FEDERAL SUPPORT OF MATERIALS RESEARCH

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The Federal government has assumed a major role in the support of materials-related research. This situation is in sharp contrast to that prior to World War II, when the preponderance of research support, both for materials problems and in other fields, was furnished either by private industry or by endowment funds. In 1961, for example the Federal government allocated approximately \$8.2 billion for research and development in all fields of science and engineering¹. Compare this with an expenditure in 1940 of a mere \$74 million.

The growth of Federal R&D support in recent years is shown in Fig. 1, based on data from Ref. 1. Although the statistics shown are approximate (for example, a revised definition of development was used subsequent to 1957), the trend is obvious. Fig. 1 also illustrates the marked growth in that proportion of the Federal budget allocated to research and development. Thus, while less than 1 pct of all Federal funds were utilized for research and development in 1940, the proportion increased to over 10 pct in 1961.

It is also interesting to note the distribution of Federal R&D funds. In 1960 23 pct of the total Federal research and development budget represented work performed in Government installations; the balance of research and development funds went to profit organizations, educational institutions, and other groups. The actual distribution of all Federal obligations, as well as those funds obligated for basic research is shown in Table I, also based on Ref. 1. In addition, National Science Foundation has observed that Federal R&D funds comprised approximately two-thirds of the national total,² thus affirming the reliance of industry and educational institutions upon the Federal gov-

ernment for support of research and development.

In the specific area of materials research, historical data for Federal expenditures are not available. However, the estimated Federal materials research and development budget is summarized in Table II. The figures cited are approximations, since not only do the definitions for materials research differ slightly from agency to agency, but the demarcation, e.g. between basic and applied research is at best diffuse. Nevertheless, in spite of the uncertainties in estimating expenditures, materials research and development at a level in excess of \$700 million can be seen to comprise almost 10 pct of the total Federal

budget for research and development.

Analysis of information presented in Ref. 2 in conjunction with the data of Table II emphasizes that the performance of basic research in materials is strongly dependent upon Government support. Not only is the absolute level of basic research support high, but basic research can be estimated to constitute over 10 pct of the total Federal materials budget. This balance compares favorably with an industrial distribution of overall R&D funds in recent years in which less than 4 pct of the total was designated for basic research. Also of interest is the extent of support for basic materials research furnished to universities—\$55 million of the total \$80.6 million last year was directed to educational institutions.

Table II further suggests that insufficient attention is devoted to long-range applied research in materials, i.e. to solving specific problems from a scientific point-of-view and applying information obtained in basic research to development problems. Studies of means for alleviating this situation presently are being conducted.

Interdisciplinary laboratories

Making available adequate funds for support of materials research and development represents a continual problem for Government agencies. However, attention has been given recently to another critical problem, namely, the inadequate supply of scientists and engineers trained in the materials-related sciences. The shortage of these personnel first was recognized by an advisory group to the Atomic Energy Commission. In 1959 the Coordinating Committee for Mate-

Table I. Distribution of Federal Research and Development Funds (1960)

	Total R&D, pct	Basic Research, pct
Federally-Owned Laboratories	23	30
Profit Organizations	64	14
Educational Institutions	11	44
Other	2	12

Table II. Estimated Federal Materials Research and Development* Budget

Fiscal Year 1961
(in millions of dollars)

	Fundamental Research	Long-Range Applied Research	Development
AEC	16.1	33	125
Bureau of Mines	1.0	4	1
Dept. of Defense	40.0*	42	400
NASA	5.3	4	24
NBS	5.7	—	—
NSF	12.5	—	—
TOTAL	80.6	83	550

* Includes funds for four-year ARPA contracts.

(Continued on page 186)

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(Continued from page 181)

materials Research and Development of the Federal Council formulated the concept of a multiagency program of support for interdisciplinary laboratories (IDL's) in the materials-related sciences at universities and educational institutions. The primary objective of the IDL program was to augment the supply of trained people for basic research in materials. However, the research conducted at these laboratories was to be an important component of the IDL program; and maintenance of a high level of quality was considered to be a prerequisite for success of the program.

The original IDL concept since has been implemented by several Government agencies. Contracts or grants providing research support and incentive for the development of new facilities have been awarded or are being processed by the Atomic Energy Commission (University of California at Berkeley and University of Illinois), National Aeronautics and Space Administration (Rice and Rensselaer Polytechnic Institute), and Advanced Research Projects Agency (ARPA) of the Department of Defense (Cornell, University of Pennsylvania, Northwestern, Brown, Harvard, MIT, University of Chicago, Stanford, Purdue, University of North Carolina, and University of Maryland). Supplemental funds for equipment also have been furnished to many schools.

Over a period of time, the IDL program will provide basic scientific knowledge and will play an important part in increasing the supply of scientists trained in materials research. But the problem of the overall supply of scientists, although under intensive study by the National Science Foundation, remains to be resolved.

Summary

In summary, it is evident that Federal funds are an important element in the support of research and development, both in the area of materials and in other fields of science. Most Federal R&D funds go to organizations outside the government, and strong emphasis is placed upon basic research. Unfortunately, the transition in the materials fields between basic research and development is tenuous and needs strengthening. The problem of trained technical personnel for materials research has been attacked vigorously via the multiagency interdisciplinary laboratory program.

References

¹Federal Funds for Science, NSF 60-80, National Science Foundation, 1960.

²Funds For Research and Development in Industry, NSF 61-32, NSF 59-40, National Science Foundation, 1961.

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