

## Reaching Consensus on the Open Flow and Governmentwide Dissemination of Federal STI

### Open Flow of STI

The U.S. scientific and technical enterprise is premised on the open exchange of STI. The basic premise of openness has generally been modified only in narrowly defined areas of STI relating to national security. Recently several trends have converged to raise questions about the need to restrict the flow of Federal STI for other reasons.

First, the United States is no longer a leader in many areas of science and technology. The U.S. advantage that existed during the post-World War II years, through the 1950s and 1960s, has evaporated. Second, the global economy is more competitive, with foreign countries and companies challenging U.S. dominance in several economic sectors. Third, the U.S. military industrial advantage is under competitive pressure from foreign manufacturers. Fourth, electronic technologies vastly speed up the collection, storage, dissemination, and use of STI and thus accelerate the rate of information transfer within the global scientific and technical community.

Several efforts to restrict access to Federal STI for economic or security reasons emerged in the 1980s.<sup>1</sup> The Department of Defense (DoD) generally supports an open exchange of basic research information to promote scientific progress in defense technology. However, some DoD agencies and

services (e.g., especially the Air Force and National Security Agency (NSA)) favor restrictions on access to applied research and technical information. This led to proposals to give NSA the lead in ensuring government computer security and to extend NSA's authority to so-called "sensitive but unclassified" Federal information.<sup>2</sup>

"Sensitive but unclassified" was to include unclassified information that becomes sensitive to the national security when, for example, it is aggregated in electronic form and available over online databases. Opposition to this proposal by the commercial information industry, academia, scientific and library associations, civil liberties groups, and Congress led to enactment of the Computer Security Act of 1987. This act assigned the National Bureau of Standards (now the National Institute of Standards and Technology (NIST))—rather than NSA—the lead role for civilian computer security, and limited the role of DoD with regard to unclassified, civilian Federal information. Information industry and civil liberties representatives, among others, are still concerned about the NSA role in civilian information systems, and its potential to interfere with the free flow of unclassified Federal information.<sup>3</sup>

Congress seeks to ensure that the flow of scientific and technological information is equitable and

<sup>1</sup>See U.S. Congress, Office of Technology Assessment, Federal Government Information Technology: *Management, Security, and Congressional Oversight*, OTA-CIT-297 (Washington, DC: U.S. Government Printing Office, February 1986); Commercial *Newsgathering From Space*, OTA-TM-ISC-40 (Washington, DC: U.S. Government Printing Office, May 1987); Marine Minerals: Exploring Our New Frontier, OTA-O-342 (Washington, DC: U.S. Government Printing Office, July 1987), esp. ch. 7 on "Federal Programs for Collecting and Managing Oceanographic Data;" The Regulatory Environment of Science, OTA-TM-SET-34 (Washington DC: U.S. Government Printing Office, February 1986); International Competition in Services, OTA-ITE-328 (Washington, DC: U.S. Government Printing Office, July 1987); Defending Secrets, Sharing *Data*, O'C4-CIT-310 (Washington DC: U.S. Government Printing Office, October 1987); Science, Technology, and the First Amendment, OTA-CIT-369 (Washington, DC: U.S. Government Printing Office, January 1988); Holding *the Edge*: Maintaining *the* Defense Technology *Base*, OTA-ISC-420 (Washington, DC: U.S. Government Printing Office, April 1989).

<sup>2</sup>U.S. Congress, Office of Technology Assessment, *Defending Secrets*, op. cit., footnote 1, chs. 1, 6, and 7; also see W.R. Blades, "Controlling Unclassified Scientific and Technical Information," *Information Management Review*, vol. 2, No. 4, 1987, pp. 46-60.

<sup>3</sup>Public Law 100-235, the "Computer Security Act of 1987," Jan. 8, 1988. Also see testimony of Kenneth Allen, Senior Vice President, Information Industry Association and Marc Rotenberg, Director, Washington Office, Computer Professionals for Social Responsibility, before a May 4, 1989, hearing of the House Committee on Government Operations, Subcommittee on Legislation and National Security. The House Committee on Government Operations and industry and public-sector representatives are still not satisfied with the working relationship between NIST and NSA, and seek further assurances that NIST—not NSA—will be in charge of civilian computer security.

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reciprocal among nations.<sup>4</sup> The Secretary of State is directed to consider several factors in negotiating international scientific agreements:<sup>5</sup>

- scientific merit;
- equity of access by U.S. public and private entities to public (and publicly supported private) research and development (R&D) opportunities and facilities in each country which is a major trading partner of the United States;
- possible commercial or trade linkages with the United States which may flow from the agreement or activity;
- national security concerns; and
- any other factors deemed appropriate.

The “Stevenson-Wydler Technology Innovation Act of 1980”<sup>6</sup> and the “Federal Technology Transfer Act of 1986”<sup>7</sup> are efforts to reinforce the U.S. position in international competition by facilitating the transfer of technology from Federal laboratories to the private sector. These acts authorize Federal laboratories to cooperate with other governmental (Federal, State, local) entities and with the private sector (including universities and commercial firms) in R&D, and to license, transfer, or waive patent rights resulting from cooperative R&D. However, if

exclusive rights in technical data are given by the government to the private sector, this could result in constraints on the dissemination of much unclassified Federal STI.

A 1987 executive order directs agencies to transfer technical data by allowing Federal contractors and grantees to own rights in computer software, engineering drawings, and technical data funded by Federal contract or grant.<sup>8</sup> This executive order and other proposals by the Office of Federal Procurement Policy<sup>9</sup> caused a vigorous debate over how to transfer government-funded technology and still preserve the public value of knowledge produced with taxpayer money.<sup>10</sup> Agencies such as the Department of Energy (DOE) and National Aeronautics and Space Administration (NASA) consider the open exchange of technical information to be fundamental to their research missions. A blanket transfer of rights in technical data could impair research in fields such as energy and space that generate technologies that are valuable assets with commercial potential. Too much emphasis on short-term commercialization of technology and related technical data could actually impair the U.S. long-term competitive posture.<sup>11</sup>

In many fields of science and technology, STI developed by other countries is increasingly important. Policies that severely restrict public access to unclassified Federal STI might encourage similar restrictions by other countries and frustrate the international exchange of STI. The thrust of DOE policy in energy research is to increase—not decrease—the equitable exchange of international energy STI. The DOE Office of Scientific and Technical Infor-

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<sup>4</sup>See, for example, H.C. Relyea, *Striking A Balance: National Security and Scientific Freedom*, American Association for the Advancement of Science, Washington, DC, 1985; U.S. Congress, Office of Technology Assessment, Science, Technology, and the First Amendment, op. cit., footnote 1, ch. 4; and National Academy of Science, Panel on the Impact of National Security Controls on International Technology Transfer, Balancing the National Interest: U.S. National Security *Export Controls and Global Economic Competition* (Washington, DC: National Academy Press, 1987).

<sup>5</sup>Public Law 100-418, the “Omnibus Trade and Competitiveness Act of 1988,” Aug. 23, 1988, Part 11-Symmetrical Access to Technological Research, sec. 5171 (a) and (d).

<sup>6</sup>Public Law 96-480, Oct. 21, 1980.

<sup>7</sup>Public Law 99-502, Oct. 20, 1986.

<sup>8</sup>Executive Order 12591, Apr. 10, 1987.

<sup>9</sup>U.S. Office of Federal Procurement Policy, “Intellectual Property Rights Policy,” draft, February 1989.

<sup>10</sup>OFPP discussion of proposals to establish and transfer copyright in Federal computer software, see U.S. General Accounting Office, Technology Transfer: Copyright Law Constrains Commercialization of Some Federal Software, GAO-RCED-90-145 (Washington, DC: U.S. General Accounting Office, May 1990), and testimony of James W. Curlin, OTA, and other witnesses before an Apr. 26, 1990, hearing of the House Committee on Science, Research, and Technology, Subcommittee on Science, Research, and Technology. For general discussion of computer-related intellectual property issues, see U.S. Congress, Office of Technology Assessment, Computer Software & Intellectual Property, OTA-BP-CIT-61 (Washington, DC: U.S. Government Printing Office, March 1990), and *Intellectual Property in an Age of Electronics and Information*, OTA-CIT-302 (Washington DC: U.S. Government Printing Office, April 1986).

<sup>11</sup>I see, for example, the special issue, “Symposium on the Impact of Competitiveness,” *Government Information Quarterly*, vol. 6, No. 1, 1989.

mation manages the Energy Technology Data Exchange (ETDE) under the auspices of the International Energy Agency. Canada, Denmark, Finland, France, the Federal Republic of Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom participate along with the United States.<sup>12</sup>

Participating countries send summaries of energy-related STI to DOE on a monthly or biweekly basis. DOE transmits them to participating countries for dissemination to their own researchers and policymakers. The ETDE includes about 7,500 biweekly updated STI entries and over 2 million entries in the retrospective file. The latter is available by online commercial vendors to research organizations, universities, and libraries within the participating countries. Online usage is divided roughly as follows: industry (71 percent); academia (15 percent); and government (14 percent).<sup>13</sup>

Numerous vendors sell or resell Federal STI databases, or include significant Federal STI in more comprehensive databases, to both domestic and international customers. Reduced availability of Federal STI to commercial vendors (and for that matter, not-for-profit vendors as well), coupled with reciprocal restrictions by other countries, would reduce the utility and value of comprehensive, subject-specific databases.

The challenge is to develop an STI dissemination policy that:

1. encourages U.S. researchers to employ all means, including electronic where appropriate,

- ate, to facilitate access to and use of domestic and foreign STI; but at the same time
2. protects U.S. national security interests by controlling access to classified or narrowly defined militarily sensitive STI; and
3. encourages U.S. international competitiveness through:
  - a. the open, reciprocal international exchange of STI,
  - b. domestic transfer of federally funded technology from the Federal Government to the private sector where appropriate,
  - c. protection of private-sector proprietary rights in technology and data (to the extent non-Federal funds are used), and
  - d. domestic transfer of rights in technical data developed by or for the Federal Government (with Federal funding) to the private sector in narrowly defined areas where the benefits substantially outweigh the costs.<sup>14</sup>

Congress, the Office of Science and Technology Policy (OSTP), and the Office of Management and Budget (OMB) must reconcile their philosophical differences about the open flow of STI and provide guidance to the agencies. A balance is needed. This balancing should consider legislative proposals that focus on the open, unrestricted flow of Federal information<sup>15</sup> as well as legislation that would transfer federally supported technology and information to the private sector.<sup>16</sup> A balance must also consider statutes that promote information access

<sup>12</sup>International Energy Agency, *Energy Technology Data Exchange, 1989 Annual Report, ETDE/OA-37* (Oak Ridge, TN: U.S. Department of Energy, Office of Scientific and Technical Information 1989); International Energy Agency, *Introducing ETDE: An LEA Multilateral Information Program, ETDE/OA-06-Rev.* (Oak Ridge, TN: U.S. Department of Energy, Office of Scientific and Technical Information June 1989).

<sup>13</sup>*Ibid.*

<sup>14</sup>For some proposed policy statements, see "Changing Federal Relationships in Intellectual Property," February 1989 draft, provided to OTA by CENDI, and "Policy Directions [in New Regulations on Patents and Copyrights]," May 1989 draft, provided to OTA by NASA.

<sup>15</sup>U.S. Congress, House, H.R. 2381, the "Information Policy Act of 1988," 101st Cong., 1st sess., May 16, 1989; H.R. 3695, the "Paperwork Reduction and Federal Information Resources Management Act of 1989," 101st Cong., 1st sess., Nov. 17, 1989; and S. 1742, the "Federal Information Resources Management Act of 1989," 101st Cong., 1st sess., Oct. 6, 1989; also see U.S. Congress, House, H.R. 2773, the "Freedom of Information Public Improvements Act of 1989," 101st Cong., 1st sess., June 28, 1989, that would redefine government records for FOIA purposes to cover all "computerized, digitized and electronic information."

<sup>16</sup>See U.S. Congress, Senate, S. 550, the "Department of Energy National Laboratory Cooperative Research and Technology Competitiveness Act of 1989," 101st Cong., 1st sess., Mar. 9, 1989, as amended Aug. 4, 1989, and included as the "Department of Energy National Competitiveness Technology Transfer Act of 1989," in Title XXXI, Part C of S. 1352, the "National Defense Authorization Act for Fiscal Years 1990 and 1991," Aug. 4, 1989. Also see U.S. Congress, Senate, Committee on Armed Services, National Defense Authorization Act for Fiscal Years 1990 and 1991, Report No. 101-81, 101st Cong., 1st sess. (Washington DC: U.S. Government Printing Office, July 19, 1989); and U.S. Congress, Senate, Committee on Energy and Natural Resources, Department of Energy National Laboratory Cooperative Research and Technology Competitiveness Act of 1989, Report No. 101-108, 101st Cong., 1st sess. (Washington, DC: U.S. Government Printing Office, Aug. 4, 1989).

(such as the Freedom of Information Act (FOIA)<sup>17</sup>) and those statutes that tend to limit access.

The Defense Authorization Act of 1984 authorizes DoD to withhold certain unclassified but militarily sensitive and export-controlled scientific and technical information developed by or for DoD that would otherwise be accessible under FOIA.<sup>18</sup> NASA sought similar authority to withhold technical information about NASA-funded technologies. NASA policies also limit the dissemination of technical information to U.S. industry only, if it is likely to give the United States a competitive edge in commercializing NASA technology. But this information is currently available through FOIA requests, thus undermining NASA's policy. NASA has therefore sought to establish "significant potential for commercial use" as a statutory basis for FOIA exemption.<sup>19</sup>

A 1988 FOIA proposal supported by the Office of Science and Technology Policy and U.S. Department of Justice would have provided exemption for any STI that: 1) "was generated in a laboratory. . . owned and operated, in whole or in part, by the Federal Government"; 2) "has commercial value"; and 3) if disclosed under FOIA, "could be reasonably expected to cause harm to the economic competitiveness of the U.S."<sup>20</sup> This proposal was controversial and was challenged on several grounds, including:<sup>21</sup>

- the need for such a blanket exemption has not been established, since only a very small percentage of STI is commercially sensitive;
- such an exemption could set a dangerous precedent for undermining FOIA in other

subject areas and by other kinds of agencies; and

- an exemption could encourage reciprocal actions by other countries that would undermine the international exchange of STI and hurt the U.S. R&D effort in the longer term.

In reviewing Federal policy, Congress needs to take into account the changing economic realities. The globalization of the economy means that an increasing percentage of U.S. domestic R&D companies operate under foreign ownership, just as many U.S. corporations now have their own foreign subsidiaries. Most of the largest U.S. companies operate globally, with research, manufacturing, and marketing distributed over many countries. Similar trends are evident in the commercial information sector, to the point where one cannot assume that a U.S. information vendor operates under domestic rather than foreign ownership, and vice versa. Under these conditions, the old approaches to controlling information access do not work.

### Role of Governmentwide Dissemination and Archival Agencies in STI

As information changes from paper (and to a lesser extent microfiche) to electronic formats, the roles of the agencies with governmentwide dissemination and archival responsibilities require reconsideration. This is especially true for scientific and technical information, much of which is in digital form and may only be usable in electronic formats.

The major governmentwide agencies are: the Government Printing Office (GPO), responsible for printing, sales of selected documents by the Superin-

<sup>17</sup>For a detailed discussion of issues concerning an electronic FOIA, see J. Grodsky, "The Freedom of Information Act in an Electronic Age," in U.S. Congress, Office of Technology Assessment *Informing the Nation: Federal Information Dissemination in an Electronic Age*, OTA-CIT-396 (Washington, DC: U.S. Government Printing Office, October 1988), pp. 207-236; also see Jerry J. Berman, "The Right to Know: Public Access to Electronic Information%" in P.R. Newberg (ed.), *New Directions in Telecommunications Policy*, vol. 2, Information Policy and Economic Policy (Durham, NC: Duke University Press, 1989), pp. 39-69; H.H. Perritt, Jr., "Electronic Acquisition and Release of Federal Agency Information," Report to the Administrative Conference of the United States, Oct. 1, 1988 (also see the related article by H.H. Perritt, Jr., in *Administrative Law Review*, vol. 41, 1989, pp. 253 ff.); and Thomas L. Susman, Chairman, American Bar Association Committee on Government Information and Privacy, "Access to Electronic Information Under the Freedom of Information Act," draft report, Feb. 28, 1989. Also see statements of Ronald Plesser, Esq., Piper & Marbury, and Patti A. Goldman, Esq., Public Citizen, Inc., before a July 11, 1989, hearing of the House Committee on Government Operations, Subcommittee on Government Information, Justice, and Agriculture.

<sup>18</sup>U.S. Congress, Public Law 98-94, "Department of Defense Authorization Act of 1984," Sept. 24, 1983; also see W.R. Blades, "Controlling Unclassified Information," op. cit., footnote 2.

<sup>19</sup>See statement of Kenneth S. Pederson, Associate Administrator for External Relations, U.S. National Aeronautics and Space Administration, before a hearing of the House Committee on Science, Space, and Technology, Subcommittee on International Scientific Cooperation July 19, 1989.

<sup>20</sup>U.S. Department of Justice, Office of Legal Policy, Office of Information and Privacy, "New FOIA Legislation proposed to Promote U.S. Competitiveness," *FOIA Update*, vol. IX, No. 1, Winter 1988, pp. 1-2.

<sup>21</sup>See U.S. Congress, Senate, Committee on the Judiciary, Subcommittee on Technology and the Law, *Information Policy and Competitiveness*, Hearing, 100th Cong., 2d sess. (Washington DC: U.S. Government Printing Office, Mar. 16, 1989).

The question is how to preserve and strengthen the ability of the government-wide agencies to carry out their functions in a decentralized electronic environment.

tendent of Documents (SupDocs), and distribution of documents through the Depository Library Program (DLP); the National Technical Information Service (NTIS), the clearinghouse and sales outlet for technical documents; and the National Archives and Records Administration (NARA), concerned with archiving and long-term preservation of documents.<sup>22</sup>

#### Decentralized Nature of STI

It is clear that the creation, storage, and dissemination of STI is decentralized within the science agencies. This is because:

1. STI is voluminous, and agencies have difficulty in managing their own information base, much less another agency's data;
2. centralizing all STI in one databank is neither cost-effective nor technically feasible at this time;
3. technical systems for creating, storing, and disseminating STI are typically closely tied to agency automation programs;
4. centralizing STI dissemination, even if technically feasible, could slow innovation and limit

opportunities for improving efficiency in the agencies;

5. the diversity of STI needs and users among the Federal science agencies includes many varied disciplines and research areas;
6. the decentralized approach brings agency STI officials and the scientists and researchers who create and use the STI closer together; and
7. the economies-of-scale for electronic formats are achieved at lower levels of demand than for ink-on-paper printing.

Several agencies have data centers that are responsible for collecting, archiving, and disseminating databases, and much of these data are already in electronic formats. The major centers include: the National Space Science Data Center, National Climatic Data Center, National Oceanographic Data Center, National Geophysical Data Center, Earth Science Information Center, and Earth Resources Observation Systems Data Center. Several of the science agencies have their own central STI office (e.g., at NASA and DOE<sup>23</sup>) for STI documents and bibliographies, and most have infrastructure for handling STI, though it varies among the agencies (e.g., in terms of resources, staffing, visibility).

The question is how to preserve and strengthen the ability of the governmentwide agencies to carry out their functions in a decentralized electronic environment. Alternatives were considered by OTA in *Informing the Nation*,<sup>24</sup> by various congressional committees in hearings on NTIS, GPO, and the DLP,<sup>25</sup> and at a NARA conference on electronic recordkeeping.<sup>26</sup>

<sup>22</sup>The implications of electronic information for GPO, SupDocs, DLP, and NTIS are discussed in U.S. Congress, Office of Technology Assessment, *Informing the Nation*, op. cit., footnote 17, see esp. chs. 4-7, and 12. The implications for NARA are considered in National Academy of Public Administration, *The Effects of Electronic Recordkeeping on the Historical Record of the U.S. Government* (Washington, DC: National Archives and Records Administration January 1989).

<sup>23</sup>See National Aeronautics and Space Administration, *The NASA Scientific and Technical Information System and How to Use It*, NASA SP-7073, Washington, DC, 1989; and Department of Energy, *The Role of the Office of scientific and Technical Information in DOE'S Scientific and Technical Information Program*, November 1988.

<sup>24</sup>U.S. Congress, Office of Technology Assessment, *Informing the Nation*, op. cit., footnote 17.

<sup>25</sup>See, for example, U.S. Congress, House, Committee on Science, Space, and Technology, Subcommittee on Science, Research, and Technology, National Technical Information Service, Hearing, 100th Cong., 2d sess., U.S. Government Printing Office, Washington, DC, Feb. 24, 1988; U.S. Congress, House Committee on Science, Space, and Technology, *National Bureau of Standards Authorization Act for Fiscal Year 1989*, Report 100-673, Part 1, 100th Cong., 2d sess., U.S. Government Printing Office, Washington, DC, June 3, 1988; U.S. Congress, House, Committee on Energy and Commerce, National Bureau of Standards *Authorization Act for Fiscal Year 1989*, Report 100-673, Part 2, 100th Cong., 2d sess., U.S. Government Printing Office, Washington, DC, July 8, 1988; U.S. Congress, House, Committee on Administration, Subcommittee on Procurement and Printing, hearings on "Review of the Printing Chapters of Title 44 of the U.S. Code Due to the Changes in Electronic Information Format, Distribution, and Technology During the Last Decade," May 23-24 and June 28-29, 1989; U.S. Congress, House, Committee on Government Operations, Subcommittee on Government Information, Justice, and Agriculture, hearings on "Federal Information Dissemination Policies and Practices," Apr. 18, May 23, and July 11, 1989.

<sup>26</sup>National Archives and Records Administration "Electronic Records: A Strategic Plan for the 1990s," Conference Summary and Recommendations, June 21-23, 1989, see especially the recommendations of the working group on information collection and dissemination.

Under the OTA scenario, the Federal science agencies retain primary responsibility for the storage and dissemination of STI collected by each agency. The science agencies would be governed by:

- their enabling statutes regarding STI;
- OSTP guidance provided under the National Science and Technology Policy, Organization, and Priorities Act of 1976, as possibly amended to give further congressional direction on STI policy;
- OMB guidance promulgated under the Paperwork Reduction Act (ch. 35 of Title 44 of the U.S. Code, as possibly further amended to provide congressional statutory direction on overall dissemination policy<sup>27</sup>);
- GPO (and Joint Committee on Printing) guidance under the printing chapters of Title 44, as possibly amended,<sup>28</sup> to ensure that the integrity of the GPO printing procurement program, SupDocs sales program, and DLP is maintained;
- NTIS guidance promulgated under the “National Technical Information Service Act of 1988”<sup>29</sup> to ensure that the integrity of the NTIS clearinghouse is maintained; and
- NARA guidance promulgated under the archival chapters of Title 44, as possibly amended, to ensure long-term preservation and access to STI.

This scenario is predicated on the assumption that OMB, GPO, NTIS, and NARA guidance would be generally consistent and compatible.

#### Roles of Science Agencies, NTIS, and GPO

One possible division of effort between the mission agencies and governmentwide agencies is outlined below using a hypothetical example of an electronic product—hydrology information of the U.S. Geological Survey (USGS) (e.g., trends in stream flows and reservoir and lake levels) issued on CD-ROM:

- USGS would notify GPO, NTIS, and NARA in advance of production and supply product information (e.g., size of the hydrology data-

base, type of search-and-retrieval software, estimated cost and demand).

- GPO would decide whether the CD-ROM should be included in the SupDocs sales program, based on an estimate of demand beyond that being met by USGS direct sales. USGS could opt to use SupDocs as the primary sales outlet if the CD-ROM qualified.
- GPO also would determine whether the CD-ROM should be offered to depository libraries, and if so, how many libraries desired a copy of the CD-ROM.
- NTIS would decide whether the CD-ROM should be included in the NTIS clearinghouse and sales program.
- GPO and NTIS would, on a coordinated basis, make sure that the CD-ROM is cataloged and listed in appropriate governmentwide directories and bibliographic databases—whether or not it is sold by GPO and/or NTIS.<sup>30</sup>
- NARA would review the CD-ROM to determine long-term archival needs.
- GPO and NTIS would, again on a coordinated basis, advise USGS of their need for copies of the CD-ROM (to meet estimated SupDocs sales, depository library distribution, and NTIS sales needs).
- USGS would obtain CD-ROM production services in the manner that best meets its cost, quality, and turnaround requirements. This could be through an agency contractor, GPO contractor, GPO itself (if an inhouse service is offered), or NTIS contractor (if NTIS offers CD-ROM services).
- Wherever the USGS CD-ROM is produced, GPO and NTIS would ride the order for the number of additional copies required.

This example could apply to all offline electronic products, including optical disks, magnetic tapes and cassettes, and diskettes (hard and floppy). The large online electronic STI databases would be maintained by the agency data centers. But online directories and possibly subsets of data might be handled similarly to the CD-ROM illustration above. Some directories also could be disseminated on CD-ROM or other offline electronic formats.

<sup>27</sup>See H.R. 3695, op. cit., footnote 15; S. 1742, op. Cit., footnote 15.

<sup>28</sup>See H.R. 3849, the “Government Printing office Improvement Act of 1990,” 101st Cong., 2d sess., Jan. 23, 1990.

<sup>29</sup>See U.S. Congress, Public Law 100-519, Subtitle B—National Technical Information Service, codified at 15 U.S.C. 3701 et. seq.

<sup>30</sup>See discussion of STI directories in ch. 5.

The future of NTIS and GPO will be influenced by the increasingly decentralized, competitive environment of the electronic information marketplace. Federal science agencies are rapidly installing electronic systems for their activities, including the collection, processing, and dissemination of STI (see the appendix for illustrations). NTIS and GPO will have to adapt to the reality that technology has changed and sometimes eliminated the distinctions between reports, publications, databases, and the like, and has blurred the distinctions between their roles and those of the agencies.

Most Federal STI will likely exist in electronic form as computerized electronic databases. Users will have a wide assortment of formats available, from printed reports to online information retrieval, printing-on-demand, and compact optical disk. NTIS and GPO will have to become more flexible, adaptive, creative, competitive, and user-oriented than they currently are.<sup>31</sup> Many users may continue to prefer the convenience of "one-stop" information shopping at NTIS or GPO, especially for hard-to-find documents (or their electronic equivalents). But the governmentwide dissemination programs will need to complement, not preempt, individual agency activities.

GPO and NTIS appear to be philosophically accepting this reality. The former Acting Public Printer has stated GPO's preference for the "Electronic GPO-Decentralized" approach.<sup>32</sup> In this scheme, GPO would continue its centralized con-

ventional printing functions, but would aggressively plan for and implement electronic printing and dissemination services, working through a decentralized Federal electronic information environment.<sup>33</sup> Centralized conventional ink-on-paper printing would continue, with about three-quarters of all Federal printing done by or through GPO (although three-fourths of this is contracted out by GPO to commercial printing companies), and the rest at authorized agency printing plants. Decentralized agency electronic information dissemination would continue, with GPO offering a variety of electronic services to the agencies, but on a competitive, discretionary basis (in contrast to conventional ink-on-paper printing where GPO services must be used, unless an explicit exemption or exception is granted).<sup>34</sup>

The NTIS Director and Deputy Director have stated their commitment in principle to the 'Electronic NTIS' alternative.<sup>35</sup> After years of declining demand for paper and microfiche products and the debate over privatization, Congress has directed NTIS to modernize. NTIS has developed a preliminary plan to increase its use of electronic formats, including CD-ROM, electronic bulletin boards, and, ultimately, an electronic document system that could accept electronic input from the source agencies and support electronic printing-on-demand. To be successful, NTIS will need to reduce per-unit costs, decrease the time delays between the existence of a document and its availability via

<sup>31</sup>For further discussion, see U.S. Congress, Office of Technology Assessment, *Informing the Nation*, Op. cit., footnote 17, ch. 12.

<sup>32</sup>U.S. Congress, Office of Technology Assessment, *Informing the Nation*, op. cit., footnote 17, ch. 4. Also see F.B. Wood, "Title 44 and Federal Information Dissemination—A Technology and Policy Challenge for Congress: A Viewpoint," *Government Publications Review*, vol. 17, 1990, pp. 1-5.

<sup>33</sup>See statement of Joseph E. Jenifer, Acting Public Printer, Government Printing Office, before a May 23, 1989, hearing and statement of Samuel B. Scaggs, Assistant Public Printer, Operations and Procurement, Government Printing Office before a June 29, 1989, hearing, Committee on House Administration Subcommittee on Procurement and Printing. Also see statements of Joseph E. Jenifer, Acting Public Printer, before a Feb. 7, 1989, hearing of the House Committee on Appropriations, Subcommittee on the Legislative Branch, a July 11, 1989, hearing of the House Committee on Government Operations, Subcommittee on Government Information, Justice, and Agriculture, and a Mar. 7, 1990, hearing of the Committee on House Administration, Subcommittee on Procurement and Printing. The new Public Printer stated a position on some of these issues before an Apr. 6, 1990, hearing of the Senate Committee on Appropriations, Subcommittee on the Legislative Branch. For other views and general discussion see U.S. Congress, House, Committee on House Administration, Subcommittee on Procurement and Printing, *Title 44 U.S.C.-Review, Hearings, 101st Cong.*, 1st sess., May 23, 24, and June 28, 29, 1989 (Washington, DC: U.S. Government Printing Office, 1989); statements of Fred B. Wood, OTA, before May 23, 1989, and Mar. 7, 1990, hearings of the Committee on House Administration, Subcommittee on Procurement and Printing; and OTA comments on S. 1742, the "Federal Information Resources Management Act of 1989," prepared for a Feb. 21-22, 1990, hearing of the Senate Committee on Governmental Affairs.

<sup>34</sup>This general approach is consistent with that of other countries such as New Zealand and Canada. See Canadian Communications Services Directorate, "Electronic Publishing Information Center," *Electronic Publishing Bulletin*, October 1989.

<sup>35</sup>U.S. Congress, Office of Technology Assessment, *Informing the Nation*, op. cit., footnote 17, chs. 5 and 12.

NTIS, and increase user awareness of NTIS services.<sup>36</sup>

Beyond this, NTIS must develop a clear strategic vision of its future, and a realistic, detailed implementation plan for getting there. During the 1980s, user demand for paper and microfiche documents in the basic NTIS archive steadily dropped; agency cooperation in providing documents to NTIS also declined. NTIS sales of electronic formats—the one bright spot—are likely to feel increasing pressure from agency, private sector, and GPO competition.<sup>37</sup>

### Roles of NARA and DLP

The roles of NARA and the DLP deserve special attention. NARA might find that agency data centers can efficiently archive STI databases, releasing NARA from the need to retain physical control. Even if an agency or data center serves as the archive, NARA would help ensure that the system is cost-effective and meets data and technical standards (e.g., regarding longevity of storage media, conversion from one storage medium to another, and portability among different media and equipment). NARA could also assist the data centers in determining what should and should not be retained inhouse, with permanent STI archives retained by NARA. NARA needs to develop clear and workable agreements with the science agencies, and with NTIS and the Library of Congress (LOC), to ensure that archivable STI does not fall through the cracks.

Machine-readable materials are included within the legal definition of “record.”<sup>38</sup> NARA has initiated a program for archiving electronic records that is now being extended to Federal STI. Perma-

nent electronic records identified by NARA include, for example:<sup>39</sup>

- unique and important scientific and technical data resulting from observations of natural events or phenomena or from controlled laboratory or field experiments;
- natural resources data related to land, water, minerals, or wildlife; and
- geographic data used to map the surface of the earth.

NARA will need to assess the vast store of geographic, space, and earth sciences data with respect to archival needs and requirements—a task that becomes even more challenging with the rapid evolution of electronic storage and retrieval technologies and the poor condition of current data archives. Technological change means that large amounts of archived STI will be inaccessible and/or unusable to future generations of researchers unless standard information formats are developed and mandated. The long-term utility of STI requires that today’s data and documents be retrievable with tomorrow’s technologies.<sup>40</sup>

As for the Depository Library Program, there appears to be a consensus that electronic formats should be included, although there are differences of opinion over implementation. For several years now, the congressional Joint Committee on Printing (JCP), Depository Library Council, and the major library associations have argued that, as the Federal Government makes increasing use of electronic information, the DLP must also include electronic information, lest the integrity of the program be

<sup>36</sup>See National Technical Information Service, Annual Report to the Congress from the Secretary of Commerce, The National *Technical Information Service: Operations, Audit, and Modernization*, January 1989; also see U.S. Congress, Office of Technology Assessment, *Informing the Nation*, op. cit., footnote 17, chs. 5 and 12; C.R. McClure, P. Herson, and G.R. Purcell, *Linking the U.S. National Technical Information Service With Academic and Public Libraries* (NorWood, NJ: Ablex Publishing Corp., 1986). Also see Statement of Joseph F. Caponio, Director, National Technical Information Service, before a July 13, 1989, hearing of the National Commission on Libraries and Information Science.

<sup>37</sup>For further discussion, see the statements of Fred B. Wood, OTA, Harold B. Shill, West Virginia University, and Jean Mayhew, United Technologies Corp., before a Mar. 8, 1990, hearing of the House Committee on Science, Space, and Technology, Subcommittee on Science, Research, and Technology. Also see C.F. McClure, “The Future of the National Technical Information Service: Issues and Options,” Jan. 20, 1990, contractor paper prepared for OTA. For background discussion of the NTIS privatization debate, see F.B. Wood, “Proposals for Privatization of the National Technical Information Service: A Viewpoint,” *Government Publications Review*, vol. 15, 1988, pp. 403-409 (which is based on testimony presented at a Feb. 24, 1988, hearing of the House Committee on Science, Space, and Technology, Subcommittee on Science, Research, and Technology).

<sup>38</sup>44 U.S.C. 3301.

<sup>39</sup>U.S. National Archives and Records Administration, “Managing Electronic Records: An Instructional Guide,” draft, no date, pp. 15-17; also See Michael L. Miller, “Appraisal and Disposition of Electronic Records,” National Archives and Records Administration March 1988 draft; and June 13, 1989, cooperative agreement between NARA and NOAA.

<sup>40</sup>The U.S. General Accounting Office is conducting audits of the major data archives maintained by Federal science agencies. See U.S. Government Accounting Office, Space Operations: NASA Is Not Properly Safeguarding Valuable Data From Past Missions, Report to the Chairman, Committee on Science, Space, and Technology, U.S. House of Representatives, IMTEC-90-1 (Washington, DC: GAO, March 1990). Subsequent reports will address NOAA and USGS data archives.

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The long-term utility of STI requires that today's data and documents be retrievable with tomorrow's technologies.

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eroded.<sup>41</sup> In May 1989, GPO's General Counsel ruled that it has legal authority to distribute agency publications in electronic format to depository libraries, thereby clarifying a 1982 opinion that was widely interpreted as limiting the DLP to traditional (paper and microfiche) formats.<sup>42</sup> This apparently ended a long conflict between GPO and the JCP about whether the depository library provisions of Title 44 apply to government publications regardless of format.<sup>43</sup>

The differences between the JCP, OMB, and Information Industry Association (IIA) appear to have narrowed. OMB supports the voluntary participation of agencies in DLP electronic dissemination, and is willing to consider requiring that some agency electronic information products be provided to depository libraries.<sup>44</sup> The IIA now supports the

inclusion of some electronic formats in the DLP, but with reservations about online dissemination and financing, and suggests testing alternative mechanisms such as vouchers, bulk rate and off-peak contracts, user charges, and cost-sharing.<sup>45</sup> In Congress, the House Appropriations Subcommittee on the Legislative Branch has supported distribution of CD-ROMs to depository libraries, and maybe open to distributing other electronic formats, including online services, although questions of cost, demand, technical feasibility, and administrative responsibility have not been resolved.<sup>46</sup> These questions, among others, are being addressed through the DLP electronic pilot projects now being implemented.<sup>47</sup>

Two of the DLP pilot projects cover Federal STI. The first involves the distribution of the Environmental Protection Agency's "Toxic Release Inventory (TRI)" to depository libraries. TRI includes details on the location, storage, emissions, and waste treatment and transfer for over 300 toxic chemicals. EPA is disseminating TRI to the public online via the National Library of Medicine computer center, in magnetic tape format via the NTIS and GPO sales programs, and in computer output microfiche and CD-ROM formats through selected libraries, including all 1,400 depository libraries.<sup>48</sup> The second

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<sup>41</sup>See statements of D. Kaye Gopen, Dean of Libraries, University of Wisconsin (on behalf of the Association of Research Libraries), and Sandra McAnich, Head, Government Documents, University of Kentucky Libraries (on behalf of the Government Documents Roundtable, American Library Association), before a May 24, 1989 hearing of the House Administration Committee, Subcommittee on Procurement and Printing. Also see the statement of D. Kaye Gopen, on behalf of the American Library Association and Association of Research Libraries, before a Feb. 7, 1989, hearing of the House Committee on Appropriations, Subcommittee on the Legislative Branch.

<sup>42</sup>Memorandum from GPO General Counsel to Acting Public Printer, "GPO Dissemination of Federal Agency Publications in Electronic Format," May 22, 1989.

<sup>43</sup>See U.S. Congress, Joint Committee on Printing, provision of Federal Government Publications in Electronic Format to *Depository Libraries*, Report of the Ad Hoc Committee on Depository Library Access to Federal Automated Databases (Washington, DC: U.S. Government Printing Office, 1984); U.S. Congress, Joint Committee on Printing, An Open Forum on the Provision of Electronic Federal Information to *Depository Libraries*, 99th Cong., 1st sess. (Washington, DC: U.S. Government Printing Office, 1985); Joint Committee on Printing resolutions of Apr. 8, 1987, June 17, 1987, and June 29, 1988 regarding GPO, depository libraries, and electronic formats; and letter from Honorable Frank Annunzio, chairman, Joint Committee on Printing, to Honorable Ralph E. Kennickell, Jr., Public Printer, Mar. 25, 1988.

<sup>44</sup>See Office of Management and Budget, "Second Advance Notice of Further Policy Development on Dissemination of Information," Federal Register, vol. 54, No. 114, June 15, 1989, pp. 25554-25559.

<sup>45</sup>See statement of Kenneth B. Allen, Senior Vice president, Government Relations, Information Industry Association, accompanied by Peyton R. Neal, Jr., Chair, IIA Government Printing Office Committee, before a May 24, 1989, hearing of the House Committee on Administration, Subcommittee on Procurement and Printing. Also see a somewhat more critical statement of Paul P. Massa, President, Congressional Information Services, Inc., before a July 13, 1989, hearing of the National Commission on Libraries and reformation Science. One private vendor, Legi-Slate, Inc., has offered to provide electronic online dissemination of selected congressional information to depository libraries at bulk rate discounted prices, based in part on the results of a successful 5 1/2 month pilot test with 51 depository libraries. The same concept could be used by other vendors with respect to other types of Federal information, including S-II. See Legi-Slate, "Pilot Project Evaluation Preliminary Summary," Jan. 8, 1989.

<sup>46</sup>U.S. Congress, Committee on Appropriations, *Legislative Appropriations Bill, 1989, Report to accompany H.R. 4487, Report No. 1(X3-621, 100th Cong., 2d sess., 1988*. Also see statement of Honorable Viz Fazio, Chairman, House Committee on Appropriations, Subcommittee on the Legislative Branch, before a June 28, 1989, hearing of the House Committee on Administration, Subcommittee on Printing and Procurement.

<sup>47</sup>The U.S. General Accounting Office is conducting an evaluation of the research methodology of the electronic pilot projects. See May 8, 1989, letter from Donald E. Fossedal, Assistant Public Printer, U.S. Government Printing Office, to Richard Fogel, Assistant Comptroller General, U.S. General Accounting Office.

<sup>48</sup>Statement of Edward J. Hanley, Director, Office of Information Resources Management, U.S. Environmental Protection Agency, before a hearing of the Subcommittee on Government Information, Justice, and Agriculture, House Committee on Government Operations, Apr. 18, 1989.

project involves the U.S. Department of "Energy Data Base" (EDB). DOE has proposed to provide depository libraries with online access to the EDB.<sup>49</sup> (See the appendix for further discussion of the EDB pilot project.)

In addition, GPO is seeking suggestions from private vendors on how they might participate in electronic dissemination to depository libraries. Industry interest appears to be high. Finally, Federal agencies also seem generally supportive of an electronic role for the DLP, but have unanswered questions and concerns about selection procedures, financing, and user support for electronic format items included in the DLP.<sup>50</sup>

The remaining DLP issues concern cost and financing, especially for online dissemination. CD-ROM and offline formats are gaining acceptance as cost-effective alternatives to paper and microfiche. It is likely that most depository libraries would select only a relatively small portion of total Federal STI—as is the case with Federal information in general—and would more typically refer users to STI data centers and existing archives. This would require that depository libraries have efficient access to directories, indices, and bibliographies of the Federal STI, rather than to the STI itself.

Alternatively, a small number of depository libraries could be designated as STI depositories. These libraries would include a large amount of STI in their collections, and would serve as a shared resource for local and regional libraries. STI depositories could be strategically located in areas of concentrated scientific and technical activity where the local community is committed to building its R&D base. STI depositories would have to have the

technical capabilities to use all electronic formats—online, CD-ROM, and diskette. This possibility could be explored in depth as part of an overall reexamination of the DLP.

Funds for STI dissemination at depositories could come from several sources, with a portion funded through the DLP direct appropriation, a portion by the Federal science agencies (e.g., for free copies of selected agency CD-ROMs and fee reductions or waivers for online access to selected agency databases), a portion by the depository libraries (e.g., for microcomputers, CD-ROM readers, and modems), and apart by the library users (e.g., for telecommunication line charges). The libraries could have discretion over how the appropriated funds are spent. For example, libraries could be issued vouchers for access to online STI bibliographic databases. These funds could be expended on a mix of government, commercial, and not-for-profit databases, depending on user needs. Vouchers might also be used for library purchase of equipment needed to support electronic dissemination, and for subsidy of telecommunication or electronic printing charges incurred by students or others with limited means.<sup>51</sup>

Overall, an estimated 9 to 10 million persons use depository libraries each year. Academic libraries represent about 55 percent of all depository libraries. Students and faculty account for 85 percent of academic library users. Students and professional, technical, and managerial persons together represent about 77 percent of public depository library users.<sup>52</sup> Thus, depository users are likely to be a ready market for Federal STI in electronic formats, and open to technical and institutional innovation in information dissemination. The electronic pilot projects will shed more light on this prospect.<sup>53</sup>

<sup>49</sup>U.S. Congress, Joint Committee on Printing, "Dissemination of Information in Electronic Format to Federal Depository Libraries: Proposed Project Descriptions," June 1988.

<sup>50</sup>See statement of Forrest B. Williams, Branch Chief, Data User Services Division, U.S. Bureau of the Census, before a July 13, 1989, hearing of the National Commission on Libraries and Information Science.

<sup>51</sup>Representatives of library associations are concerned about proposals for sharing costs of online or other electronic dissemination. Depository libraries already spend several dollars (in building, equipment, and staff costs) for every dollar spent by the Federal Government on documents, and oppose shifting more costs of dissemination to the libraries. See statements of Cheryl Rae Nyberg, American Association of Law Libraries, Merrily Taylor, Association of Research Libraries, and Katherine Mawdsley, American Library Association, before a Mar. 8, 1990, hearing of the Committee on House Administration, Subcommittee on Procurement and Printing.

<sup>52</sup>C.R. McClure and P. Herson, *Users of Academic and Public GPO Depository Libraries* (Washington DC: U.S. Government Printing Office, 1989).

<sup>53</sup>For further discussion of depository library alternatives, see U.S. Congress, Office of Technology Assessment, *Informing the Nation*, op. cit., footnote 17, ch. 7; and Association of Research Libraries, Technology and U.S. Government Information Policies: Catalysts for New Partnerships (Washington, DC: October 1987). Also see statements of D. Kaye Gapen before the House Committee on Administration and House Committee on Government Operations, op. cit., footnote 41; and statements of Vicki W. Phillips, Chair, Depository Library Council to the Public Printer, Patricia Glass Schuman, President, Neal-Schuman Publishers, Inc. (on behalf of the American Library Association), and Bruce M. Kennedy, Head, Reference Department, Georgetown University Law Center (on behalf of the American Association of Law Libraries) before a July 13, 1989, hearing of the National Commission on Libraries and Information Science.