have to bail out during ascent," he says. "All of the astronauts have to wear their suit for launch. Fortunately, nobody's had to bail out. But in case they do, we've tested the suit for its ability to withstand a variety of stresses."

One of the chief concerns he and the team of engineers and technicians working on the project made sure to guard against is "immersion hypothermia." Stated simply, in a bailout, astronauts might have to endure hours of immersion in icy ocean water.

Wearing their escape suit — which has a built-in flotation device — astronauts can easily withstand that contingency, and countless others.

"The librarians really know technically what's going on, especially in the life sciences area," he says. "Their work especially helps me at the beginning of projects. When I'm wearing my escape suit, I'm often reminded of how much we all benefit from their skills."

Searching the Heavens With Your PC

At the National Space Science Data Center (NSSDC), the day is fast approaching when astrophysicists will be able to search three leading professional journals from their PCs, retrieve the relevant articles ... then print out a hard copy of those articles, on command.

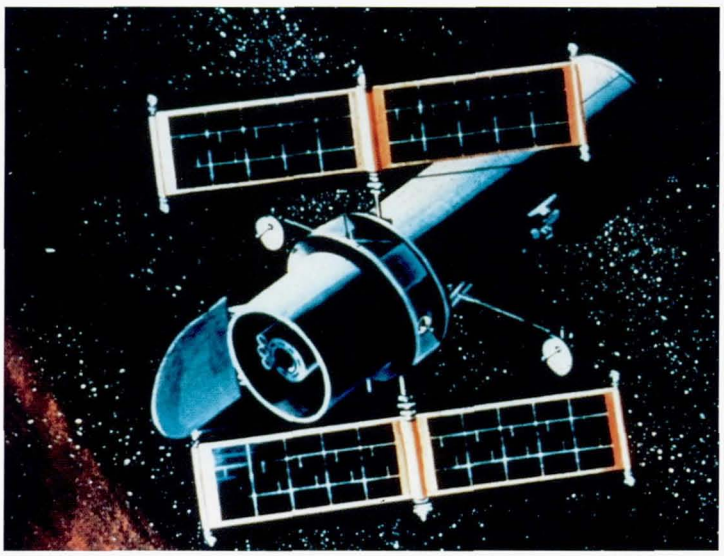
And the STI Program will have played a key role in pioneering the advanced technologies that make it all possible.

It's part of the NSSDC's STELAR experiment, an electronic literature experiment funded by Code SMI at NASA Headquarters. (STELAR stands for *S*tudy of *E*lectronic *L*iterature for *A*stronomical *R*esearch.)

The idea originated several months ago in conversations between senior-level managers from each organization. The more they explored the basic concept, the more each liked it.

The union of the NSSDC's and the STI Program's talents is not surprising, since each stores and offers information that helps the NASA research community.

The NSSDC, established in 1967, serves as a long-term archive and distribution center for numerical and image data obtained on NASA space flight investigations. It also provides a variety of services to enhance the overall scientific return from these missions.



The Advanced X-Ray Astrophysics Facility (AXAF) is just one of a family of large orbital observatories NASA plans to launch, each tuned to a different part of the electromagnetic spectrum. AXAF will cover the X-ray portion of the spectrum and study stellar structure and evolution, large scale galactic phenomena, active galaxies, clusters of galaxies, quasars and cosmology.

STELAR could make the NSSDC's services more valuable than ever. As part of the experiment, the NSSDC is bringing digital images online of the last five years of *Astrophysical Journal, Astronomical Journal*, and *Publication of the Astronomical Society of the Pacific*.

That's where the STI Program comes in. Access to these articles will be provided through the use of machine-readable bibliographic records we're supplying. By using more advanced search and retrieval software and user interfaces, a user will be able to search through, retrieve and print out any article of interest.

The societies that own the copyrights on the journal articles — the American Astronomical Society and the Astronomical Society of the Pacific — are also taking a leadership role in this project as members of the STELAR Planning Committee.

If all goes according to plan, this new service should be available for testing to a limited set of astrophysicists by mid 1992.

In addition, members of the publishing community, librarians, astrophysicists, data archivists and now, members of the STI Program, are participating in a series of NSSDC-sponsored workshops to address issues related to the STELAR experiment.

Help in Handling Hydrogen Leaks

In June 1990, a launch of the Columbia space shuttle was called off because of hydrogen leaks. Several subsequent launches were scrapped for the same reason.

Bob Youngquist, a physicist for Boeing Aerospace Operations at Kennedy Space Center, was put in charge of a team of three physicists assigned to investigate one aspect of the problem.

The team was to conduct a broad search for techniques that let you detect hydrogen remotely. The leaks emanated from a difficult area to monitor: on the shuttle's midpoint, between the external tank and the orbiter — about 40 feet above the launch platform.

Youngquist and the team wrote up a requirements document detailing the problem. He circulated it to NASA Centers, industrial research centers and universities, asking all for related literature. Next, he conducted a literature search with the help of Kennedy's STI Program professionals.

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"I supplied the librarians with key words — such as 'hydrogen,' 'sensing,' and 'remote,' and they set up a worldwide literature database for me," said Youngquist. "As my research evolved, I kept fine tuning the information I wanted — by changing the key words. The literature that turned up was an *immense* help. As it turned out, we didn't get anything from the Centers that didn't show up on our STI Program literature search."

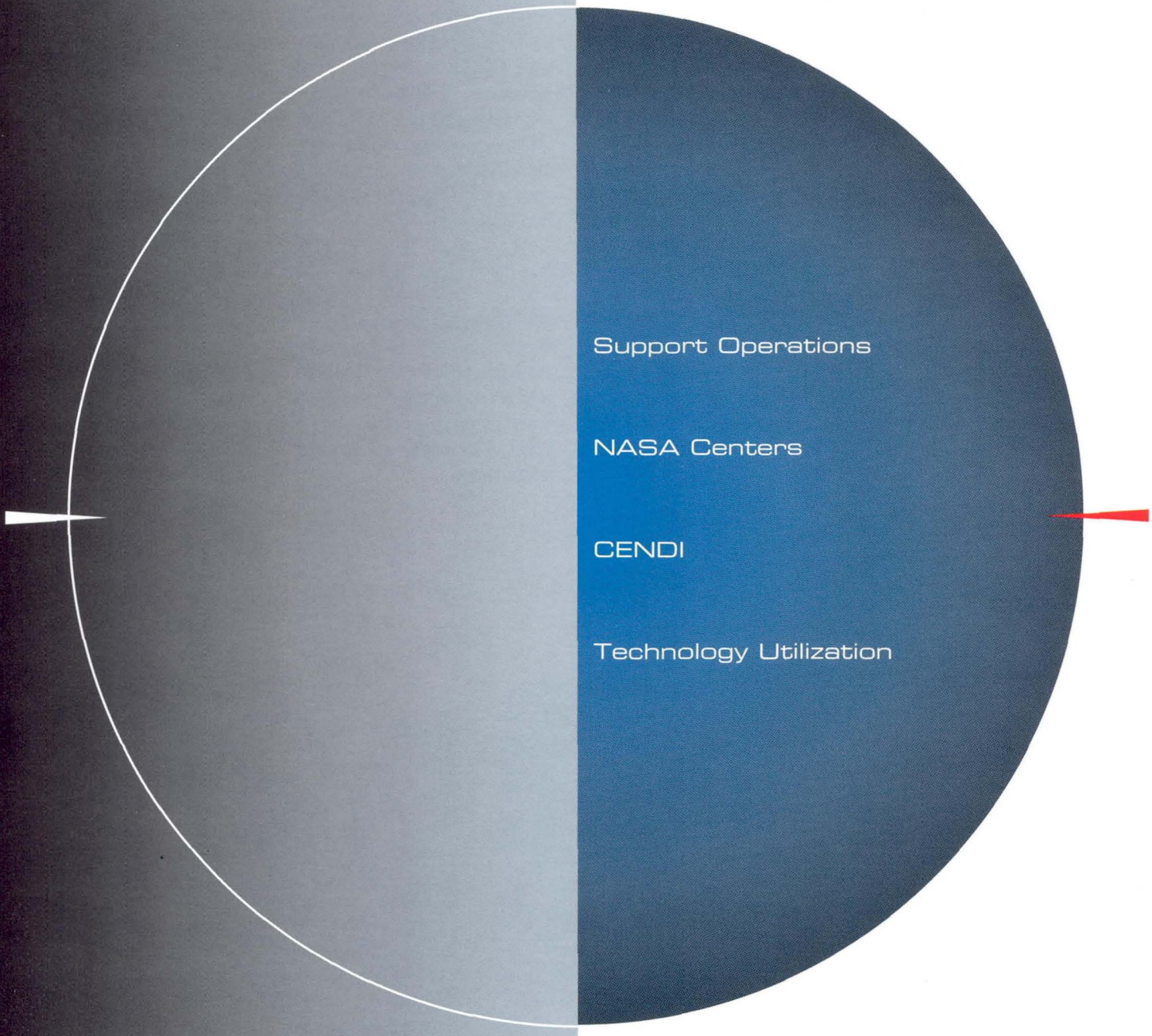
In early January, the Youngquist team's efforts were augmented by a three-day conference on the hydrogen leak problem held at KSC. Scientists and engineers from nearly every NASA Center and numerous industrial centers toured the pad, held meetings and discussed technologies.

The situation crystallized later that month. Based on their research, Youngquist and his colleagues devised a fairly complex approach to solving the problem — although it required large funding. At the same time, other NASA scientists had found the source of the leaks and repaired them.

The work of Youngquist and his associates was a great success. "Hydrogen leaks are an ongoing problem," he said. "Now we know what key technologies other people are using. The work we did will serve as a foundation for work we may have to do in the future."

Thanks to the work of Bob Youngquist and his team, and countless other scientists and engineers like them, shuttles continue to thunder off the launch pad at Kennedy Space Center ... bound for new destinations and new missions.

At the moment, KSC scientists are monitoring the hydrogen leak situation. Youngquist and his associates stand by ready to offer their expertise once again. And STI Program professionals are there as well, eager to help, as needed. ●



Support Operations

Domestically, the Program's two primary support operations are:

- The Center for AeroSpace Information (CASI); and
- The Technical Information Service (TIS).

The Technical Information Service follows a similar process for input processing its new STI, as described previously for CASI. Every two weeks, information from the Technical Information Service is electronically transferred to CASI.

At each of these locations, thousands of records are added into the central database each month. CASI focuses on acquiring technical reports, adding almost 44,000 documents to the database annually. Our Technical Information Service emphasizes published literature, such as journal articles, books and conference proceedings. It adds almost 43,000 documents each year.

The STI Program libraries at NASA Centers nationwide input almost 48,000 items into the Aerospace Research Information Network (ARIN) database. The ARIN database represents a union list of NASA library holdings. ARIN is an integrated information system that automates all functional areas of NASA libraries, including shared cataloging, bibliographic searching, circulation, interlibrary loan and management information.

NASA Centers

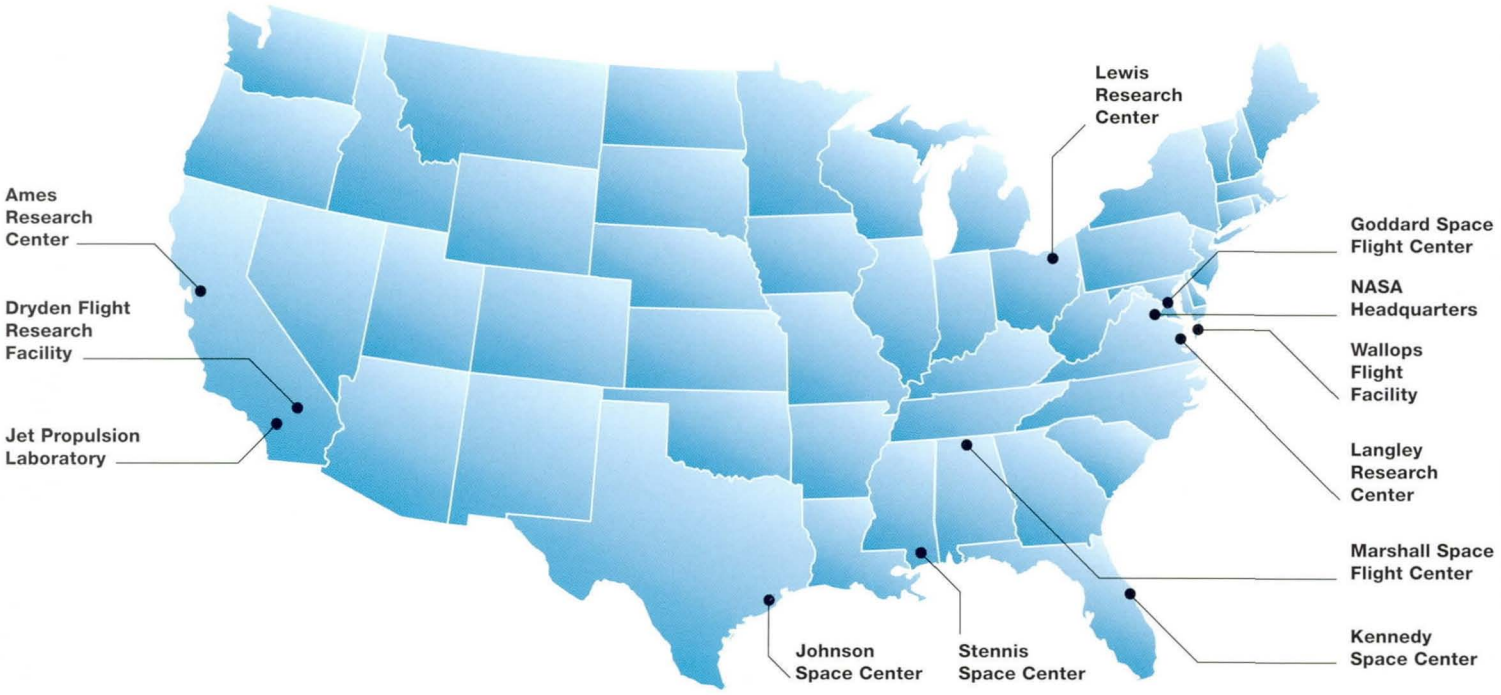
The NASA STI Program maintains operations at NASA Centers throughout the United States. NASA researchers at these facilities generate much of the Program's scientific and technical information.

Each Center is responsible for ensuring that reports from NASA employees and contractors are properly reviewed and entered into the STI system.

STI Program activities at the Centers tend to fall into several categories: publishing (editing and production); technical library services; graphics; printing; and multimedia (photography, video, optical).

Professionals from these areas work together to meet NASA goals. Similarly, *Program successes are a direct result of the staff's ongoing spirit of teamwork and dedication.*

NASA Centers



Following is a brief description of recent accomplishments at each Center.

NASA Headquarters Scientific and Technical Library
Joseph A. Langdon
Head-S&T Library & Systems Support
Washington, D.C.

Joseph A. Langdon

The Headquarters S&T Library provides the NASA community with reference and research assistance, database searches in a variety of subject areas, document ordering, and access to NASA reports.

Recent accomplishments include:

Received Headquarters Special Service Award, presented October 2, 1991, in recognition of staff support for NASA's STI initiatives. The award recognizes the outstanding services provided by the staff in improving and upgrading the Scientific & Technical Library collection and services.

Responded to a record number of requests in fiscal year 1991 — 13,040 — from NASA employees and contractors. Also responded to an additional 4,109 requests for reference assistance, RECON searches, and interlibrary loans from businesses and members of the public.

The library's new Space Station Freedom location, established in January 1991, provides many of the same services to Reston employees that are currently available at NASA Headquarters. During fiscal year 1991, the Space Station library responded to 1,320 requests from employees and contractors based in Reston, Virginia.

Completed "retrospective conversion" from a manual card catalog to an online catalog in March 1991. The library's collection is now fully accessible online through the NASA-wide Aerospace Research Information Network (ARIN). Researchers can access the collection both in the library, or by using a modem and dialing-up from their desks.

Increased total circulation of books and videotapes 81 percent, from 3,955 transactions in 1990 to 7,157 in 1991.

Initiated a collection development effort. New materials supporting NASA's current and future missions have been added in fiscal year 1991, including both print and online sources. To make room for the new items, the library staff withdrew nearly 8,000 outdated books. $50,000.00 has been allocated to update and replace scientific and technical materials in the circulating collection.

Significantly increased online searches from 1990 to 1991. Those provided to NASA employees and contractors were up 55 percent, from 565 to 874. Searches of commercial databases were up 131 percent, from 205 to 473. RECON database searches were up 11 percent, from 360 to 401.

Ames Research Center
Paul Bennett
Chief-Technical Information Division
Moffett Field, California

Paul Bennett

The Technical Information Division (TID) is STI at Ames Research Center, Moffett Field, California. TID prepares nearly 300 publications and 4,000 illustrations each year in support of some 700 researchers.

Accomplishments for fiscal year 1991 include:

Integrating the publishing process electronically. At Ames, STEPS is an electronic publishing environment. The acronym stands for the Scientific and Technical Electronic Publishing System, which includes a tracking and statistical reporting component known as STARS, or the STEPS Tracking and Retrieval System.

Researchers can work on documents at their own workstations, then transmit them to TID. Once there, these documents can be entered into STEPS, where the publishing process begins — now with new, more creative options. For instance, people from different areas in the production process can work on different aspects of the publication simultaneously. As a result of this kind of innovation, Ames is producing reports more collaboratively than ever before.

Adopting a "team of experts" approach for major projects. As part of the emphasis at Ames on Total Quality Management, TID is bringing the team

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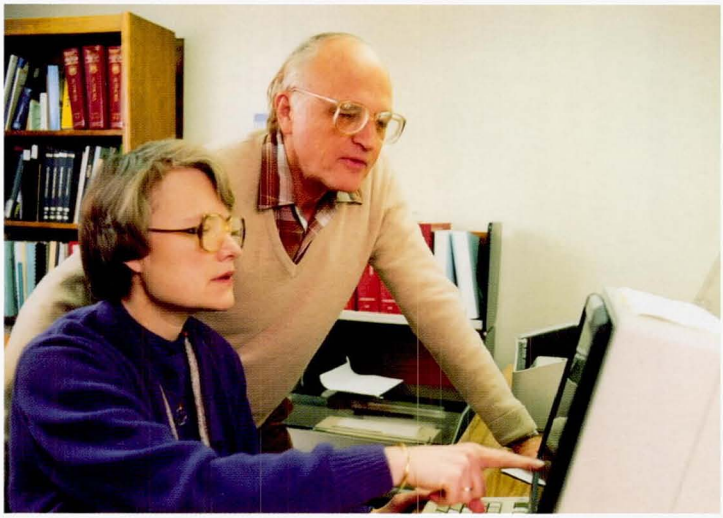
approach to its projects. Typically, the team includes a writer, an editor, a graphic artist and a printing specialist, who work as a unit to ensure a smooth production process.

Streamlining operations in the Reproduction Services Branch through several technological advances. New bar-coding equipment facilitates work flow; a new, high-speed Xerox 1090 copier provides more reliable, high-speed backup for the customer-driven Quick Copy Service; and new hardware and software allow illustrations to be supplied in electronic format directly to the GPO.

Offering library literature searches to researchers in a variety of media. The Library offers a full range of commercial databases on-line and on CD-ROM, as well as searches of its own on-line book catalog. Books are being bar-coded for better tracking and inventory, and for quicker circulation. The Library is inventorying their NACA collection for the agency project.

Ames Research Center
Dryden Flight Research Facility
Florence Kailiwai-Barnett
Chief-Administration and Technical Services Division Reports and Presentations Branch
Edwards, California

The Reports and Presentations Branch is STI at Ames-Dryden Flight Research Facility.



STI Program professionals at every Center routinely perform online literature searches to help NASA researchers.

Accomplishments for fiscal year 1991 include:

Dryden extends STEPS. The Ames Dryden Flight Research Facility also works in the STEPS and STARS environments. Dryden has extended STEPS by automating their presentations system.

Artwork is generated electronically, combined with photos and text, then displayed in real time through a projection system linked to the computer — first used for the Annual Headquarters RX Review in September 1991. With overwhelming management support, plans are underway to develop this system into a true multimedia platform including the integration of animation and video.

Goddard Space Flight Center
V. Sue Prevost
Assistant Chief for Operations-Information Management Division
Greenbelt, Maryland (includes Wallops Flight Facility, Virginia)

V. Sue Prevost

At Goddard Space Flight Center (GSFC), the Information Management Division implements the STI Program through two branches — Library Services and Technical Information Services. With locations in Greenbelt, Maryland, and Wallops, Virginia, the STI Program at GSFC handles: thousands of requests each year for scientific and technical information at its two libraries; the preparation and printing of reports, articles, books and brochures; scheduling and conducting 150 large and 1,000 smaller conferences that draw worldwide audiences.

Major accomplishments for fiscal year 1991 include:

Library Services

Acquired new databases to support Center's research goals. Recently acquired products including GeoRef and Inspec on CD-ROM and PHYS (Astronomy and Astrophysics Abstracts online) through the Scientific and Technical Information Network (STIN), an international commercial database vendor.

Provided individual or group instruction in using the library services and searching specific databases by conducting monthly tours and providing demonstrations of the ARIN online catalog and the RECON

database, CD-ROM databases, and dial-up access to ARIN. Developed self-help user's guides for electronic databases.

Provided information to researchers covering a broad range of subject areas through a variety of CD-ROM and online databases. Search results offered in either printed or electronic format.

Technical Information Services

Assisted a customer base of 585 scientists, engineers and managers who regularly request graphic services.

Helped NASA scientists to produce, publish and distribute more than 100 technical reports, which provided worldwide, current data in the scientific and technical fields.

Maintained a computer file of more than 500 pieces of vugraph art for the Earth Observing System (EOS) project that are still being used by project scientists and engineers.

Provided scientists at Wallops Flight Facility testing the TOPEX Radar Altimeter with photographic documentation of spacecraft buildup from the drawing table to the finished product.

Jet Propulsion Laboratory
Charles B. Chapman III
Manager-Documentation and Material Division
California Institute of Technology
Pasadena, California

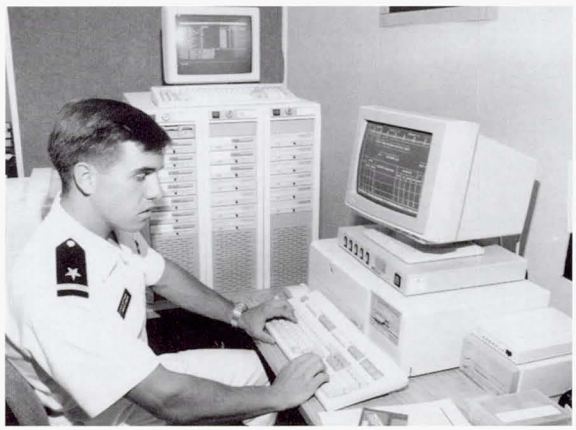


photo credit: U.S. Naval Academy

The U.S. Naval Academy's recently established Department for Aerospace Science and Engineering supports the completion of a research project for third- and fourth-year midshipmen. The Goddard Space Flight Center library furnishes literature support and provides reference services for visiting midshipmen.

Charles B. Chapman III

At the Jet Propulsion Laboratory (JPL), the Documentation and Material Division implements the NASA STI Program through a range of support activities, including library services, supply and equipment, air operations and documentation, photographic and printing services.

Recent accomplishments include:

JPL Library featured in JPL Expo Open House. The June 1991 event drew nearly 20,000 visitors, many of whom stopped by the Library for demonstrations of the ARIN and RECON databases. Bedazzled high school students, amateur scientists, Hollywood screen writers and aerospace company executives were among the attendees.

JPL Library has joined METRONET, a group of greater Los Angeles libraries and information resource centers. This move substantially broadens the library's offerings to NASA researchers.

JPL Archives has processed more than 300 cubic feet of records in the past two years, which includes materials from the Ulysses, Galileo, Magellan, Voyager, Mars Observer, and Viking projects. Established in April 1989, the Archives documents the history of JPL's flight projects, research and development, and administration operations from its beginnings in the late 1930s to the present.

Researchers from Canada, Great Britain and the U.S. have sought information in the Archives History Collection on numerous past projects, including Surveyor, Prospector, Viking and Mariner, as well as the application of such varied technologies as launch vehicles and charge-coupled devices.

JPL's Documentation Section prepared 32-page booklet covering unmanned exploration from the Pioneer project to Ulysses. *Our Solar System at a Glance* was produced as part of the NASA Information Series, with 20,000 copies produced for distribution to high schools, colleges and universities across the nation.

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Johnson Space Center
Carol Homan
Deputy Chief-Management
Services Division
Houston, Texas

Carol Homan

The STI Program at the Johnson Space Center has undergone considerable change. Staffing and technological changes have renewed interest in Program information services and publications capabilities.

Recent accomplishments include:

JSC Technical Library renamed the Scientific and Technical Information Center. This move reflects Johnson's growing reliance on electronic databases, CD-ROM products, videotape collections, and information services ... beyond the traditional library emphasis on book and periodical holdings.

Mission Specialist and co-author Bonnie Dunbar exchanges samples in the Fluids Experiment Apparatus (FEA), one of the instruments used on board the shuttle to measure the microgravity environment.

Installed a CBIS CD-ROM server for the STI Center. Connected to the local area network (LAN), the server allows users to access up to 21 compact disks from workstations throughout the STI Center. The Program expects to expand the availability of this service Center-wide by providing dial-in LAN access.

User demand for these and other reference services *more than doubled* in the last two years.

Move to decentralize operations and establish satellite information centers continued, with STI specialists providing support to specific disciplines or organizations at Johnson. Last year, specialists at the Medical Sciences information center — Johnson's most successful satellite operation — performed more than 3,000 reference searches for nearly 350 customers.

Number of Johnson-authored STI documents more than tripled in the past year. Johnson's Documentation Management Branch has moved aggressively to identify documents intended for internal publication that might have a broader interest. To produce these documents, Johnson authors were then offered access to the branch's publications expertise and streamlined production process.

Increase in number of scientist-astronauts interested in using NASA Technical Paper series as the primary forum for publishing results of their Shuttle research. Two of the three Technical Papers published in 1991 by scientist-astronauts include articles on the results of the Microgravity Disturbances Experiment conducted on STS-32, January 9-20, 1990 (see photo).

Kennedy Space Center
Lex O. Pierce
Chief-Supply, Transportation and
Services Division
Kennedy Space Center, Florida

Lex O. Pierce

At the Kennedy Space Center (KSC), STI Program activities focus on the Technical Library and its information services. The activities of most Program users are related in some way with the Center's primary mission — to launch the Space Shuttle.

Recent accomplishments include:

Expanded interlibrary loan service to users by joining the Central Florida Consortium and the State of Florida Library Information Network (FLIN).

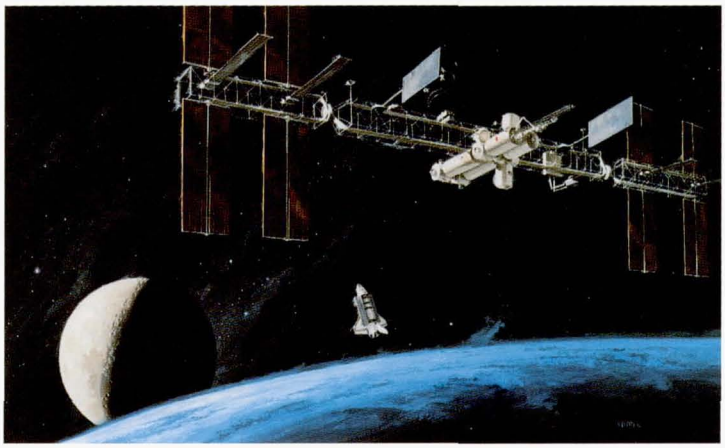
Redesigned and produced a new STI Program brochure to familiarize current users and new employees at KSC with the library and various information services — Reader Services, Specs and Standards, Documents, Processing, and Archives.

Added three patron terminals in the library to facilitate searching the STI Program databases.

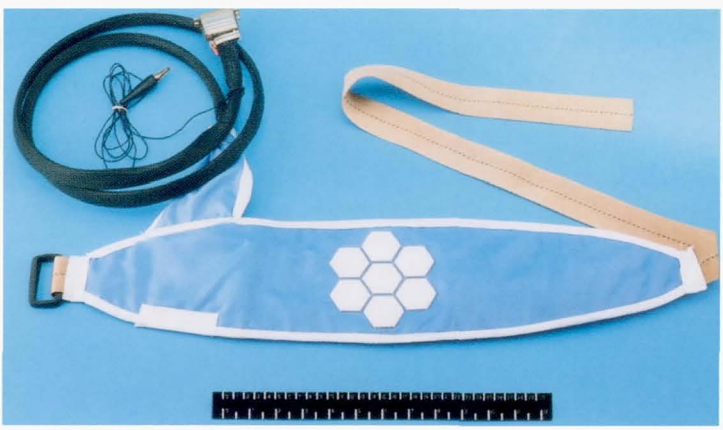
Added two CD-ROM drives to the current library facilities to expand patrons' search possibilities further still.

Developed a special collection and index on Total Quality Management (TQM) in response to a request from the TQM Project Management and the Center's Deputy Director for a reference resource for contractors and civil servants.

Assisted in the preparation of assessment reports for each Shuttle launch in 1991, using the high-speed color copier in place of four-process color. These reports are photographic assessments of the tiles in the shuttle's thermal protection system (TPS) and how the system is affected by ice, frost, and debris during launch and landing.



Freedom scientists will be looking for new materials, new medicines, new medical equipment and techniques, new uses for existing technologies, and much more.



Here are just two of the hundreds of photos the STI Program at Langley provides annually in support of Center programs: (top) HL-20 vehicle, now under development, and (bottom) fetal heart monitor, an application of sensor technology devised by a Langley research team.

Provided STI services to life science researchers for the Biomedical Operations and Research Office, including the preparation of journal articles and presentations, along with NASA TMs. These researchers are carrying out vital work on their Controlled Ecological Life Support System (CELSS), which contributes to NASA's investigation of long- duration space flight and habitation — particularly in the Space Station Freedom era.

Langley Research Center
Andrew J. Hansbrough
Chief-Research Information and Applications Division
Hampton, Virginia

Andrew J. Hansbrough

During fiscal year 1991, NASA Langley Research Center (LaRC) contributions to STI literature included 307 NASA technical reports, 298 formal articles, 903 meeting presentations, 51 technical briefs, 30 patents and 15 conferences or workshops sponsored or co-sponsored by LaRC.

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Other accomplishments include:

LaRC received an Award for Typographic Excellence and Electronic Composition from the National Composition and Prepress Association for one of the Center's all-electronic reports. The all-electronic report has become the Center's standard mode of production for NASA technical reports. This approach makes higher-quality camera-ready copy — and eliminates the need for manual page paste-up.

LaRC continues to support the NASP-JAPO by printing and distributing all NASP conference proceedings and the Technology Maturation Plan (some material is classified or otherwise restricted). The Center can print and distribute 500 copies of these large documents within 10 working days.

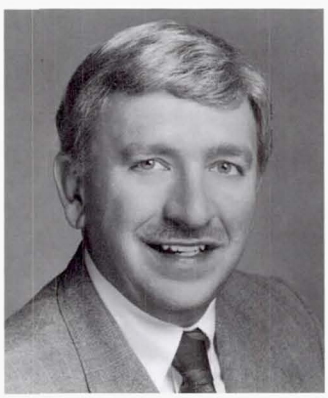
NASA LaRC Technical Library implemented STILAS (Scientific and Technical Information Library Automated System). The system supports cataloging, acquisitions, circulation and searching of multiple databases. STILAS provides users access to the library's entire book collection ... and portions of the journal and document holdings.

All researcher workstations are expected to have access to the library online catalog by the first quarter of 1992.

Lewis's Photographic and Printing Branch helped provide still photographic coverage of the recent STS-41 Discovery Shuttle landing. This photo was highlighted in national press releases and has become one of the official photos of the STS-41 landing.

LaRC created a new, centralized video production facility. Using state-of-the-art equipment, the video operation has created 19 original productions, some of which include video graphics created at LaRC. Outtakes highlighting research and technology efforts at LaRC have been used on the national network, NASANET, as well as on local television programs.

Lewis Research Center
Richard E. Texler
Chief-Technical Information
Services Division (TISD)
Cleveland, Ohio



Richard E. Texler

1991 was an outstanding year for the NASA STI Program at Lewis. The R&D staff at the Center authored 788 technical publications, an increase of 76 percent since 1986. This figure reflects a 41 percent growth in civil service R&D staff since 1986.

STI Program services are provided through TISD's branches: Library, Editorial, Graphics and Exhibits, and Photographic and Printing. Among TISD's accomplishments are:

A Conference Planning Team will assist Lewis requestors with coordinating production work on conference presentation and publication materials.

Several Outreach Programs were initiated to inform researchers about the STI Program and our division services, and to solicit feedback from current users on their satisfaction with and need for STI Program services.

An online Library literature request card now makes it possible to electronically order all forms of library material (books, reports, journal articles, specifications, and translations).

A Library User Committee, composed of representatives from nine directorates at Lewis, was formed.

The editing staff increased its involvement in writing to include brochure and script writing.

Editors are editing online with new software programs and computers.

An editor/writer has been designated as the History Coordinator for Lewis.

A custom modified, electronic still imaging system allows Lewis researchers to convert film frames to electronic still images and transmit them over telephone lines.

An image processing and data reduction facility allows researchers to work with film, video and/or electronic still imaging formats to analyze and reduce research data in support of Mission Imaging. Data are then easily integrated into the technical video production facility to supplement published research reports.

Marshall Space Flight Center
Annette K. Tingle
Chief-Technical Information and Services Branch
Huntsville, Alabama

Annette K. Tingle

At the Marshall Space Flight Center (MSFC), the STI Program is coordinated through the Technical Information and Services Branch of the Management Operations Office.

NASA Deputy Administrator James R. Thompson, Jr. challenged those attending the STI Conference and Workshops '91 to develop an innovative strategy for creating and disseminating STI. STI Program managers from around the nation responded with inter-office memos filled with new insights and ideas, all culminating in a memo to Mr. Thompson from the Director of the IRM Division, Wallace O. Keene.

STI Program professionals nationwide journeyed to STI Conference and Workshops '91, making it one of the largest STI conferences NASA has ever held.

STI related functions include the Technical Library, Technical Publications, and the Documentation Repository.

To better serve the technical information needs of NASA scientists, engineers and managers, the MSFC Library works in coordination with the local Redstone Scientific Information Center (RSIC), operated by the U.S. Army Missile Command under joint Army-NASA sponsorship.

In fiscal year 1991, the total output of STI to the NASA information system from MSFC included 63 NASA technical reports, 80 journal articles, and more than 750 technical papers. More than 165 reports on MSFC contracts were received from U.S. contractors and processed into the NASA information system.

Other accomplishments include:

Hosted the NASA STI Conference and Workshops '91, one of the year's highlights Program-wide. Last April, representatives from NASA Headquarters, all Centers, and numerous contractors attended this annual event to exchange ideas and discuss strategies for success.

Introduced a new communications system for staff and patrons. MSFC staff and users can now access RSIC's open literature through STILAS (Scientific and Technical Library Automation System). Ultimately,

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MSFC engineers and scientists will also be able to access RECON and ARIN from their desks.

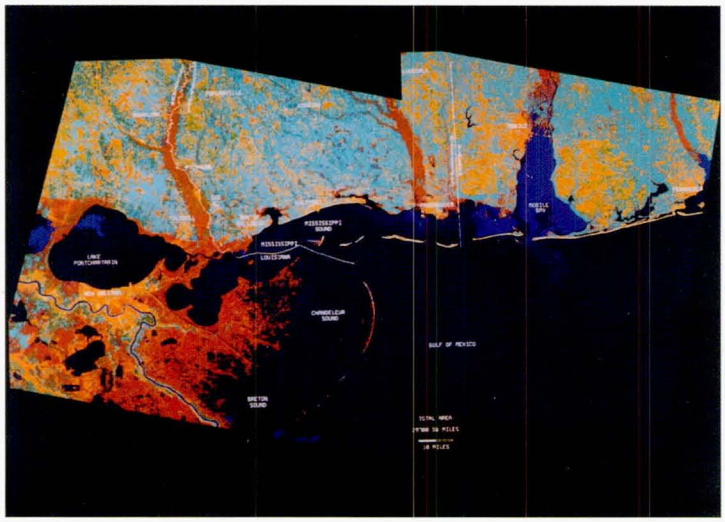
Documentation Repository completing second of three phased upgrades of its optical imaging system. The second-phase changes, scheduled for completion in January 1992, will make it possible for MSFC users, contractors and other NASA Centers with appropriate communications capability and compatible software to electronically send and receive engineering drawings and documentation from the Documentation Repository.

Stennis Space Center
Herman L. Watts
Manager-Scientific and Technical Information
Hancock County, Mississippi

Herman L. Watts

At Stennis Space Center, the STI Program encompasses the Technical Library, the Science and Technology Laboratory (STL), and the Technology Transfer Center.

ORIGINAL PAGE
COLOR PHOTOGRAPH



This remote sensing image from Stennis offers detailed information about the terrain in and around Mississippi.

In fiscal year 1991, Stennis Space Center's output of STI materials included 28 journal articles, nine public conference proceedings papers, four Technical Memorandums, and six chapters for scientific and technical books.

Other recent STI Program accomplishments at Stennis include:

Technical Library procured specialized printed materials to aid Propulsion Test Operations in the planning and design of the National Launch System/ Component Test Facility Complex. The complex will help NASA and the Air Force develop new engines to lift heavier payloads for the space shuttle.

Technical Library provided numerous bibliographic searches for NASA and other government agencies — especially the Navy — that do not have access to RECON.

STL archeologist, Dr. Tom Sever, wrote a lengthy article for *National Geographic* concerning research he's conducting on the Mayan civilization, as part of his normal duties at NASA.

Technology Transfer Center, through its Visiting Investigator Program (VIP), assisted U.S. industries by providing remote sensing data to improve their commercial operations. ●

CENDI

CENDI is an interagency working group composed of senior STI managers from the NASA STI Program (NASA) and the U.S. Departments of:

Commerce — National Technical Information Service (NTIS)
Energy — Office of Scientific and Technical Information (OSTI)
Defense — Defense Technical Information Center (DTIC)
Health and Human Services — National Library of Medicine (NLM).

These managers have responsibility for STI at agencies representing more than *90 percent* of the $70 billion Federal R&D budget.

The STI programs at these agencies have many common interests. CENDI was chartered in 1984 in recognition of this, and to maximize the opportunities for member agencies to share resources, avoid duplication of effort, and improve each agency's effectiveness.

CENDI is making significant progress in helping ensure that Federal STI is used to enhance U.S. economic competitiveness.

CENDI has been the focal point in working with such other Federal organizations as the

Office of Science and Technology Policy (OSTP, executive branch) and the Office of Technology Assessment (OTA, legislative branch) on STI policy and support for improving U.S. competitiveness, particularly in the ways U.S. success is dependent on high technology.

The OSTP is looking at a CENDI suggestion to establish a Federal Coordinating Committee on Science, Engineering and Technology (FCCSET) to consider the importance of STI to the national welfare.

CENDI activities emphasize cooperative programs, joint funding of special projects, joint efforts in data gathering and analysis on STI issues, and sharing database records. For instance, the NASA STI Program has ongoing exchange agreements with NTIS, DOD and DOE to process computer tape input from each of these agencies.

Each CENDI agency has an extensive international program. CENDI helps ensure that the U.S. maintains the strongest position in STI negotiations and that the best use is made of foreign information received under each exchange program.

The NASA STI Program plays a key role at CENDI:

- In 1991, NASA took responsibility for management of CENDI's Secretariat contract and oversaw its operations.
- In 1991, the Secretariat —in cooperation with NASA — prepared a technical article entitled "Data Policy and Availability Supporting Global Change Research, Development, and Decision-Making: An Information Perspective." The article demonstrated CENDI's proactive voice on the support STI can provide in data management related to global change.
- NASA holds the chairmanship of CENDI's Networking Working Group, the special committee charged with determining how agencies can best cooperate in their development of STI networks and gateways.
- NASA has the lead in coordinating vocabulary and lexicon creation in cooperation with the numeric data community and Global Change Research Program. ●

Technology Utilization

NASA's Technology Utilization (TU) Program is part of the STI Program user community. TU links NASA and U.S. companies that may be able to use NASA innovations productively ... and profitably. TU is designed to stimulate "spinoffs" — the secondary application of technologies originally developed for NASA programs.

Until recently, ten Industrial Application Centers (IACs) and their affiliates located throughout the nation served as U.S. industry's main point of contact with TU.

To facilitate access by the private sector to federally sponsored technology, NASA recently initiated a new Regional Center concept that became operative in January 1992. NASA has identified six organizations to receive contracts under the agency's new Regional Technology Transfer network:

Northeast

Center for Technology Commercialization
Westborough, Massachusetts

Mid-Atlantic

University of Pittsburgh
Pittsburgh, Pennsylvania

Mid-West

Battelle Memorial Institute
Columbus, Ohio

Southeast

University of Florida
Alachua, Florida

Mid-Continent

Texas A & M University
College Station, Texas

Far West

University of Southern California
Los Angeles, California

In the past, our main information transfer to TU was via tapes spun off from our chief database and sent to two IACs. Last year, TU made more than 3,000 RECON searches to benefit members of U.S. industry.

We will continue to supply tapes to TU, now via its Regional Technology Transfer centers. ●

Overview

ICSTI

AGARD

Overview

Aerospace-related STI is produced, enhanced and stored around the globe. Two trends highlight the importance of our obtaining the results of international R&D:

- Budget pressures both here and abroad have increased the need for international cooperation.

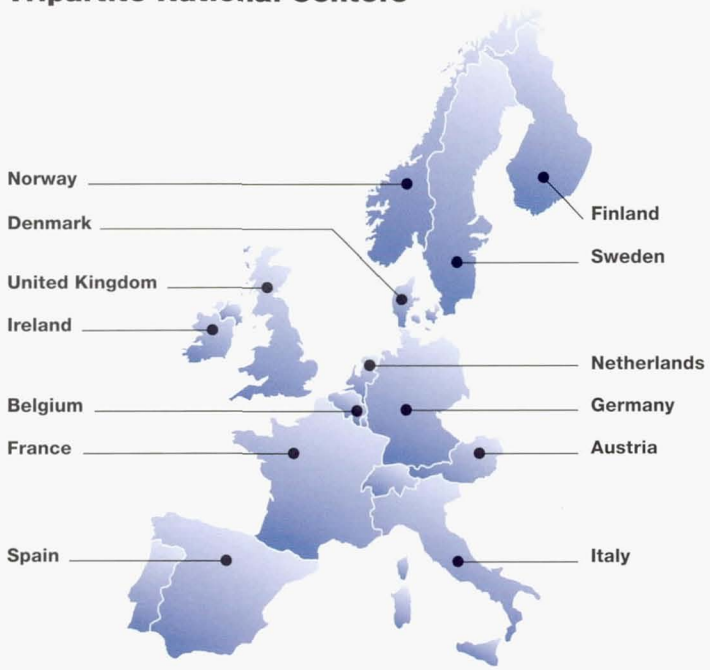
- Foreign competitors are increasing their challenge to U.S. leadership in critical technologies.

Through decades of international activities, the NASA STI Program has developed an enormous knowledge base of foreign R&D. This work not only fosters better relations among NASA and members of the international community ... it provides valuable new STI for our domestic R&D efforts.

"Exchange" is the key to the NASA International STI Program. In return for foreign STI, NASA gives overseas partners access to U.S. aerospace information, as well as STI from other international sources.

Our International Program relies on three basic kinds of exchange agreements: bilateral, ESA tripartite, and national.

International Partners with NASA/ESA Tripartite National Centers



Since 1978, major aerospace information organizations in ESA member states have been given the additional responsibility to be proactive within their country and to *coordinate relationships with NASA through ESA.*

Bilateral Agreements

Dating from the mid-1960s, bilaterals were the earliest exchanges between individual foreign organizations and the NASA STI Program office. Many such agreements are still active.

In 1990, over 60 foreign organizations sent us more than 2,500 reports and papers from Australia, Belgium, Canada, Czechoslovakia, Denmark, Finland, France, India, Italy, Japan, Netherlands, Norway, Poland, Sweden, Switzerland, United Kingdom and West Germany. (See the pie chart on page 12 for a better sense of the importance of international acquisitions to the STI database.)

ESA Tripartite Agreements

Through ESA and its predecessor, the European Space Research Organization (ESRO), NASA has an umbrella relationship with the major Western European countries that dates back more than 25 years.

Today, this mutually rewarding association has evolved into a special partnership in which ESA, as a major on-line European database host, provides on-line access to the NASA Aerospace Database for Europe. (The NASA Aerospace Database contains citations to the richest supply of aerospace report and journal literature in the world.)

In exchange, ESA has taken over management of many previous bilateral exchanges with European institutions in member countries under what are called NASA/ESA tripartite agreements. ESA acts as the consolidator of European input to NASA from the tripartite institutions and as the distributor of NASA information back to these same institutions.

In 1990, ESA provided NASA with 2,738 citations. Each was fully-indexed and abstracted according to NASA specifications — making it ready for loading into the NASA Aerospace Database and backed by copies of the complete reports. These reports were submitted to NASA by 145 organizations from 13 Western European countries.

Nation to Nation

As the European relationship became increasingly productive and beneficial to NASA, the bilateral agreements with individual institutions around the world were viewed as inefficient

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arrangements. Where possible, the NASA STI Program adopted a national level approach in dealing with foreign countries.

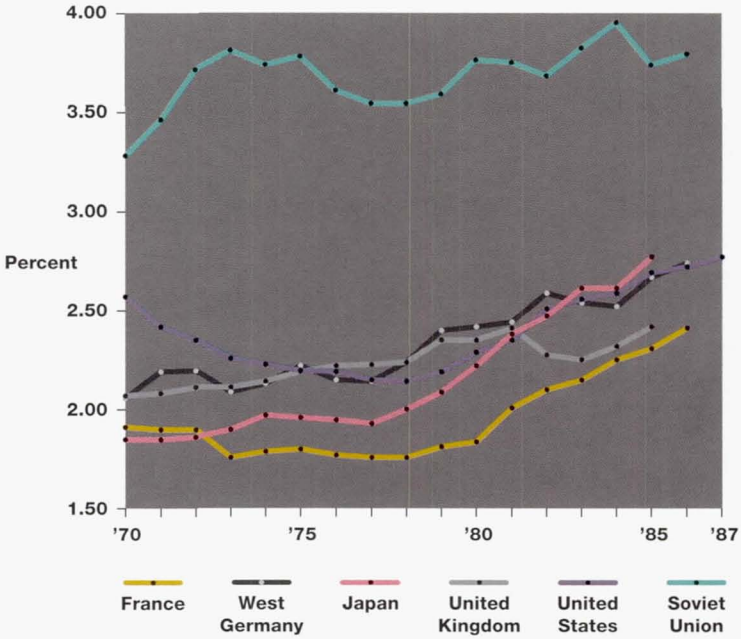
Under this strategy, NASA and the foreign government's national organization handling aerospace activity sign a "Technical Protocol."

Countries are selected for these protocols based on NASA interest in the country's R&D. Single countries in some cases are acknowledged leaders in select scientific and technical disciplines.

The protocols call for the NASA counterpart organization to act as the coordinator of the exchange for aerospace information between NASA and that country. Under this arrangement, the partner has access to NASA's International Aerospace Database — in exchange for that country's information ... provided in specified formats compatible with the NASA information processing system.

To date, we have national level agreements with Canada, Israel and Australia. Negotiations are continuing with Japan, and fruitful, early discussions have begun with Hungary.

Total R&D Expenditures as a Percentage of GNP



Source: Science & Engineering Indicators - 1987

The relatively high level of Soviet R&D expenditures hints at their abundance of STI — and the need to pursue negotiations with their successors toward a mutually beneficial exchange of STI.

In September 1991, NASA STI Program representatives visited members of Australia's Defence Information Services (DIS) to review implementation procedures for the Australian Protocol. Attendees included (left to right) Anne Robinson, DIS; Thomas Lahr, NASA; Judy Hunter, NASA; Linda Beverage, DIS; Michael Streeks, NASA; Gladys Cotter, NASA; Thomas Hermann, NASA; and Denise Bird, DIS.

Representatives from the STI Program have also had opportunities to meet with Soviet Union scientists from a number of organizations, including the Central Aero-Hydrodynamic Institute (TsAGI), the All-Union Institute for Scientific and Technical Information (VINITI), the Moscow Aviation Technological Institute (MATI), and the Institute of Chemical Physics (ICP). By the end of fiscal year 1991, the Program had prepared a project description and proposal to obtain U.S. State Department authorization to visit Moscow in 1992 and see if these organizations would be receptive to information exchanges with the NASA STI Program. ●

ICSTI

In 1990, NASA STI was elected into membership in the International Council of Scientific Unions (ICSU)/International Council for Scientific and Technical Information (ICSTI). ICSTI provides a forum for the exchange of information and the sharing of experience among international peers. It is intermissionary, interdisciplinary and international in its makeup.

In May 1991, the NASA STI Program participated in the first ICSTI Council meeting, hosted by the Institut de L'Information Scientifique et Technique (INIST) in Nancy, France. To celebrate its 40th anniversary, ICSTI sponsored an international information symposium in conjunction with the Council meeting. ●

Nation to Nation Exchanges — A Closer Look

Israeli Protocol — NASA signed the first nation to nation Technical Protocol in 1986 with the Israeli Space Agency (ISA). ISA is part of Israel's Ministry for Science and Development. The agreement remains in effect until October 1992.

Australian Protocol — NASA and the Australian Department of Defence, Information Services Branch signed the Australian national agreement in early 1988. After a period of negotiation over cooperation in certain technical areas, the agreement was fully implemented in 1990.

Canadian Protocol — In 1989, NASA signed an agreement with the Canada Institute for Scientific and Technical Information (CISTI) of the National Research Council of Canada. The agreement, which has been fully implemented, provides for the mutual exchange of both paper document and bibliographic database information.

Japan — Negotiations are progressing with the National Space Development Agency of Japan (NASDA), that country's national center for the exchange of aerospace STI. While discussions are still underway on various technical and policy areas, there is already basic agreement on the approach for the Technical Protocol.

Hungary — In early 1990, the Hungarian Academy of Sciences initiated negotiations for the exchange of aerospace information. Review by NASA indicates that there is a potential for a mutually beneficial agreement. Negotiations on an exchange of STI are continuing.

AGARD

AGARD — the Advisory Group for Aerospace Research and Development — is an agency of the North Atlantic Treaty Organization (NATO) Military Committee. Founded in 1952, the agency's main tasks are to:

- Exchange information relating to aerospace R&D among NATO nations.
- Stimulate cooperation among the nations.
- Advise NATO's military committee.

AGARD's operations are carried out by nine technical panels. One of these — the Technical Information Panel (TIP) — is composed of information center managers and administrators as well as information specialists. All 36 panel members are from NATO nations.

The Director of the NASA STI Program is the U.S. Panel Coordinator for AGARD/TIP. Recent AGARD developments in which NASA STI members played a key role include:

Coordinated Intellectual Property Rights lecture series in the U.S. — Intellectual property has become one of the keys to the management of high technology sectors and communications systems. The examination of intellectual property rights is a natural outgrowth of these developments. Gladys Cotter, Director of NASA's STI Program, coordinated the lectures in Arlington, Virginia in November 1991 — the only U.S. location in the series.

Provided support to nations developing information systems and programs — Spain, for instance, is developing a centralized aerospace database and asked the NASA STI Program for assistance. Likewise, Portugal, Turkey and Greece have requested our expertise. The NASA STI Program will participate in a lecture series in those countries focusing on the establishment and operation of an STI program.

NATO Thesaurus — TIP members were involved in the development of a NATO thesaurus that provides an international standard and controlled vocabulary throughout the NATO nations. NASA STI Program input was crucial in this project. We will continue to provide the thesaurus with new terminology, definitions and descriptions in the months and years ahead as we update our own NASA terminology.

A Manual for the Evaluation of Information Centers and Services — With NASA STI Program assistance, TIP produced this manual to help all documentation and information centers

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throughout NATO. The manual offers proven strategies and techniques for determining the effectiveness of information centers and their services.

Foreign Acquisitions Workshop

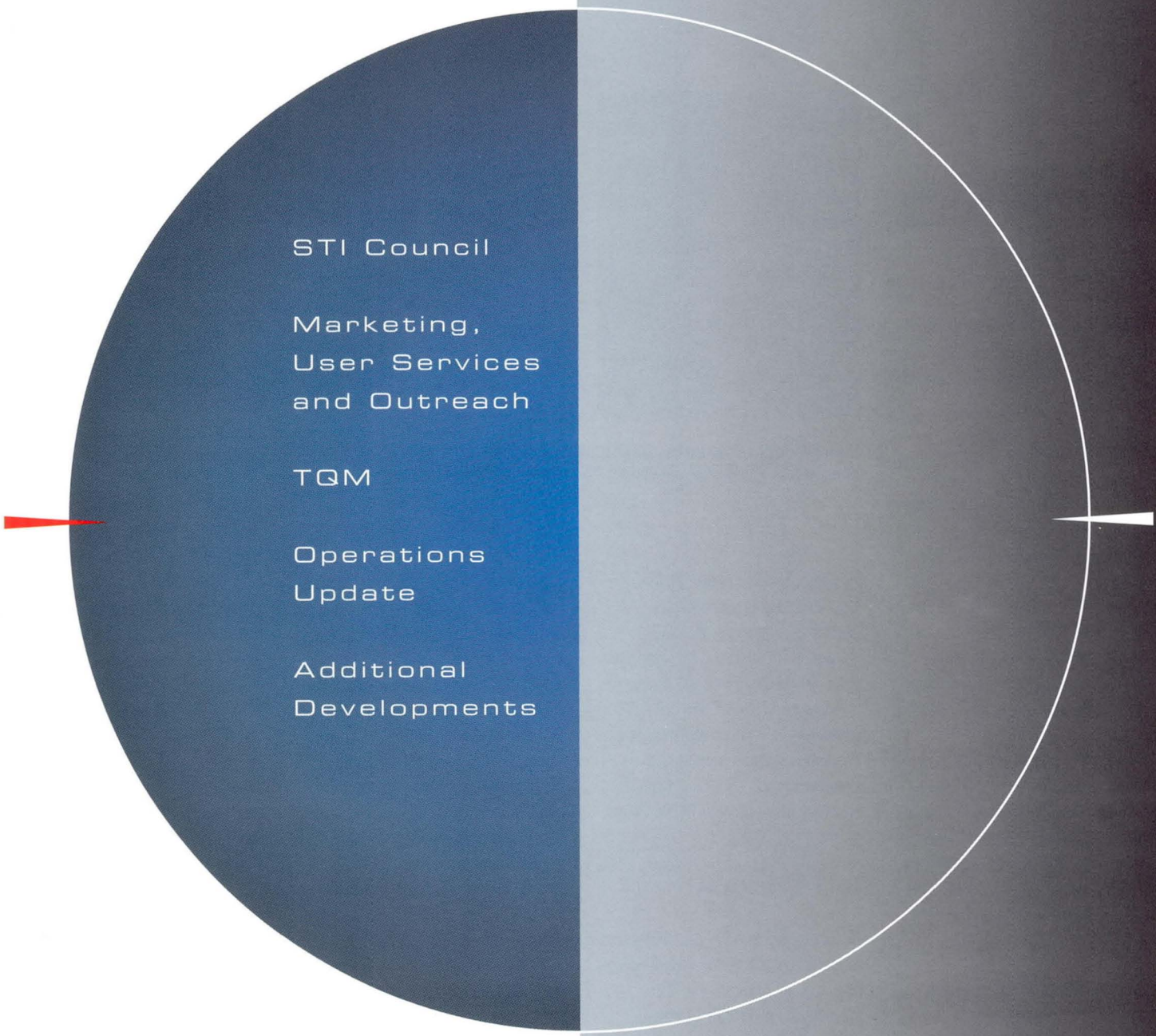
The NASA STI Program recently hosted a "Foreign Acquisitions Workshop" for U.S. agencies active in acquiring foreign documents.

The purpose of the workshop was to discuss methods of acquiring foreign STI through vendors and brokers, foreign service and local representatives, and improved exchanges. The workshop included meetings and discussions of interagency joint venture and cooperative programs. Members expressed appreciation for the detailed briefings of individual agency programs.

NASA is also expected to host the next "Foreign Acquisitions Workshop," tentatively scheduled for July 1992. ●

At NATO/AGARD's TIP symposium, part of the annual meeting held last October in Madrid, three TIP members from the United States confer — Gladys Cotter, Director-NASA STI Program; Walter Blados, International Specialist-NASA STI Program; and Dr. J. Marshall Hughes, Chief Librarian-Naval Surface Warfare Center, Dahlgren, Virginia (left to right).

Ms. Jackie Hergert of the U.S. State Department was among the foreign acquisitions specialists who addressed attendees at the NASA STI Program's Foreign Acquisitions Workshop.



STI Program Headquarters

Headquarters' duties fall into four broad categories:

1. Program Direction — Provide direction for the development, communication and coordination of NASA STI policy, procedures and standards.

2. Information Management — Acquire, manage and provide access to relevant aeronautic and space science STI.

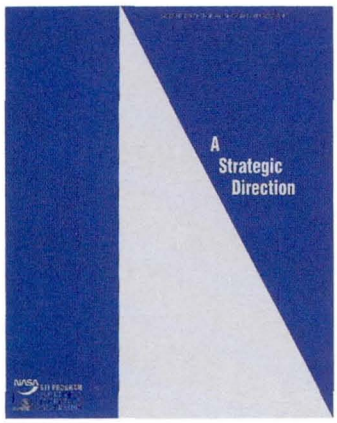
3. Consultation — Provide consultation and assistance to NASA program offices and activities in planning, developing and implementing STI activities.

4. Representation — Represent NASA in a broad range of interagency, international and domestic STI activities.

One overarching goal shapes each of those duties — to ensure that the NASA STI Program is a leader in the management and use of scientific and technical information. Many new developments in 1991 helped the Program with that goal.

Plan for the Program's Future Formalized

Through discussions in 1991 among NASA Headquarters, NASA Centers, other Federal agencies and international exchange partners, the STI Program formulated its Strategic Plan. The plan gives the Program a renewed sense of direction by focusing on future opportunities, customer requirements and Program goals — along with the changes needed to achieve those goals.



The major, long-term goals of the NASA STI Program Strategic Plan are outlined in this attractive booklet.

STI Council

A successful NASA STI Program must always look for new ways to improve its operations. The recently founded STI Council shares that critical interest.

The Council, made up of senior program- and support-office representatives, reviews current STI Program policies and goals. The Council ensures a range of perspectives on the Program from NASA's highest levels.

The Council provides impartial advice and counsel to the Program, aimed at identifying:

- The STI requirements of NASA scientists and engineers
- As stated in the 1958 Space Act, NASA responsibilities regarding the widest practical dissemination of its information to the scientific and engineering communities at large
- To what degree the NASA STI Program meets these requirements
- What changes, if any, should be made in the Program

At their first meeting, held April 12, 1991, the Council reviewed the Program's Strategic Plan, then recommended that three actions should be handled over the next twelve months:

1. Determine the basic requirements for the STI Program — Define current user requirements for STI across all NASA Centers. Survey users and non-users. This study, which is being carried out in two phases, began in July 1991 and will end in April 1992.

2. Improve the STI database — Devise methods for improving STI database content and access — without additional budget. "Database" refers to all resources that can be accessed through the STI Program, regardless of format, media or location.

3. Determine the benefits of the Program to its users — Develop a statistical baseline of the use of NASA STI Program products and services, and evaluate the impact of that use. This study is being conducted in three phases, with an option for further action, based on Council recommendations.

This analysis should identify new access and delivery methods for STI, and the cost and impact of each.

In sum, these tasks mandate a critical reassessment of three key aspects of the STI Program. The Program welcomes these tasks as opportunities to revalidate the STI Program — and gain new, valuable insights as well. ●

Marketing, User Services and Outreach

Among the findings of an ad hoc Review Committee of Headquarters and Field Installation executives: Many NASA researchers simply are not aware of the STI Program infrastructure already in place to meet their needs. Results of a survey conducted by Dr. Thomas Pinelli of Langley Research Center at the committee's request reaffirmed this conclusion.

To remedy the Program's poor visibility, three new efforts are being undertaken — each aimed at publicizing Program capabilities and improving communications with current users at NASA Centers while developing new users at Centers and elsewhere.

General Marketing. We've launched a new STI Program marketing campaign that has a "supermarket" focus. The effort concentrates on Program exhibiting at conferences serving a range of audiences — all united by a need for STI Program products and services.

We've introduced two marketing themes:

- "NASA's Best Kept Secret"
- "Managing a Universe of Information"

ORIGINAL PAGE
COLOR PHOTOGRAPH

Jonathan Grant (far left), a reference analyst at CASI, Rixie Schmidt (second from left), documents acquisitionist at Redstone Scientific Information Center and Nancy Stilson, a Redstone reference librarian, chat with visitors to the new STI Program exhibit booth at Space Summit '91.

Over the past several months, Headquarters has worked closely with Lewis Research Center to design and assemble a modular exhibit tied to those themes. The result is a lightweight, attractive booth, whose flexible design elements make it easy to tailor the exhibit to each show.

In 1991, the STI Program brought its new, proactive marketing approach to nine conferences and trade shows:

AAAS '91— American Association for the Advancement of Science, Washington, D.C., February 16-18

SCOUG '91 — Southern California Online Users Group, San Diego, March 13-16

GISDEX — Geographic Information and Spatial Data Exposition, Crystal City, Virginia, July 9-12

1991 Summer Computer Simulation Conference — Society for Computer Simulation, Baltimore, Maryland, July 22-24

SAE Aerotech— Society of Automotive Engineers, Long Beach, California, September 22-26

Space Summit '91 — The University of Alabama, Huntsville, Alabama, October 29-31

DTIC '91/Annual Users Conference— Department of Defense, Alexandria, Virginia, November 6

SuperComputing '91— Association for Computing Machinery and the Institute of Electrical and Electronics Engineers, Albuquerque, New Mexico, November 18-22

Technology 2001— NASA and NASA Technology Utilization, San Jose, California, December 2-4.

We're producing a series of brochures and related marketing materials for use at our exhibits and in a variety of other promotions. These publications will reinforce awareness about how Program products and services can help users meet NASA mission goals ... and show potential users how the Program infrastructure can help them eliminate redundant projects, provide background information when starting a new project, and answer questions about research in progress.

Improving Center Communications. To get a better sense of Center needs — and how the NASA STI Program can best meet those needs — we've placed a new emphasis on User Services. Appropriately, these moves dovetail with the STI Council's first recommended task of determining the Program's basic requirements.

→

The goal is to create a stronger team spirit nationwide by having Headquarters STI Program representatives work more closely with each Center's STI manager and staff.

Part of that responsibility falls to our Center Coordinator, a new Headquarters role created to ensure that Center concerns are handled promptly and efficiently.

A second strategy for improving communications is to re-cast the STI management reviews held at each Center. Beginning with Ames Research Center in February 1992, senior members of the Headquarters staff are conducting an on-site, in-depth review of all aspects of the Center's STI Program. Centers will be encouraged to offer their input on how their needs can be best met.

These new efforts were launched at the NASA STI Conference and Workshops '91, held April 9-11, 1991, at the Marshall Space Flight Center. The record STI Annual Conference attendance of approximately 100 included representatives from NASA Headquarters, all Centers, and numerous contractors.

The program had a three-part focus: STI purpose, product and customers; current developments and technology trends; and STI Program strategy and plans for the 1990s. Attendees enjoyed a variety of lectures, panel discussions, workshops, and work site tours. Participants exchanged information on innovative methods to improve productivity, and new technologies and their application in an STI environment.

Johnson Space Center will host the next STI Annual Conference, scheduled for April 29-May 1, 1992.

Outreach and Program Office Support. The Outreach Program is yet another effort to improve Program visibility and responsiveness. Here, the focus is on reaching the NASA research community through NASA program offices. To date, efforts have included presentations at conferences, meetings and workshops addressing critical aspects of STI Program technology.

Often, these events offer new opportunities for the Program to expand its activities further still. For instance, NASA STI Program representatives spoke to the Potomac Valley Chapter of the American Society for Information Science last February about digital document storage and the challenges presented by large document databases.

A NASA astrophysicist in attendance invited the participating Program representatives to speak at an online astronomy documentation workshop to be held in Columbia, Maryland the following month. The Columbia presentation led to the Program's involvement in the STELAR program, an experiment in the electronic delivery of journal articles (see page 19). ●

TQM

TQM Drives NASA-Wide Program Developments

At the NASA STI Program, the revolutionary management tool of Total Quality Management (TQM) is the force that unifies and powers our efforts to improve the Program NASA-wide.

A long-range process with many interim successes, TQM operated on various fronts on 1991, as detailed in the following developments and elsewhere. ●

Operations Update

Matching NASA STI Program users with the information they want — promptly, courteously and efficiently. Everything the Program does is built around that core function.

To meet that objective, our Operations area is developing:

- New and better ways to improve our response time for filling orders, and
- Innovative approaches that ensure our products and services are timely and of unwavering quality.

Several current projects address these needs.

Reviewing the CASI Microfiche Archive. Nearly one million of the three million records in the STI database have been microfiched, with some pieces dating back nearly 30 years. Cursory inspection has shown a portion of these records are deteriorating, unusable or both.

The STI Program has retained a consultant to inspect our microfiche archive and recommend ways to improve our quality control procedures. Review and testing of these new procedures will take place throughout 1992.

Re-Filming Documents. Many of the original documents in our CASI collection were microfiched on acetate-based film according to the standard of the day — 5" x 8". (Now we use polyester-based film, which is more durable and easier to store.) Today, we can't reproduce documents from microfiche in this outmoded size.

To increase the amount of information we can deliver to users, we're retrieving and re-filming nearly 15,000 documents captured in the earlier format — each according to the latest micrographic standards.

Once re-filming is complete, we'll be able to reduce the time to fill orders for those documents: orders that used to take up to four months to fill will take only two or three days.

Document re-filming will take approximately one year to complete.

Upgrading the CASI Infrastructure. This move has several components and primarily addresses CASI computer and communications capabilities:

- *Optimizing Internal Systems* —To help do this, we're implementing an Ethernet local area network (LAN). Local area network, workstation-based architecture is cheaper and easier to maintain. We'll use it primarily for internal systems, such as accounting, registration and compiling the Thesaurus.
- *Enhancing Desktop Publishing*—We'll accomplish this upgrade — and the related capabilities of graphics design and imaging — by adding additional microcomputers. This will simplify and speed up design and production of our many product publications as well as many of our new marketing materials that will describe them.
- *Improving Tape Storage and Exchange* — As already mentioned, we have tape exchange agreements with numerous agencies in the U.S., and STI partners around the world. Our new tape system — already installed on our mainframe — lets us put a copy of our database on a cartridge instead of a 16-track tape ... making tape interchange easier than ever. Another advantage: cartridge back-ups are easier to make and store than tape back-ups.

Speeding Up the Dissemination of Bibliographic Information. Currently, documents are processed according to the *STAR* publication cycle, which takes about three months. Our goal is to make documents available to users within two weeks of receipt at the CASI. We'll accomplish this goal by altering the document processing cycle to ensure that documents are available for distribution as soon as they're announced in RECON — not after they're announced in *STAR*. This document processing innovation was scheduled to be introduced in March 1992.

Reviewing our Internal Processing Systems and Developing Enhanced Functional Requirements. The systems for accounting, compiling the Thesaurus, file updating, and registration tend to be inefficient and mainframe dependent. We are in the process of upgrading these systems to make the NASA STI Program even more competitive and responsive to user needs.

Refining the Existing STI Acquisitions, Processing and Delivery Systems. In this, the first in a series of moves aimed at improving these systems, the Program is making a comprehensive analysis of our current processes of inputting, document ordering and inventory management. On the input side, the aim is to upgrade the scope and efficiency of our new STI. On the output side, our purpose is to speed up our document delivery and upgrade the quality of our document reproductions. ●

Additional Developments

In 1991, several projects in addition to those already mentioned helped us ensure that STI Program products and services meet user needs.

Gateway Requirements Analysis. The STI Program provides users with the world's largest collection of information on aeronautics and space science. Still, broader coverage may be needed to meet all of NASA's R&D needs. In March and April, the Program had a study team examine the wisdom of developing an intelligent gateway interface so that our R&D community could access STI sources outside the RECON bibliographic database. To help assess our user needs, four Centers participated in the study— Goddard, Langley, Lewis and Ames.

Among the findings: NASA researchers do indeed need more comprehensive STI coverage as well as a better system for alerting them to recent developments in their areas of interest. It was recommended that NASA test a prototype intelligent gateway for six months to determine the benefits of expanded STI coverage. NAM is that prototype ...

NASA Access Mechanism (NAM). NAM will let NASA researchers access countless new sources of STI worldwide within minutes — and all from the computer in their own work area. Programmers at NASA STI Program Headquarters are currently writing the software that will make this possible.

In the second quarter of 1992, when a NAM prototype is ready, Program representatives will visit Centers around the nation to show libraries and researchers how NAM works. The researchers will use the software for six months, noting its strengths and weaknesses. Then the STI Program will decide whether to develop a production version of this software for application NASA-wide.

NAM features include: *User Interface*— a highly user-friendly graphics component; *Resource Locator*— an STI searching and locating tool that automatically navigates various networks and protocols ... worldwide; *E mail*— lets researchers communicate with their peers inside and outside NASA; and *Toolbox*— integrates the software's communications and networking capabilities.

Internetworking/NREN. Technology continues to increase the speed and ease with which we can interact with other STI Centers around the nation, and partners around the world. Perhaps Internet is the best-known computer network. Many Federal agencies, universities and →

private companies use it to exchange information worldwide.

But while Internet presents opportunities, it also has serious limitations, such as:

- The type and quality of its service are uneven.
- It doesn't reach the entire research and educational community.

In the 100th Congress, Senator Albert Gore (D-Tenn.) introduced legislation for the establishment of the National Research Education Network (NREN). This telecommunications infrastructure will substantially expand and upgrade the existing interconnected array of mostly scientific research networks. For example, one of its goals is to reach a three gigabit per second capacity by 1996 (about 100,000 typed pages per second).

The NASA STI Program monitored the progress of this momentous legislation throughout the year. Since its enactment in September 1991, the Program has been moving aggressively to ensure that our users are among the first to reap its many benefits.

RECON Processing Improvements. In 1991, we simplified the process for announcing and disseminating NASA research reports. Now reports can go into the STI database as soon as CASI receives them, with the immediate knowledge of their distribution limits. In the past, this process sometimes took months.

To expedite the processing of materials into RECON, CASI no longer requires the Document Availability Authorization (DAA) when Centers submit reports. However, a distribution statement is still required. This statement of availability can be in the form of a label on the cover of the report, in a separate cover letter, or the notation on the Report Documentation Page (RDP).

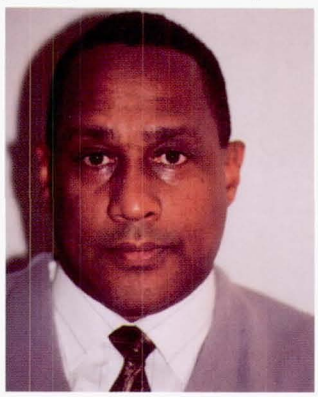
Previously, reports sometimes arrived at CASI minus the Document Availability Authorization (DAA) — approval from the Center and NASA Headquarters on a report's range of distribution. Now CASI simply checks the report's statement of availability without having to wait for the DAA. The statement identifies the proper distribution, and the report can then be announced to our users on RECON, as appropriate.

Centers are responsible for getting the proper DAA sign-offs. In early 1992, results from the Electronic Data Exchange Project, a pilot project underway at the Ames Research Center, will offer insights on how we can automate — and streamline — the DAA approval process NASA-wide.

New Printing Manager Dedicated to New Era of Printing Management. Mr. Fred Moore was recently named NASA's Printing Management Officer. He assumed his new duties in October. Mr. Moore's primary responsibility is to coordinate printing policies and standards agency-wide. He will also be meeting with Center printing managers to review requirements and operations at all NASA printing plants and duplicating facilities.

Mr. Moore says he is committed to ensuring a new era of cooperation and understanding between NASA and the Joint Committee on Printing.

Prior to joining NASA, Mr. Moore served 10 years as manager of the printing function at the U.S. Marine Corps. Previously, he spent 18 years as the director of printing for the U.S. Army. ●



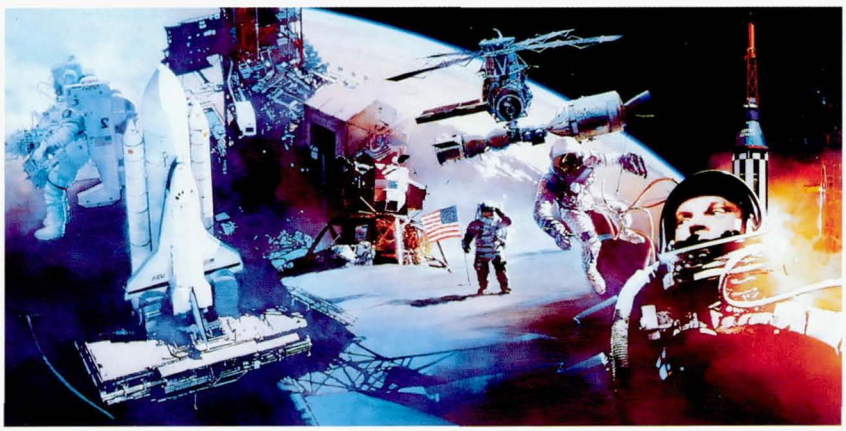
Fred Moore

Prologue to the Future

Since its founding, NASA has been dedicated to ensuring U.S. leadership in aeronautics and space science.

Within the scope of its duties, the NASA STI Program has played an important part in helping NASA maintain its leadership role.

But what went before — the momentous tides of history that shaped our nation's need for the NACA and NASA, the breakthrough R&D discoveries and spectacular aeronautical and space science successes that followed — all of that is prologue. Every eye is now on the future.



Houston artist Alan Chinchar captures 30 years of U.S. manned space flight (1961-1991).

At NASA STI Program Headquarters and at Centers across the nation, we are preparing for a future filled with more challenges and opportunities than ever before. As you have seen, we are reviewing and upgrading our operations; improving our communications throughout NASA, the nation and the world; and putting programs in place that will not only consolidate these gains, but foster still others.

As this decade unfolds, the STI Program is positioning itself for an even more comprehensive, systematic use of computer and communications technology for all phases of our operations. The revitalized STI database will continue to serve our users — more quickly and more comprehensively than ever before. Gateways and networks will give NASA researchers and STI Program professionals access to additional rich sources of STI worldwide.

As the world continues to shrink, the NASA STI Program is ever mindful that we are not a separate entity. We are part of the team that supports NASA R&D, and NASA R&D supports the larger Federal research community. We continue to focus on these realities in ways that benefit our users. Partnerships already exist — and others will be formed, as needed — to heighten our current levels of interagency and international cooperation.

Of course, the future we see is filled with high-tech advances. One day, for instance, interactive multimedia might prove invaluable to the STI Program. It could bring a universe of words, sounds and images to our fingertips. But only when the technology is ready. And only if it will bring meaningful benefits to our users.

We shall continue to seek the guidance and wisdom of the STI Council. They bring a truly unique perspective on how the NASA STI Program can best meet user needs.

As this Program Overview has shown, all our efforts are united by the common bond of an STI Program dedicated to developing a community of satisfied, productive users. We shall continue to cultivate our users' enthusiasm and value their input. We're committed to spreading the word about the STI Program — and assessing its impact on those we serve.

The NASA STI Program is using its resources as effectively as possible to help meet the mission needs of NASA. With proactive policies now in place, the Program remains vital, vigorous and eager to exploit new opportunities as they arise. ●

Key Acronyms

AGARD
Advisory Group for Aerospace Research and Development

ARIN
Aerospace Research Information Network

CASI
Center for AeroSpace Information

CD-ROM
Compact Disk — Read-Only Memory

CENDI
Commerce, Energy, NASA, Defense, and Health and Human Services Information

CISTI
Canada Institute for Scientific and Technical Information

DAA
Document Availability Authorization

DIS
Defence Information Service (Australia)

DOD
Department of Defense

DOE
Department of Energy

DTIC
Defense Technical Information Center (Department of Defense)

ESA
European Space Agency

ESRO
European Space Research Organization (now ESA)

FCCSET
Federal Coordinating Committee on Science, Engineering and Technology

GPO
Government Printing Office

IAA
International Aerospace Abstracts

IAC
Industrial Application Center

ICSTI
International Council for Scientific and Technical Information

ICSU
International Council of Scientific Unions

INIST
Institut de L'Information Scientifique et Technique

ISA
Israeli Space Agency

LAN
Local Area Network

NACA
National Advisory Committee for Aeronautics

NAM
NASA Access Mechanism

NASA
National Aeronautics and Space Administration

NASDA
National Space Development Agency of Japan

NATO
North Atlantic Treaty Organization

NLM
National Library of Medicine (Department of Health and Human Services)

NREN
National Research Education Network

NSSDC
National Space Science Data Center

NTIS
National Technical Information Service (Department of Commerce)

OAST
Office of Aeronautics and Space Technology

OSTI
Office of Scientific and Technical Information (Department of Energy)

OSTP
Office of Science and Technology Policy

OTA
Office of Technology Assessment

R&D
Research and Development

RECON
REsearch CONnection

RTOP
Research and Technology Objectives and Plans

SCAN
Selected Current Aerospace Notices

STAR
Scientific and Technical Aerospace Reports

STELAR
Study of Electronic Literature for Astronomical Research

STI
Scientific and Technical Information

STILAS
Scientific and Technical Information Library Automated System

TIP
Technical Information Panel

TIS
Technical Information Service

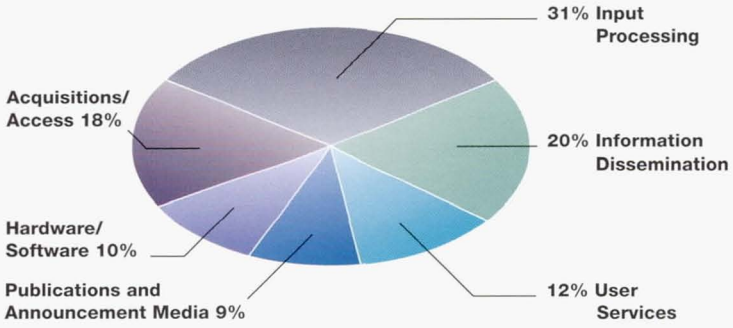
TQM
Total Quality Management

TU
Technology Utilization

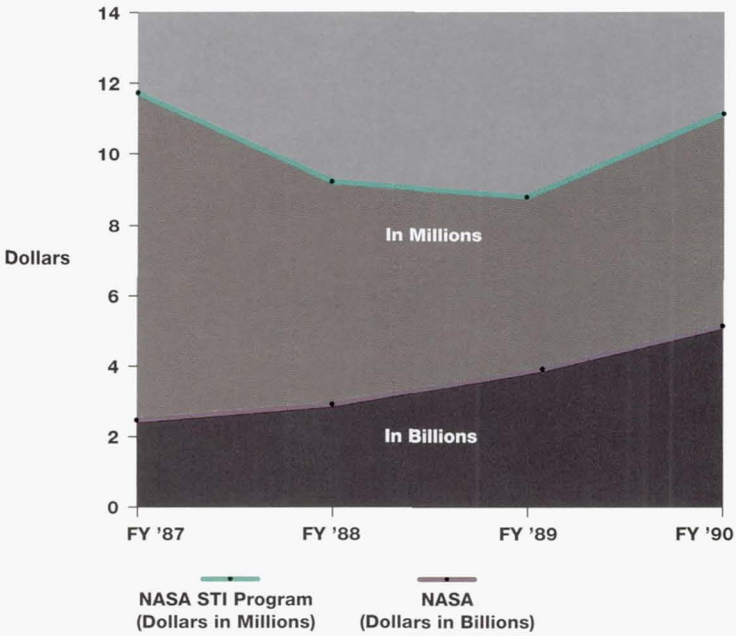
How Our Money Is Spent

In the chart below, you can see how NASA STI Program Headquarters allocated its operating funds for fiscal year 1991.

Total: $12,070,000



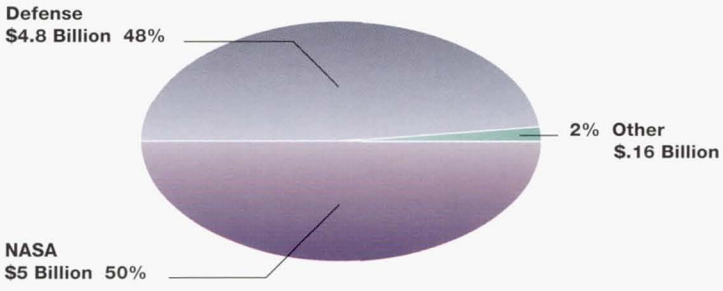
R&D Budget of NASA ... and the NASA STI Program



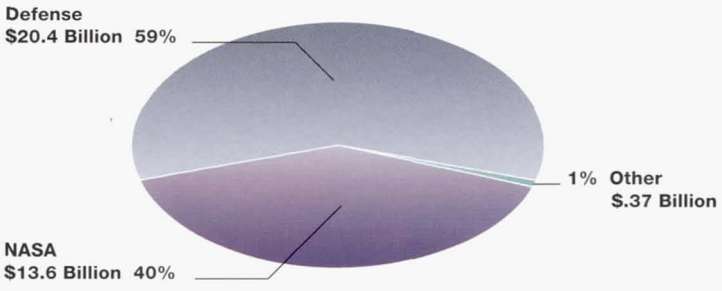
Sources: NASA Pocket Statistics, January 1991

U.S. Space Activities by Department

1981

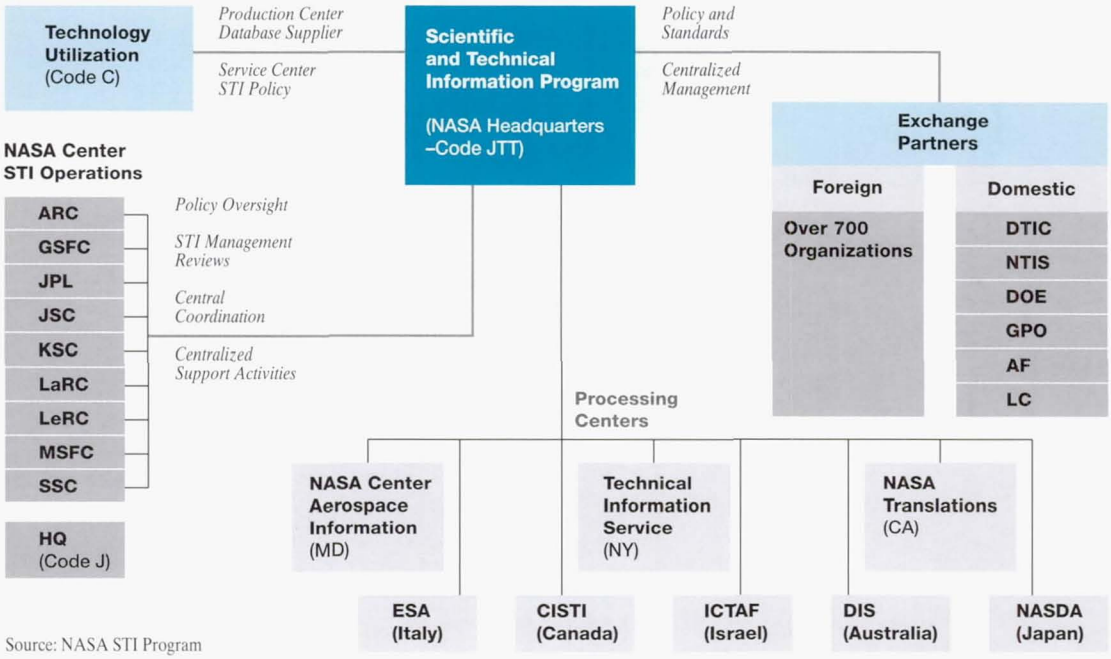


1991



Source: Aeronautics and Space Report of the President

STI Program Organizational Components



Source: NASA STI Program

STI Program Management Team

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Thomas F. Lahr
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Barbara T. Everidge
Resources Management

Fred Moore
NASA Printing Management Officer

Phil Thibideau
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John Wilson
Project Management

Patt Sullivan
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