

Total Stock of Academic Research Instruments Tops \$6 Billion in 1993

by Carolyn B.
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Respondents rated 27 percent of the instruments in research usage in 1993 to be state-of-the-art. An additional 63 percent were not state-of-the-art but were judged to be adequate for the needs of the research users.

Electronic Dissemination

SRS data are available through the World Wide Web (<http://www.nsf.gov/sbe/srs/stats.htm>) For NSF's Telephonic Device for the Deaf, dial 703-306-0090. If you are a user of electronic mail and have access to the internet, you may order publications electronically. Send requests to pubs@nsf.gov. In your request, include the NSF publication number and title, your name, and a complete mailing address.

The conduct of high-quality research requires adequate instrumentation. For cutting-edge research, rapid advances in research instrument development and capabilities have meant that equipment only a few years old may be obsolete. Concern about maintaining cutting edge research capability led Congress in the early 1980s to direct the National Science Foundation (NSF) to monitor the status of, and needs for, academic research instrumentation.

In response to this mandate, NSF developed the Survey of Academic Research Instruments and Instrumentation Needs (Instrument Survey), which is co-funded by the National Institutes of Health (NIH). This survey has a sample panel of 79 academic institutions selected to represent the Nation's colleges, universities, and medical schools that annually conduct at least \$3 million of research and development (R&D). In 1993 there were 318 institutions in the Nation that reported R&D at this level. This Data Brief summarizes findings from the survey questionnaires sent to principal investigators responsible for research instrumentation with an original purchase price of at least \$20,000.

Aggregate Stock of Instruments in 1993

There were an estimated 61,684 instruments in the stock of research instruments at the 318 colleges, universities, and medical schools represented in the survey in 1993. This stock had an estimated aggregate original purchase price (aggregate cost) of \$6.255 billion. The instruments were categorized into the following types:

Computers and data handling equipment (Computers). The 12,023 computers had an aggregate cost of \$1.851 billion (representing 19 percent of the number of instruments in the national stock and 30 percent of total aggregate cost).

Chromatographs and spectrometers. The 13,789 instruments had an aggregate cost of \$1.286 billion (representing 22 percent of the total number of instruments and 21 percent of total aggregate cost).

Microscopy instruments. These 5,597 instruments had an aggregate cost of \$547 million (9 percent of both number and cost of aggregate stock).

Table 1. Total number and aggregate purchase price of academic research instruments, by type of instrument: 1993

Detailed type of instrument	Number of systems	Aggregate purchase price [dollars in billions]
Total, all instruments.....	61,684	\$6.255
Computers and data handling instruments.....	12,023	1.851
Chromatographs and spectrometers.....	13,789	1.286
Microscopy instruments.....	5,597	.547
Bioanalytical instruments....	10,205	.468
Other instruments.....	20,071	2.103

NOTE: This table includes data for supersystems. Because of rounding, details may not add to totals.

SOURCE: National Science Foundation/SRS, Survey of Academic Research Instruments and Instrumentation Needs: 1993

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Bioanalytical instruments. The 10,205 units in this category had an aggregate cost of \$468 million (representing 17 percent of the number of instruments in the stock, but only 7 percent of total aggregate cost).

“Other” instruments. This category contained miscellaneous groups of instruments, none of which was large enough to constitute a separate major category of its own. The number of pieces in this category (20,071) accounted for 33 percent of the total number, with an aggregate cost of \$2.103 billion (34 percent of the total). Among these instruments were 6,958 electronics instruments and lasers of various kinds totaling \$428 million (11 percent of the total numbers and 7 percent of total cost). Major

Status of Research Instruments in 1993¹ Maintenance and Repair

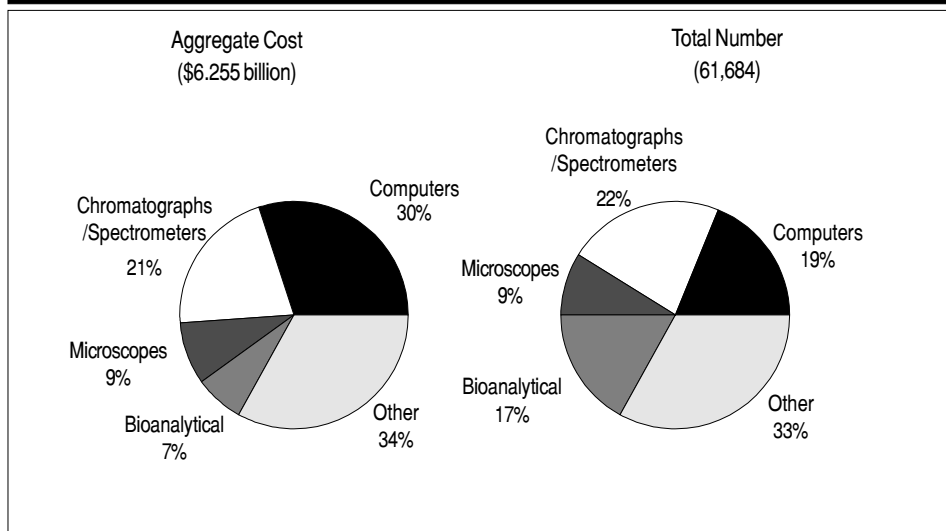
Respondents rated 64 percent of the instruments as receiving above adequate to excellent maintenance/repair in 1993. Maintenance/repair was judged less than adequate or poor for only 8 percent of all instruments.

State-of-the-Art Status

Respondents were also asked to assess each instrument's state-of-the-art research capability. Overall, 27 percent of the instruments in research usage in 1993 were rated state-of-the-art. An additional 63 percent were not state-of-the-art but were judged to be adequate for the research users' needs. Only 9 percent of instruments overall were rated inadequate for the research users' needs.

About 4 of every 10 research instrument systems in use in 1993 had been acquired within the previous 4 years, while 23 percent were over 8 years old. The average age of a research instrument in 1993 was 5.8 years.

Chart 1. Percentage distribution of academic research instrumentation by major type of instrument: 1993



Source: National Science Foundation/SRS, Survey of Academic Research Instruments and Instrumentation Needs: 1993

instruments comprised 1,259 systems with an aggregate cost of \$643 million (6 percent of total instruments and 10 percent of total cost); included in this group were instruments such as research vessels, telescopes, and other major instruments including nuclear reactors, wind/wave/water/shock tunnels and major prototype systems.

¹ Status information could not be collected for approximately 155 “supersystems,” which were specialized, integrated instruments that were essentially synonymous with the administering unit itself. Totalling \$1.171 billion in aggregate cost, these 155 supersystems represented less than 1 percent of the total numbers of research instruments over \$20,000 and 19 percent of the aggregate cost of the total inventory. Therefore, although the *aggregate stock* information above does include these “supersystems,” the *status* information in this Data Brief pertains only to non-“supersystems”—approximately 61,529 research instruments with a total aggregate purchase price of \$5.083 billion.

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Average Age of Research Instruments

Overall, about 4 of every 10 research instrument systems in use in 1993 had been acquired within the previous 4 years. On the other hand, almost one quarter (23 percent) of the instruments in active research use in 1993 were over 8 years old. The average age of a research instrument was 5.8 years. Seventeen percent of all instruments costing less than \$1 million were less than 2 years old in 1993, but only 7 percent of instruments over \$1 million were that new.

Functional usage of research instruments

Sixty-four percent of the instruments in research usage in 1993 were used *exclusively for research*. Most of the remaining instruments (32 percent) were utilized *predominantly for research* with some instructional use. Only 4 percent of the total were used *primarily for instruction* with some research usage.

Average number of users of research instruments

In 1993, there was an average of 24.2 users per instrument system. The largest single category of user—an average of 8.5 per instrument—was the graduate students and postdoctorates assigned to the same unit that owned the instrument (host unit). On average, there were also 3.5 faculty users from the host unit, 6.0 researchers from other units in the host institution, 4.5 researchers from outside the host institution, and 1.8 other users (primarily staff and undergraduates). State-of-the-art instruments were used at about the same rate as all instruments combined: there was an average of 25.7 users of state-of-the-art instruments and 24.2 users for all instruments, not a statistically significant difference.

Description of the 1993 Survey

In 1993, there were 318 colleges, universities, and medical schools in the U.S. with total R&D expenditures at or above \$3 million; there were about 1,541 in-scope S&E departments and research facilities (units) at these institutions. The 1993 Instrumentation Survey covered the research instruments in

these units which had an original purchase price of \$20,000 or more and were in the following science and engineering (S&E) fields: agriculture, biology, computer science, environmental sciences, chemistry, physics/astronomy, and engineering.² The survey excluded research instruments assigned to any of the university-administered Federally Funded Research and Development Centers (FFRDCs), as well as any assigned to laboratories that might be housed on a university campus but not administered by the university.

The Instrument Survey had two questionnaires and two sets of respondents:

- Principal investigators completed an *Instrument Data Sheet* in which they provided detailed data about individual pieces of research instruments. This Data Brief summarizes the findings from this questionnaire. More detailed data may be found in the forthcoming NSF publication, *Characteristics of Science and Engineering Instrumentation in Academic Settings: 1993*.
- The heads of academic departments and research facilities completed a *Department/Facility Questionnaire* in which they provided 1993 expenditure data for purchasing, maintaining, and operating their instruments, as well as an evaluation of their overall instrumentation and future needs. Data from this questionnaire are published in the companion NSF report, *Academic Research Instruments: Expenditures-1993, Needs-1994 (NSF 96-324)*.

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²The survey excluded mathematics, the clinical sciences, psychology, and the social sciences.

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