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THE SOLUTION OF DUFFING'S EQUATION FOR THE SOFTENING SPRING SYSTEM USING THE RITZ-GALERKIN METHOD WITH A THREE TERM APPROXIMATION

This paper presents the results of an investigation of the solutions of the differential equation (Duffing's equation) $\ddot{q} + q - \frac{4}{3} q^3 = F \cos \omega t$ based on a three term approximation to the solution $q(t)$. The assumed solution is of the form $q(t) = A \cos \omega t + B \cos 3\omega t + C \cos 5\omega t$. The method of solution used is known as the Ritz Averaging Method (or the Ritz-Galerkin Method). The differential equation was solved for both free and forced oscillations. Solutions are presented in the form of amplitude vs frequency plots for the three components of the assumed solution. Resonance of the harmonics is indicated in certain regions of the amplitude vs frequency plane. In these regions the fundamental component alone is not adequate in describing the response of the system.

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Nomenclature

A = amplitude of the fundamental component of $q(t)$
A_{ni} = amplitude of the general term of a series
B = amplitude of the third harmonic component of $q(t)$
c = spring constant
C = amplitude of the fifth harmonic component of $q(t)$
F = amplitude of the forcing function
E = differential equation of motion
i = an integer $i = 1, 2 \ldots\ldots$
k = modulus of the elliptic function
$K(k)$ = complete elliptic integral of the first kind
m = mass, or also as an integer, when used as part of the argument of a cosine function
n = an integer 1, 2, 3 .....
q, $q(t)$ = dimensionless dependent variable of the systems studied
$\dot{q}$, $\ddot{q}$ = first and second derivatives of q with respect to time
t = time
T = period of oscillation
$\eta = q/q_{max}$
$\phi_i(t)$ = a generalized function used as an assumed solution in the Ritz-Galerkin Method
$\theta = \frac{4}{3} q^2_{max}$
$\mu^2 = \mu^2$ is dimensional coefficient of the cubic term in Figure 1
π = the constant 3.1416
ω = circular frequency of the forcing function

Introduction

The purpose of this paper is to present the results of an investigation of the solutions of the differential equation

$$\ddot{q} + q - \frac{4}{3} q^3 = F \cos \omega t \qquad (1)$$

based on a three term approximation to the solution $q(t)$. The assumed solution is of the form

$$q(t) = A \cos \omega t + B \cos 3\omega t + C \cos 5\omega t \qquad (2)$$

where A, B, C are constants. Figure 1a shows a mechanical model of a system whose motion would be described by (1). Figure 1b is a sketch of the spring restoring force for a linear spring, a hardening spring and a softening spring.

The method of solution used for solving (1) is known as the Ritz Averaging Method [7] or the Ritz-Galerkin Method [1, 5, 8]. The method can be applied to an oscillatory system described by differential equations of the type

$$E_n (\ddot{q}_n, \dot{q}_n, q_n, t) = 0 \qquad (3)$$

The exact solution would yield the coordinates $q_n(t)$ describing the response of the system at any time t. In the absence of a theory or a method for producing the exact solution of (3) and hence of (1), the Ritz-Galerkin

Method will yield the approximate steady state solution by the following procedure:

1. Each of the coordinates q_n is replaced by an assumed approximate solution of the form

$$q_n(t) = \sum_{i=1}^{m} A_{ni}\phi_i(t) \quad \begin{matrix} n = 1, 2, 3 \ldots \\ i = 1 \ldots m \end{matrix}$$

where the A_{ni} are a set of unknown coefficients, and the functions $\phi_i(t)$ are assumed functions expected to yield the best average solution over a period.

2. Then the assumed solutions are introduced into (3) and integrations of the type

$$\int_0^{\frac{2\pi}{\omega}} (E_n(\ddot{q}_n, \dot{q}_n, q_n, t)\phi_i(t))\, dt = 0 \quad \begin{matrix} n = 1, 2, 3 \ldots \\ i = 1 \ldots m \end{matrix}$$

are performed over a period as indicated. A set of mn algebraic equations are obtained which must be solved for the coefficients A_{ni}.

Ritz-Galerkin Method Applied to Duffing's Equation with a Three Term Approximation to the Solution

For the differential equation (1) the integral expressions are of the form

$$\int_0^{\frac{2\pi}{\omega}} [\ddot{q} + q - \tfrac{4}{3}q^3 - F\cos\omega t]\cos\omega t\, dt = 0$$

$$\int_0^{\frac{2\pi}{\omega}} [\ddot{q} + q - \tfrac{4}{3}q^3 - F\cos\omega t]\cos 3\omega t\, dt = 0$$

$$\int_0^{\frac{2\pi}{\omega}} [\ddot{q} + q - \tfrac{4}{3}q^3 - F\cos\omega t]\cos 5\omega t\, dt = 0$$

since the assumed solution as given in (2) shows $\phi_1 = \cos\omega t$, $\phi_2 = \cos 3\omega t$, and $\phi_3 = \cos 5\omega t$. The algebraic manipulation for the solution of these integrals is long but not complicated for this system. It is not included here but can be found in [6]. The algebraic equations resulting from the application of the Ritz-Galerkin Method to (1) are

$$A - A\omega^2 - (A^3 + A^2B + 2AB^2 + 2AC^2 + 2ABC + B^2C) - F = 0$$

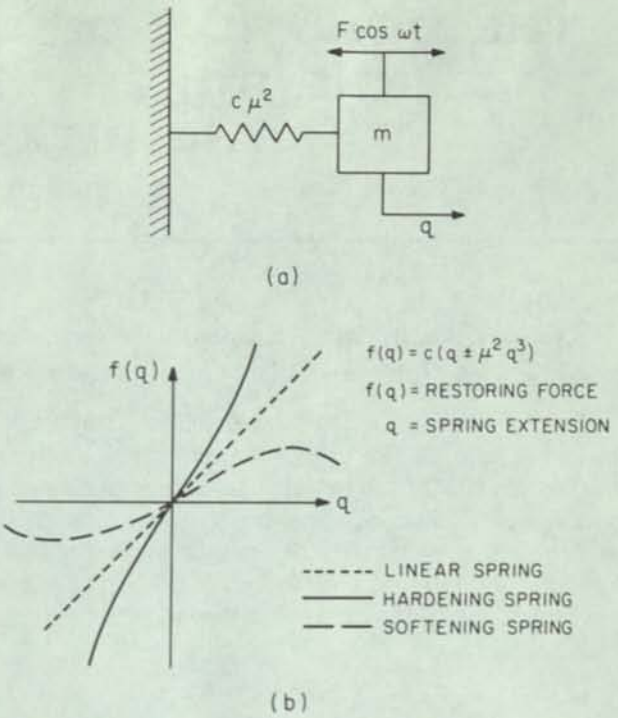

FIGURE 1. a) MODEL OF MECHANICAL SYSTEM
b) GENERALIZED SPRING FORCE VS SPRING EXTENSION CURVES

$$B - 9B\omega^2 - (A^3/3 + 2A^2B + A^2C + 2ABC + 2BC^2 + B^3) = 0 \quad (4)$$

$$C - 25C\omega^2 - (A^2B + AB^2 + 2A^2C + 2B^2C + C^3) = 0.$$

Eliminating ω^2 between the first and third of (4) and solving for C results in

$$C = \frac{-(A^3B + A^2B^2 - 49AC^3 - 50ABC^2 - 25B^2C^2)}{25A\left[\frac{24}{25} - (\frac{23}{25}A^2 + AB + \frac{48}{25}B^2) - \frac{F}{A}\right]}, \quad (5)$$

while eliminating ω^2 between the second and third of (4) yields

$$C = \frac{-(9A^2B^2 + 9AB^3 + 9BC^3 - 25A^2C^2 - 50AC^2B - 50BC^3)}{225B\left[\frac{16}{225} - \left(\frac{A^3}{27B} + \frac{32A^2}{225} + \frac{7B^2}{225}\right)\right]}. \quad (6)$$

Assuming that powers of C can be neglected compared with C (which limits the usefulness of the results to small C), (5) and (6) can be equated to yield a fourth order equation in A, B, and F

$$B^3(51A) + B^2(27A^2) - B(24A - 21A^3 - 27F) - A^4 = 0. \quad (7)$$

This equation is the starting point for the numerical processes to obtain the constants B, C, and ω^2. The process was started by choosing an amplitude F of the forcing function. Then, for an assumed value of A (the coefficient of the fundamental term), the corresponding value of B was calculated from (7). The value of C was found from (6) neglecting powers of C. Having A, B, C, and F, ω^2 was obtained from the first of (4).

Only the real roots (for B) in (7) were used, since the physical significant of complex amplitudes in this system is not understood. There are regions where three real roots of (7) occur. The response curves presented in this paper are based on single real roots of (7) or on middle roots when three roots occurred.

Method of Computation

Since all of the computations were of a repetitive nature, the problem was especially suited for digital computer techniques. The machine which was used for this computation is an IBM 701 which is located at the University of California at Berkeley, California.

The technique of computation was as follows: For a given amplitude F of the forcing function, a value of A was chosen and the corresponding value of B, C, and ω^2 were computed for this value of A. Then the value of A was incremented by a slight amount and the new corresponding values of B, C, and ω^2 were computed. After computing all these values for 50 to 100 different values of A, the results were printed out in tabular form. The total computation time for 50 to 100 different values of A was on the order of one minute. The flow diagram for these computations is shown in Figure 2.

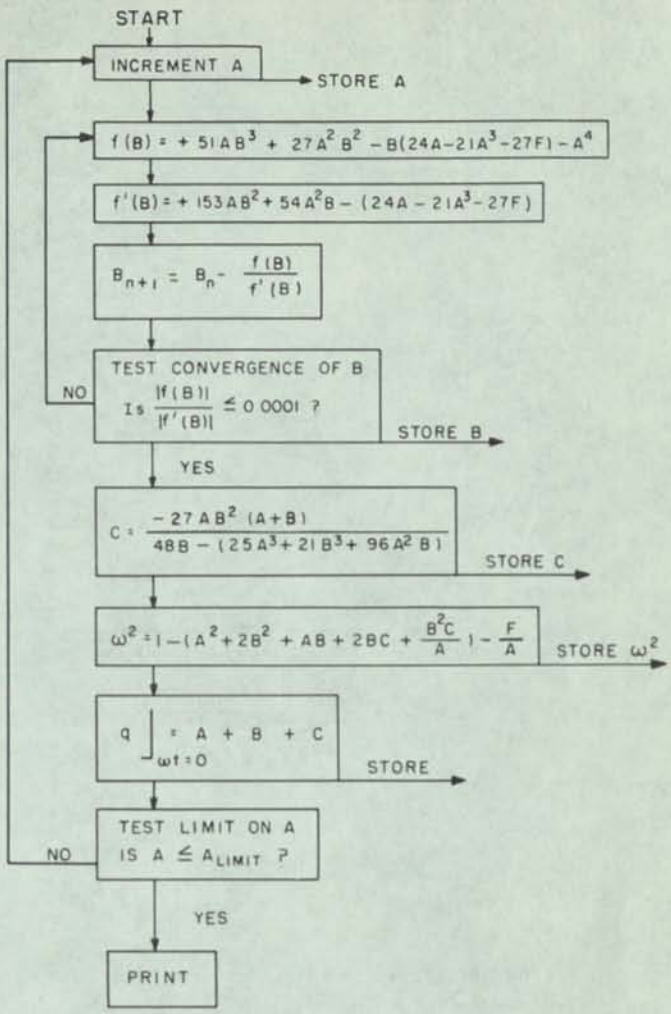

FIGURE 2. FLOW DIAGRAM FOR COMPUTER SOLUTION

Free Vibrations

Setting $F = 0$ in (7) permits the calculation of the free vibration response curves for this system. The response curves of Figure 3 result from the use of the values of B when there is only one real root to (7). This configuration is the usual [4, 9] configuration for Duffing's equation with a softening spring, showing the free vibration curve (q_{max} curve here) bending to the left. The three term solution shown yields some information that simpler solutions do not. For example, Figure 3 indicates a "nonlinear resonance" phenomenon occurring for free vibrations in the range $0.07 < \omega^2 < 0.15$. In this range the calculated curves show that both the third harmonic and fifth harmonic components increase in amplitude with decreasing frequency.

The phase relation between these harmonics is such that the value of q_{max} follows the curve indicated in Figure 3. The value q_{max} is obtained from the algebraic sum $A - B + C$, making use of the fact that in the exact solution, the elliptic sine, the maximum displacement occurs at $\pi/2$ radians. The harmonic content of the elliptic sine flattens out the peak of the displacement curve but does not allow a minimum to occur at $\pi/2$ radians. In the calculated results the fundamental and the fifth harmonic are in phase (peaks adding) while the third harmonic is out of phase. Equations (7), (6), and (4) would yield no results for free vibrations for $\omega^2 < 0.075$ (See [6] for a discussion of the multiple roots of (7)).

The exact solution for free vibrations of the softening spring system can be expressed in terms of the Jacobian elliptic sine, and the quarter period may be expressed as

$$\frac{T}{4} = \left(\frac{2}{2-\theta}\right)^{1/2} \int_0^1 \frac{d\eta}{(1-\eta^2)(1-k^2\eta^2)} \qquad (8)$$

where

$$k^2 = \frac{\theta}{2-\theta}, \quad \theta = \frac{4}{3} q^2_{max}$$

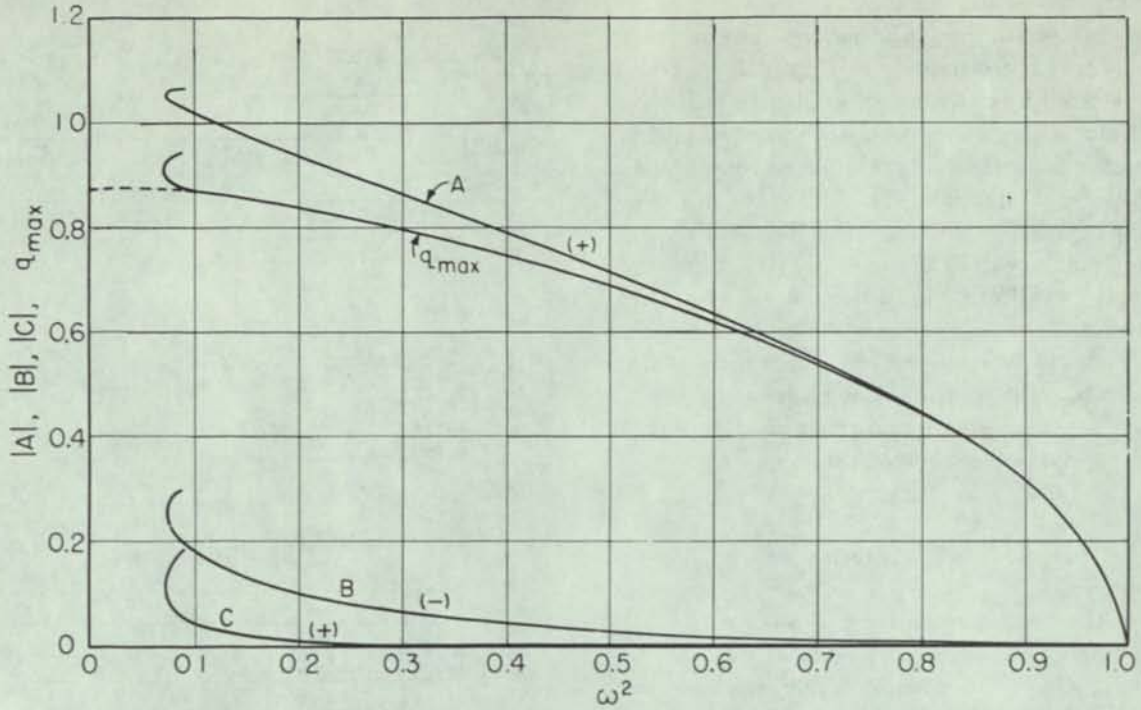

FIGURE 3. RESPONSE CURVES FOR THE THREE HARMONIC COMPONENTS OF FREE VIBRATION

then

$$\frac{T}{4} = \left(\frac{2}{2-\theta}\right)^{1/2} K(k) \qquad (9)$$

where T is the period, $K(k)$ is the complete elliptic integral with argument k, and $\eta = q/q_{max}$. For $q_{max} = \sqrt{3/2}$ or $q^2_{max} = 0.75$, $k^2 = 1$ and the circular frequency is zero.

For a value of $k^2 = 0.99$ and $q_{max} = 0.864$, the exact solution yields an ω^2 of 0.1089. A value of $q_{max} = 0.8752$ at $\omega^2 = 0.1098$ is given by (7). A comparison of these two points shows that in this region the approximate solution is within 1% of the exact solution.

For the value $q_{max} = 0.49345$ the exact solution yields $\omega^2 = 0.75349$ where the three term approximation gave $\omega^2 = 0.75323$. Figure 3 shows that the q_{max} curve and the curve for the fundamental component are quite close in the range $\omega^2 > 0.5$. For $\omega^2 < 0.5$ the fundamental deviates from q_{max} and is 16% larger than q_{max} at $\omega^2 = 0.1$. The single term Ritz approximation [9] yields a solution about midway between the q_{max} curve and the curve of the fundamental.

The softening spring system is expected to fail when the restoring force becomes zero at a displacement of $\sqrt{3/2}$. The presence of the out of phase (peaks subtracting) third harmonic yields a q_{max} that is always less than A, therefore oscillations are possible at a lower frequency than the single term approximation [9] indicates. The three term approximation (q_{max} curve, Fig. 3) indicates that the system could oscillate at $\omega^2 = 0.133$ before failure occurred, whereas the single term approximation gives an $A = 0.866$ at $\omega^2 = 0.25$. The fact that $q = \sqrt{3/2}$ is a solution to (1) with $F = 0$ indicates that oscillations should be possible down to $\omega^2 = 0$.

Comments on Free Vibrations

The calculated results for the three term approximation to the solution of the equation representing a system with a softening spring are shown in Figure 3. The response curves of Figure 3 present a fundamental response curve which is similar to the one that is usually obtained from a single term approximation to the solution.

The presence of the third harmonic component allows the system to oscillate at a lower frequency than the fundamental component alone would allow. This is due to the 180° phase relationship between the fundamental and the third harmonic component at the time the fundamental reaches its maximum.

The presence of the "resonance" phenomena of the third and fifth harmonics in the free vibration curves is of some interest. No such definite peaks occur in the free vibrations of a hardening spring system, [1, 2, 5, 7], but harmonic resonance occurs in forced oscillations of the hardening spring system. Since a "resonance" occurs in the softening spring system for free vibrations, any "resonance" phenomenon for forced vibrations can be expected to be due to the combined effects of resonating the fundamental component of the free vibrations and of resonating the harmonics in the free vibrations.

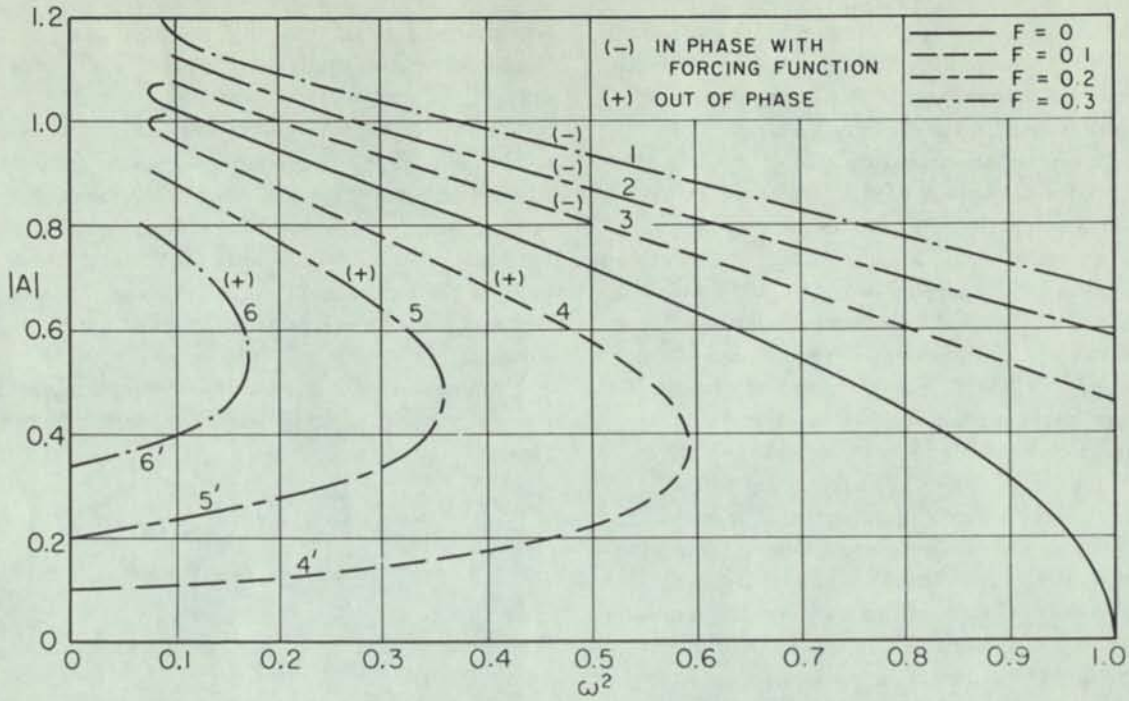

FIGURE 4. RESPONSE CURVES FOR THE FUNDAMENTAL COMPONENT (A) IN FORCED VIBRATIONS.

Fundamental Component in Forced Vibrations

The response curves for forced vibrations are presented in Figures 4 and 5 which show the amplitudes of the fundamental, the third and the fifth harmonic components. The response curves for the fundamental component in Figure 4 are similar to the usual configuration resulting from a single term approximation, except for the hooks at the upper reaches of the curves. The equations would yield no results in this upper region for $\omega^2 < 0.075$. The lower branches of these curves extended to $\omega^2 = 0$.

The amplitudes of the fundamental component are higher in magnitude for the three term approximation than in the single term approximation [9]. (This is true also for the free vibration curve where for $\omega^2 = 0.25$, $q_{max} = 0.866$ for single term approximation. The three term approximation gives an amplitude A of 0.905 at this frequency). As is seen later, the third harmonic associated with this fundamental component is out of phase with it.

The lower branches of the forced vibration curves for the fundamental component in Figure 4 with $F = 0.1$ and 0.2 are insignificantly different from the values given by the single term approximation. For example, at $\omega^2 = 0.5$ and $F = 0.1$, the three term solution yields an amplitude $A = 0.224$ whereas the single term solution (read from the graph) is $A = 0.22$. It is only on the higher values of A that a difference shows up.

The Third and Fifth Harmonic Components for Forced Vibrations

Figure 5 shows both the third and the fifth harmonic components of the solution of (1) by the three term approximation. Both sets of response curves for the harmonics arising during forced oscillations follow the curves of free vibrations for these harmonics and, similar to the fundamental component, they have a 180° phase change on the other side of the "backbone." Where the fundamental changes from plus to minus the third harmonic changes from minus to plus, while the fifth is like the first. (A plus sign indicates that the component peaks at the same time and in the same direction as the forcing function.)

Discussion and Comment on the Solutions for the Softening Spring System

For the three term approximation, Figure 4 presents a fundamental response curve that is quite similar to that which is obtained by a single term approximation. For a given value of the forcing function and for a given ω^2, the amplitudes of the fundamental component are higher than the values obtained from a single term approximation. There are hooks at the ends of the response curves beyond which the equations would yield no results.

The third and fifth harmonic components have resonance peaks (Fig. 5) in the region $0.075 < \omega^2 < 0.1$. The maximum amplitude of the peak for the third harmonic is $B = 0.3$, for the fifth harmonic the peak is $C = 0.2$. The curves for forced oscillations indicate the presence of these harmonics for all values of the forcing function. They are present in the free vibrations as well.

In the single term approximation for forced oscillations an unstable region is considered to begin at the point of vertical tangency of the double-branched response curves to the left of the "backbone" (see Fig. 4). Any displacement, q, which exceeds this point of vertical tangency of the fundamental puts the solution in an unstable region which could lead to failure of the spring. For certain values of F it may lead to a jump to the response curve on the other side of the backbone.

The three term approximation shows that in the region of the third and fifth harmonic resonance, there is the possibility of a q_{max} that would extend into the unstable region even though the fundamental amplitude alone is "safe." Although the calculated results indicate that the fundamental is associated with an out-of-phase third harmonic and an in-phase fifth in this region, there could occur a phase and amplitude jump of each of these components that would result in an unstable vibration.

These comments lead to the conclusion that for the range $0.075 < \omega^2 < 0.1$ oscillations due to forcing functions greater than $F = 0.2$ can become unstable since the sum of the three components may produce a q_{max} that will extend into the unstable region beginning at the "locus of vertical tangents" of the fundamental response curves.

The fundamental response curves for forced oscillation to the right of the backbone are marked with a minus sign which indicates an out of phase relationship with the forcing function. The addition of the corresponding third harmonic (marked with a plus sign) subtracts from the peak of the fundamental and allow oscillations at a lower frequency than the fundamental response alone would allow.

Equation (4) indicates that pure superharmonics are possible in forced oscillations according to the equations:

$$1 - 9\omega^2 = B^2 \tag{10}$$

$$1 - 25\omega^2 = C^2 \tag{11}$$

An equation similar to (10) but for the hardening spring system, was given by Kats [1]. The calculated results based on small C in (5), (6) yield no further information regarding pure superharmonic oscillations.

Acknowledgment

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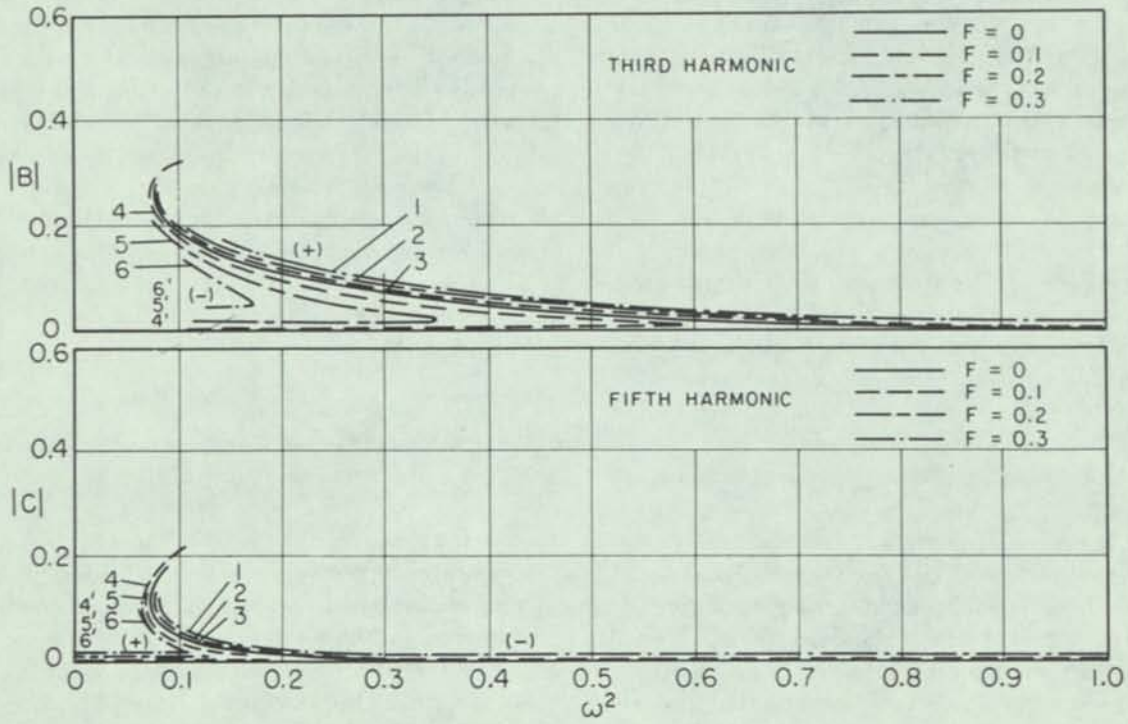

FIGURE 5. RESPONSE CURVES FOR THE THIRD AND FIFTH HARMONIC COMPONENTS IN FORCED VIBRATIONS

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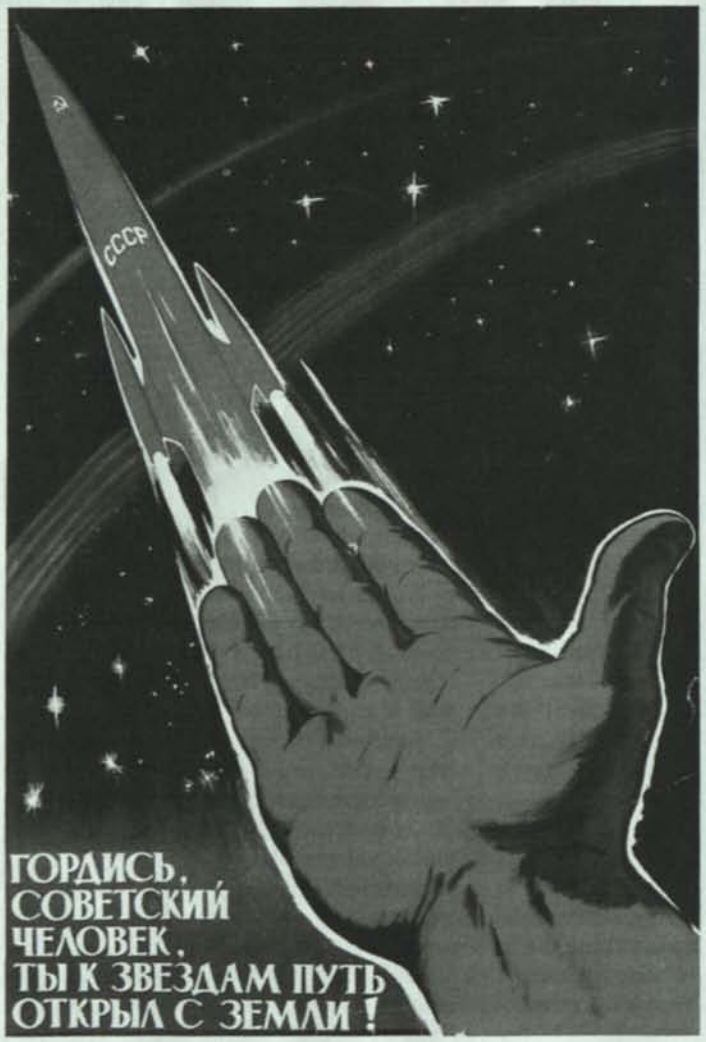
[BY JACOB ROBERTS]

Sputnik Fever



ON OCTOBER 4, 1957, the Soviet Union shot a metal sphere the size of a beach ball into orbit around Earth. This landmark in space exploration provoked a slew of conflicting emotions in American scientists, politicians, and the broader public.

On the one hand, a sense of wonder was natural. The Russian craft, *Sputnik 1*, was the world's first artificial satellite. It proved that humans, or at least their creations, could reach space. And it inspired a generation of students to pursue science.

On the other hand, the Soviet success panicked U.S. leaders locked in an ideological cold war with their Communist rivals. Allowing the Soviets to win the space race would legitimize the Communist experiment and devalue democracy. Military strategists also worried: the success of the Sputnik program demonstrated the Soviet Union's potential to launch missiles around the planet. To many Americans, *Sputnik 1* represented a dark future where the Soviet Union reigned as the world's dominant superpower.

American officials responded by pouring money into science, both basic and applied. Congress created the National Aeronautics and Space Administration (NASA) on October 1, 1958, combining multiple programs into a massive organization employing thousands of people in laboratories across the country. NASA and the National Science Foundation found themselves flush with cash and with enthusiastic backers in Washington. By 1966 NASA was consuming 4.4% of the federal budget ($5.9 billion), primarily in an effort to put a human crew on the Moon by 1969. NASA's budget for 1966 outstripped federal spending on any of the large-budget items of transportation, welfare, or education.

U.S. officials also looked to the future. Lawmakers diverted funds to bolster American science education, and grade-school and college administrators began revamping their science and technology programs. Teachers and students were swept up in education reform and a general zeal for science.

"I remember sitting in class in 1957, and the professor came in and announced that Russia had launched *Sputnik*," said computer engineer and venture capitalist William H. Davidow during his CHF oral-history interview. "I remember thinking how far behind we were because we weren't going to have a satellite up for six months and it was only going to weigh eight pounds." (*Sputnik 1* weighed 184 pounds.)

Literally and figuratively, *Sputnik 1* loomed over Davidow as he considered his future. "I was trying to make up my mind whether I'd be a businessman or a scientist. I decided that I owed it to my country to be a scientist." Davidow settled on an electrical engineering program at the California Institute of Technology where his interests turned to computer programming. Around 1969 or 1970 he approached the leaders of the newly formed Intel Corporation with a plan for a microprocessor. In 1971 Intel released the 4004, the world's first commercially available microprocessor, and by 1973 Davidow was leading the company's microprocessor division.

SR1 CULTURE SYSTEM

Learning from the Missile Crisis

What Really Happened on Those Thirteen Fateful Days in October

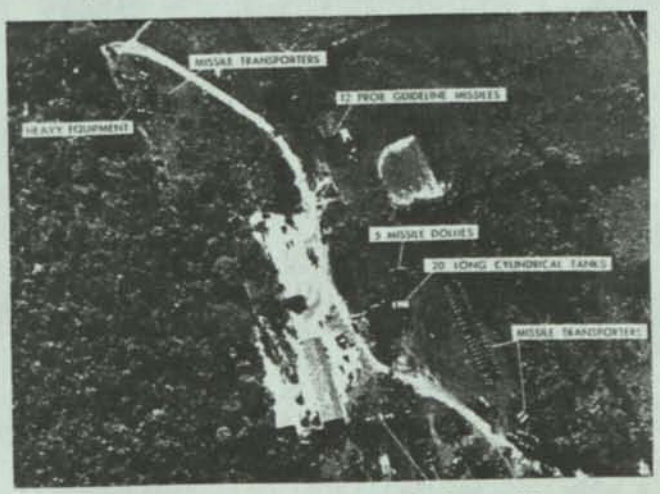
File CB Projects

BY MAX FRANKEL

IT WAS A LOVELY AUTUMN DAY 40 YEARS AGO THIS MONTH, A DAY NOT UNLIKE SEPTEMBER 11, 2001, when Americans realized that the oceans no longer protected us from enemy attack. Those old enough that October 22, 1962 to know the name John F. Kennedy will never forget the fear that swept through homes and cities when the president appeared on television, grave and gray, to proclaim a crisis. Reading a stern ultimatum to the Russians that called them nuclear cheats and liars for placing offensive missiles in Cuba, he also left the impression that his counteractions might any minute provoke a rain of Soviet missiles. The news terrified the public for six days and nights (though less for those of us trained to parse the bellicose words and signals flying urgently between Moscow and Washington). And as Hollywood has demonstrated time and again, the drama of the Cuban missile crisis has the power to instruct, beguile and entertain Americans in every decade.

The 2000 film version, with Kevin Costner playing an absurdly fictionalized role as Kennedy's aide Kenneth O'Donnell, was called *Thirteen Days*, referring to the period of public alarm plus the period of frantic, secret debate that preceded it as Kennedy planned a response to the discovery of the nuclear rockets in Cuba. If the moviemakers had bothered with the Soviet and Cuban sides of the crisis, they could have made a vastly better film, reasonably called *Thirteen Weeks*. And had they examined the calamitous miscalculations on all sides, it might have been titled *Thirteen Months*.

Most accounts of the crisis concentrate only on the Washington players, led by the glamorous, nervous president and his shrewd younger brother, Robert. A view of Havana would feature the humbling of Fidel Castro, Cuba's bearded Robin Hood, and his scheming younger brother, Raúl. In Moscow a bombastic Nikita Khrushchev was drowning in sweat as his boldest Cold War maneuver collapsed into retreat. This is a tale about a fateful triangle.



"My fellow citizens," President Kennedy began 40 years ago, warning Americans of a "secret, swift and extraordinary build-up of Communist missiles" in Cuba. Kennedy considered his handling of the crisis his greatest achievement as president.

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A GENERAL-PURPOSE TIME-SHARING SYSTEM

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INTRODUCTION

Since June 1963, a Time-Sharing System has been operational at the System Development Corporation in Santa Monica. This system was produced under the sponsorship of ARPA and has utilized ideas developed at both Massachusetts Institute of Technology[3,4] and Bolt, Beranek, and Newman,[1,11] as well as some original techniques. Time-sharing, in this case, means the *simultaneous* access to a computer by a large number of independent (and/or related) users and programs. The system is also "general purpose," since there is essentially no restriction on the kind of program that it can accommodate. The system has been used for compiling and debugging programs, conducting research, performing calculations, conducting games, and executing on-line programs using both algebraic and list-processing languages.

This paper is divided into four major discussions. These are: (1) an outline of the capabilities provided for the user by the equipment and program system; (2) a description of the system's operation, with an analysis of the system scheduling techniques and properties; (3) a somewhat detailed description of two of the currently operating system service programs; and (4) a conclusion and summary.

CAPABILITIES FOR THE USER

Equipment Configuration

The major computer used by the Time-Sharing System (TSS) Executive is the AN/FSQ–32 (manufactured by IBM). Also used by the system is the PDP–1 (manufactured by Digital Equipment Corp.), which is the major input/output vehicle for the various remote devices.

The remote input/output devices available to users include Teletypes, displays, and other computers. These devices can be run from within SDC, and from the outside, with the exception of displays, which can be operated only a short distance from the computer. It is expected that computers to be used at remote stations will eventually include the CDC 160A, the DEC PDP–1, and the IBM 1410. (Currently only the 160A is being used, from an installation 400 miles distant from the Q–32.) Figure 1 is a description of the system's remote equipment configuration.

SRI - AHI

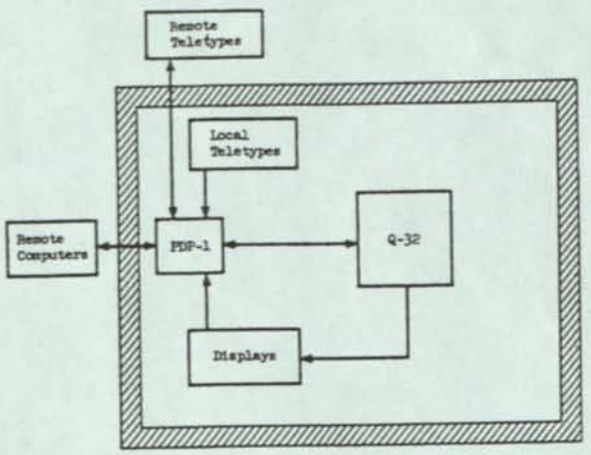

Figure 1. Remote Equipment Configuration.

The SDC time-sharing system revisited

by JULES I. SCHWARTZ and CLARK WEISSMAN
System Development Corporation
Santa Monica, California

INTRODUCTION

It has been something over three years since our original paper ("A General-Purpose Time-Sharing System")[1] was written, and over four years since the system described in that paper was put into use.

At the time of the original writing, the Q-32 Time-Sharing System (TSS)* had been in operation just over six months. Our experience with it was limited: the hardware described was installed but in some cases not fully utilized, and the number of users was small (probably no more than 50 people were users at that time). The system, however, was beginning to work reliably and for long enough periods so that we felt quite confident that its usefulness and potential had been demonstrated. Consequently, the paper was written describing the characteristics of the system, the problems as seen then, and some predictions for the future. Much of what was said concerning the system and the subject of time-sharing in general has withstood the test of time well. Some of the questions raised at that time, however, still remain unanswered; certain predictions, as well, remain unfulfilled.

Also, since the original paper was written, considerable interest in the computing world has been focused on the subject of time-sharing. Numerous time-sharing systems, both laboratory and commercial, have come into existence.[2] (Over 30 different systems exist or are promised in the near future, of which approximately half are commercial.) Computers specifically oriented toward time-sharing have been produced, and the literature and professional gatherings have demonstrated an increasing interest in the subject.

In the light of this accelerating interest, it seems worthwhile to review both the current status of TSS and some of the predictions made three years ago. Our review will include a brief overview of system changes, a discussion in some depth of resource allocation (which now appears to be the critical factor in general-purpose time-sharing systems), and some conclusions regarding how well our statements have withstood the test of time.

Current system status

Since the original paper described the Q-32 Time-Sharing System in some detail, the present discussion serves mainly to update the reader on the current status of the system.

Hardware

The hardware configuration has changed relatively little since the original writing. There are now 52 teletype-typewriter channels available, of which 21 are open to distant (Dataphone, TWX, TELEX) communications. The only significant configuration change is the size of the drum memory, which is now approximately 750,000 words, as opposed to the 400,000 originally mentioned. One other change of interest is the installation of a RAND Tablet interface in conjunction with the display scopes, which has permitted hand-written input to the computer. In the area of computer networks, the one that existed between the CDC 160A and the Q-32 is ?ow obsolete. Currently, a connection exists between the Q-32 and the Lincoln Laboratory's TX-2.[3]

Software

The overall system architecture has also had rather minimal changes, although we now see some inflexibilities in it (which are discussed in the final section of this paper). There have been a large number of improvements and additional services provided, however, within this same structure. The system today provides much more help to the user than it did originally. One item of interest to readers of the original document is that LISP 1.5 has largely replaced IPL-V as the most popular list-processing language.[4]

*Developed under the sponsorship of the Advance Research Projects Agency, Department of Defense.

Charles Bourne
1619 Santa Cruz Ave.
Menlo Park, CA 94025

File CB Projects
General

Lisa Beffa
Library and Records Center
Mail Stop BS 013
SRI International
333 Ravenswood
Menlo Park, CA 94025-3493

Hi Lisa,
Thank you for your helpful information on the phone today. As I mentioned, I was a Research Engineer at SRI (1957-66), while also an historian of the information age. (see attached, and an Oral History at the Computer History Museum).

I am currently trying to fill in the details of some of the early projects that I worked on at SRI. My records are spotty, but I do have some information.

I know, for example, that I did work on the SRI projects with the 27 project numbers noted on the attached pages. I hope that you can give me the names of the project sponsors, project titles, and project dates for each of these activities, and any other relevant information you could provide (e,g,. publication citations). I would be most appreciative.

I would be pleased to visit you to discuss this further if you wish. You can reach me at my home phone: 650/322-7101.

Thank you for your consideration.

Attachments: CB book titles and resume
SRI Project numbers in date sequence

Charlie Bourne's Project Numbers (in Date Sequence)

1958	2446
	2684
	643521
	EU3684
1959	2446
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	643521
1960	I-3434
	3425
	3660
1961	3741
	ES2056
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1962	3741
	643541
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	3975
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	643591
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1963	4239
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Charlie Bourne's Project Numbers (Consolidated)

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ES2056
EU3684
I-3434

CB copy
1/22/17 CB CALLED

Charles Bourne
1619 Santa Cruz Ave.
Menlo Park, CA 94025

Dec. 13, 2016

Lisa Beffa 650/859-5506
Library and Records Center
Mail Stop BS 013
SRI International
333 Ravenswood
Menlo Park, CA 94025-3493

BEFFA@SRI.com

Hi Lisa,
Thank you for your helpful information on the phone today. As I mentioned, I was a Research Engineer at SRI (1957-66), while also an historian of the information age. (see attached, and an Oral History at the Computer History Museum).

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I would be pleased to visit you to discuss this further if you wish. You can reach me at my home phone: 650/322-7101.

Thank you for your consideration.

1/22/17 Lisa said that legal said they can't release any info. Some are still classified, some have clients who have gone out of business. "Try NTIS" or DTIC."

Charlie Bourne

Attachments: CB book titles and resume
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EESU9307
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EU3684
I-3434

A HISTORY OF ONLINE INFORMATION SERVICES, 1963–1976

Charles P. Bourne
and
Trudi Bellardo Hahn

The MIT Press
Cambridge, Massachusetts
London, England

2003

Methods of Information Handling

CHARLES P. BOURNE, *Stanford Research Institute, Menlo Park, California*

1963

John Wiley & Sons, Inc., New York · London · Sydney

TECHNOLOGY IN SUPPORT OF LIBRARY SCIENCE AND INFORMATION SERVICE

With Particular Emphasis on Computer-Assisted Reference Service

Charles P. Bourne
Lockheed Information Systems
Palo Alto, California

SARADA RANGANATHAN ENDOWMENT
FOR LIBRARY SCIENCE
BANGALORE
1980

MARQUIS
Who's Who®

Press Release Approval Page

Press Release

For Immediate Release

Charles Bourne Recognized by Marquis Who's Who for Excellence in Information Science

Mr. Bourne was a member of the U.S. Egyptian Task Force on Technology Information Programs

MENLO PARK, CA, September 22, 2016, Charles Bourne has been included in Marquis Who's Who. As in all Marquis Who's Who biographical volumes, individuals profiled are selected on the basis of current reference value. Factors such as position, noteworthy accomplishments, visibility, and prominence in a field are all taken into account during the selection process.

The president of Charles Bourne & Associates since its inception in 1970, Mr. Bourne has become adept at demonstrating and sharing his expertise in information science and education. Over the course of his career, he has performed extensive research for libraries, schools and academies, including the Library of Congress, the National Agricultural Library, the U.S. Patent Office and the National Academy of Science. He has been a guest lecturer worldwide on the study of information science at such institutions as the University of California at Berkeley and Bangladore University in India, where he was a Sarada Ranganthan lecturer for the endowment of library science. Additionally, Mr. Bourne has brought his areas of specialization to consulting roles in Ghana, Indonesia and Tanzania. Notably, he was a member of the U.S. Egyptian Task Force on Technology Information Programs and he was a U.S. delegate for the United Nations Educational Intergovernmental Conference on Science and Technology Information Development.

Mr. Bourne's successes and significant impact on his field derive from his education and early experiences, which have established his reputation and built his prominence. He holds a Bachelor of Science in electrical engineering from the University of California, which he earned in 1957. Thereafter, he achieved a Master of Science in industrial engineering from Stanford University in 1963. Mr. Bourne began his career as a senior research engineer for the Sanford Research Institute in Menlo Park in the late 1950s. As his career progressed, he took on roles as the vice president of the Information General Corporation, and as a professor in residence, as well as the director of the Institute of Library Research at the University of California. Further, Mr. Bourne demonstrated his proficiency as the vice president of the general information division of the Dialog Information Services, Inc.

In recognition of professional career excellence, Mr. Bourne received an Annual Award of Merit from the American Documentation Institute. Additionally, he was selected for inclusion in Who's Who in America, Who's Who in American Education, Who's Who in Science and Engineering, Who's Who in the Media and Communication, Who's Who in the West, and Who's Who in the World. To remain current in his professional community, Mr. Bourne is involved with a number of organizations, including the American Society of Information Science and Technology, for which he served as president in 1970 and earned its Best Information Science Book Award in 2004 for his work, "A History of Online Information Services." He is also a member of the American Library Association, for which he served a term as its director of information science and automation, and the National Information Standards Organization, for which he served on the board of directors in the late 1980s. As he looks to the future, Mr. Bourne intends to continue on in his role as president of Charles Bourne & Associates and take on new opportunities in the field of information science.

Charlie Bourne's Project Numbers (Consolidated)

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NATIONAL SCIENCE FOUNDATION
Washington 25, D. C.

SECOND MEETING OF SCIENCE INFORMATION COUNCIL

April 14-15, 1959
Princeton, New Jersey

Contents of Members' Folders

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B. Summary of 1st Meeting of Science Information Council held on February 2, 1959

C. Opening Remarks to Members of the Council by Dr. Alan T. Waterman on February 2, 1959

D. Report to Members of the Council by Dr. Burton W. Adkinson on February 2, 1959

E. White House Press Release on Executive Order No. 10807, March 13, 1959

F. Progress Reports on Office of Science Information Service Programs Covering February and March, 1959

(1) Documentation Research
(2) Foreign Science Information
(3) Interdisciplinary Science Communication
(4) Publications and Information Services
(5) Unpublished Research Information

G. Background Information on OSIS Support of Publications

H. Examples of Mechanical Translation - Report Prepared by OSIS

I. Critique on Developments in the Mechanization of Information Systems by Foster E. Mohrhardt - (Reprinted from College and Research Libraries, September 1958)

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K. Summary of 2nd Meeting of Federal Advisory Committee on Scientific Information held on March 17, 1959

L. Report of the Committee on Government Operations, U. S. Senate, March 23, 1959 - Science Program--86th Congress

NATIONAL SCIENCE FOUNDATION
Washington 25, D.C.

AGENDA

Second Meeting
SCIENCE INFORMATION COUNCIL
Princeton, New Jersey
April 14-15, 1959

April 14

Progress Report on Science Information Service Activities

Dr. Burton W. Adkinson
Head, Office of Science Information Service

Report of the Panel on Publication Support Policy

Dr. W. N. Locke, Chairman

Report of the Panel on Copyright

Mr. W. T. Knox, Chairman

April 15

Briefing Session: Mechanization of Information Processes

Dr. John W. Mauchly, Co-Chairman

Dr. Don R. Swanson, Co-Chairman

Other Business

NOTE: Tuesday evening, April 14, is being set aside for an after-dinner discussion during which Dr. Waterman plans to make some informal remarks.

NATIONAL SCIENCE FOUNDATION
Office of Science Information Service
Washington 25, D. C.

Summary of
First Meeting of
Science Information Council
February 2, 1959

PRESENT:

Council Members

Dr. Burton W. Adkinson
Dr. William O. Baker
Mr. Curtis G. Benjamin
Mr. Boyd Campbell
Mr. Verner W. Clapp
Dr. E. J. Crane
Dr. Graham P. DuShane
Dr. John M. Fogg
Dr. Elmer Hutchisson — AIP
Mr. Merritt L. Kastens
Mr. W. T. Knox
Dr. William N. Locke
Dr. John W. Mauchly
Dr. John S. Millis
Mr. Foster E. Mohrhardt
Mr. L. Quincy Mumford
Dr. Frank B. Rogers
Dr. H. W. Russell
Dr. Don R. Swanson

NSF Staff

Mr. Gregory A. Abdian, SIS
Mrs. Helen Brownson, SIS
Mr. Paul S. Feinstein, SIS
Mr. Bernard M. Fry, SIS
Dr. Dwight E. Gray, SIS
Mr. William J. Hoff, General Counsel
Mr. Ralph E. O'Dette, Secretary, SIC

The meeting was convened at 10:00 a.m. by the Secretary who read a brief statement prepared by Dr. Waterman in the light of his last minute inability to attend in person. A copy of this statement is attached.

The Secretary introduced members of the Council and the professional staff of the Science Information Service.

Following a brief discussion of administrative details, nominations were received for Chairman of the Council. Dr. W. O. Baker was elected by acclamation.

The Chairman introduced Dr. Adkinson who spoke on the problems and programs of the SIS. A transcript of Dr. Adkinson's remarks, including interpolated discussion, is attached.

The remainder of the meeting was devoted to discussion of Dr. Adkinson's remarks, consideration of problems which the Council might study, and procedures which it might most effectively use.

Dr. Rogers said that it was important to analyze the pattern of support of existing information activities with particular emphasis on the parts played by various Federal agencies. He emphasized that the coordinating role assigned to the Foundation did not imply that other agencies should be relieved of their responsibilities. To the maximum extent feasible other agencies must continue to discharge their responsibilities for information programs.

Mr. Mohrhardt stated that since one of the Council's objectives was to help improve the flow of information, the Council should at some time plan to look into the problem of administrative classification of information. He said that while he did not wish to indicate this was the most important problem, he felt that a considerable quantity of useful information was not receiving sufficiently broad dissemination because agencies were permitting too ready use of markings such as "for internal use only," "administratively restricted," etc.

Dr. Mumford pointed out that we have a national collection of science publications although it is not formally so designated. The Library of Congress, National Library of Medicine and the Library of the Department of Agriculture, working closely together, actually constitute a national science library. Dr. Mumford said that the acquisitions program could be improved but that space was a major problem. With more room there could be an expansion of the activities of these libraries in science and technology.

Dr. Baker suggested that the roles of the three national libraries possibly should be studied by the Council. Also required are better analyses of the utilization of scientific information, including a quantitative analysis of the world's output of information.

Dr. Hutchisson pointed out that because of the varied backgrounds of Council members it will be difficult for the Council to consider technical problems in detail unless the Council is adequately briefed. He said that, for example, he would welcome a full day's study of information handling devices and a full day on the facilities of the three major libraries. This would create a severe drain on the time of Council members, but he said it was difficult for him to find an alternate approach.

Dr. Baker and others suggested that the Council might have to approach specific problems through special panels in order to reduce the need to indoctrinate the whole group. The professional societies might also be called on to conduct substantive studies of interest to the Council.

Dr. Adkinson cited the American Institute of Physics study, aupported by the Foundation, as an example of what Dr. Baker was suggesting. The AIP will investigate the entire communications network in physics, beginning with the generation of information and extending through its utilization. Dr. Adkinson said he had also discussed this problem with the American Institute of Biological Sciences and hoped that at the next Council meeting he would be able to describe the far-reaching study contemplated by AIBS.

Mr. Benjamin asked for the Government members' evaluation of the relative importance of information problems. The Council might help the Foundation establish an order of priority, but it would be helpful to know which problems the Government feels to be most urgent. In his opinion, because of his special relationship with the publishing industry, the copyright problem was most important.

Mr. Campbell questioned the responsibility of the Council for informing the public of the activities and problems of science. He said he felt this should be a Council responsibility, and suggested that the presence of lay members on the Council supported this attitude.

Dr. Baker and others felt that the principal contribution of lay members would be to bring fresh attitudes to bear on information problems and that this contribution was vital. Dr. Adkinson explained that it had been decided within the Foundation that interpreting science to the public would be the responsibility of the Foundation's Division of Scientific Personnel and Education. While SIS is interested in this problem, it does not expect to undertake specific programs of its own.

Dr. Millis questioned the interest of the Council in the problem of providing competent professional personnel for the information field. It was agreed that the Council should be very much concerned with this problem although there was no elaboration of how this concern might be expressed.

Dr. Crane emphasized the necessity of keeping a practical viewpoint in mind throughout Council discussions. He cautioned against attempts to create a revolution in the information field, saying that his long experience had convinced him that while revolutionary ideas were important and must be considered, improvements in the information field would have to come through evolution. He emphasized that the Council must always keep in mind the problems of the people who use information. Dr. Russell agreed and said he felt we needed to talk more to scientists about their information needs since not enough is known on this subject.

Mr. Kastens agreed that more needed to be known about the use of information but, he said, gathering such information was exceedingly difficult. It is not sufficient to ask a scientist how he uses information or to ask what kind of information services he wants. Experience with studies of this type has shown that scientists often do not do what they say they do.

Mr. Knox questioned the validity of general studies of user needs. He said such studies could be helpful in a carefully defined isolated situation such as within one laboratory, but that the conclusions of such a specialized investigation would not be generally applicable.

Mr. Clapp cited studies supported by the Foundation and other organizations on user needs and suggested that an evaluation of these studies should precede any new studies. He then said that an over-riding consideration of the Council should be its working procedures. He questioned the extent to which the Council should do its own work, pointing out that the Council could overwork the SIS staff by asking for background information on each problem it considered. Generally speaking, the Council should consider the information problem from two points of view: (1) It should look at the details of current programs in order to suggest possible changes and improvements, and (2) it should regularly try to look at "the big picture" so that long-range planning is not lost sight of.

Dr. Rogers and others cautioned against formalizing Council procedures too quickly. The far-ranging discussion up to that point was thought beneficial, and it was felt that such discussion should continue for some time before concrete working procedures were formalized.

Dr. DuShane and others agreed that it would be helpful to have more background information on the basic assumptions presented by Dr. Adkinson in his opening remarks: why were they needed?

Dr. Locke said that most of his knowledge of present Foundation activities dealt with machine translation research and Russian translation projects. He praised the work of the Foundation in these areas and felt that the Council could best contribute to these programs by concentrating on consideration of their future directions.

Mr. Kastens said it was risky to assume that the present pattern of national information activities was sound (the first of Dr. Adkinson's assumptions) and that it needed only patching. Neither the Council nor the Foundation should consider scrapping present programs, but it should be recognized that there is a need for more than simple repairs to the present system.

Dr. Adkinson said that the assumption of the validity of our present system was made only to clarify his belief that the system should not be scrapped. He did not mean to imply that major improvements could not be envisioned.

Mr. Clapp said that this assumption could be approached from either side; the system is both very good and very bad, depending on the knowledge and attitude of the inquirer. The system is superb in that a large amount of useful information is generated, made available, and used, but the system is also not satisfactory. Its main defects are: (1) Lack of systemization of resources. It is difficult to know where to go for information; and (2) lack of promptitude.

Dr. Rogers agreed with Mr. Clapp and cautioned against attributing either the faults or the virtues of our existing system to its degree of centralization or decentralization.

Dr. DuShane said that while the initial decision to rest with our current decentralized system was a good one, the Council could profitably study centralization versus decentralization in greater detail in order to arrive at more precise judgments of when which approach is preferable.

Dr. Crane pointed out that while we must keep looking for better methods we must continue to live within the basic system we now have until we can develop a better one.

Mr. Benjamin questioned whether or not the law did not direct the Foundation not to engage in information activities if other organizations would undertake them. If true, he said, this clearly points toward decentralization.

Mr. Knox said he felt it was most important to define what is meant by "the information problem." Somehow the over-all problem must be divided into discrete real parts. In his opinion, a technical man uses information to provide current awareness or for retrospective searching. In our concern for improving current awareness we should concentrate on improving appropriate media such as journals, abstracting services, indices, etc., and make sure they are easily accessible to the research worker. It is in organizing, storing, and retrieving information for retrospective searching that there is the greatest need and most room for improvement. Since the needs of users as well as their attitudes toward the literature vary widely we can never expect to give every scientist all the information he wants currently.

Dr. Swanson suggested that the military and intelligence agencies may have a clue to the problem in their attempt to give their subject specialists what they may need to know for their current work. He said that reprints sent him by people who know his interests are his best sources of information on his own scientific interests. It was agreed that such a specialized service would be excellent if it did not prove too costly and if it were possible to keep abreast of the changing interest of research workers.

Dr. Fogg cited the National Federation of Science Abstracting and Indexing Services as an important forward step in improving coordination between information services. Consideration should be given to other broad phases of the national information activity which might be strengthened by a similar approach.

As an example of a major problem which the SIS had not yet tackled, Dr. Adkinson cited the plight of private research libraries which are finding it increasingly difficult to keep up with the growing volume of scientific information.

Mr. Campbell said he believed we should investigate this problem thoroughly because such private institutions should be supported if their services to the public warranted it.

Dr. Rogers said that Federal support of private libraries was part of a larger social question and that while library support may prove necessary, the Foundation should proceed with great care.

Mr. Clapp said that one important Foundation responsibility may be to act as a kind of specialist Bureau of the Budget on Federal information activities. One means for obtaining coordination as well as of providing evidence of its existence is the agency budget.

Mr. Hoff, General Counsel of the Foundation, said that while the Foundation was not officially required to play this role we have performed the function Mr. Clapp referred to on general problems. The only specific program in which the Foundation has actively coordinated budget requests of other agencies is in connection with the Public Law 480 program for translation of scientific publications in foreign countries to be financed by U. S. owned foreign currencies.

Dr. Adkinson said that in the past we had participated in a kind of budgetary coordination by calling together agencies interested in similar activities before these agencies appear before the Bureau of the Budget.

Dr. Swanson said that the Foundation probably does not have enough money to engage in any kind of comprehensive library support program. Beyond this, he felt that embarking on a major program of this type implied maintenance of the status quo. It is felt by some that the day of the large comprehensive research library may have passed, so that

library support on a large scale should not be contemplated until the role of libraries in the scientific communications network has been carefully re-examined.

Dr. Crane said that one of the simplest means of strengthening the dissemination of information would be a requirement that agencies which support research also support the dissemination of information resulting from the research.

Mr. Benjamin reemphasized the importance of the copyright problem. He said that he was interested in the dissemination of information and therefore did not wish to see unnecessary deterrents to its free flow. However, if it becomes easier to copy from a published journal than to subscribe to that journal there will be serious effect on all journals which depend on advertising and subscription income. If it thus becomes uneconomical to publish technological journals, for example, there will be a net decrease in the amount of information available. It is possible that conventional publication of highly specialized information is a thing of the past.

Mr. Kastens endorsed this position and pointed out that the forthcoming development of fast searching and reproducing systems makes consideration of the copyright situation even more important.

It was agreed that the Council would meet again during April with an agenda based on specific problems of the greatest current importance at that time. It was tacitly agreed that copyright and mechanization should be considered in detail at the next meeting. The meeting adjourned at approximately 3:00 p.m.

Prepared by: Ralph E. O'Dette
Secretary

Report to the Science Information Council;

A Transcript of Extemporaneous Remarks

by Burton W. Adkinson

First Meeting - February 2, 1959

First I wish to express my thanks, individually, to each of you for accepting appointment to the Science Information Council and for attending this first meeting. I know you are all busy, and so I am especially pleased to see such a group assembled to assist in attacking the large information problem faced by the National Science Foundation.

The questions we must ask today are, "What aspects of the problem should we take up first, and where should stress be put?" We cannot cover the waterfront; we must concentrate on stimulating improvements.

Before discussing the information program I should like to briefly outline the organization of the Foundation. At the top we have the National Science Board and the Director and his immediate staff. The Board has 24 members appointed by the President, and the Director is an ex-officio member.

The Board has policy making responsibility, and they review annual budget requests before they are officially adopted by the Foundation. In addition, all research grants are reviewed and approved by the Board before the grants are made.

The operating responsibilities of the Foundation are discharged by four divisions. The Division of Administration takes care of budget, personnel, space, processing grants and contracts, and the housekeeping chores. The Division of Biological and Medical Sciences and the Division of Mathematical, Physical and Engineering Sciences are concerned with support of research in those areas. The Division of Scientific Personnel and Education is concerned with the supply of trained manpower, fellowships and the like.

There are also three Offices which are smaller in size and scope than the Divisions. One is the Office of Social Sciences just established this year to pull together small research support activities which had been in the two research Divisions. There was no definition of science in the Foundation's enabling Act, but our responsibilities in this area have been interpreted more broadly as the Foundation has gained experience. The Office of Special Studies conducts studies which the other Divisions or the National Science Board feel should be done on such topics as statistics related to the national research and development effort. This Office also studies other subjects of interest to one of the Divisions or Offices or the Board, and it generates its own studies if they are felt to be necessary and if other interested parties in the Foundation agree. It also gives

grants and contracts to other agencies, such as the Bureau of the Census, to collect and help analyze data that will be useful elsewhere in the Foundation, for example, in developing major policy in the field of science.

Last there is the Office of Scientific Information which was redesignated last week as the Office of Science Information Service. The Science Information Service was, as you know, established by act of Congress, which wished to have the name applied to our science information activity.

The policy and direction staff of the Foundation consists of the Director, Dr. Alan T. Waterman; the Deputy Director (the position is vacant); Associate Director for Management and Public Affairs, Mr. James M. Mitchell, who is also concerned with Congressional laision; and the Associate Director for Research, Dr. Robert R. Brode, formerly of the University of California, who oversees the two research Divisions. Just as a point of interest, it is Robert's twin brother, Wallace Brode, in the State Department, who heads the Science Attaché program as Science Advisor to the Secretary of State.

With this brief background I should like first to review briefly some legislation of significance to our work here, and then to review some of the characteristics of the information problem as I see them. I shall discuss briefly the scientific information activities of the Federal Government, and those outside the Government, trying more to characterize than to discuss them as they are so great in size and number. I shall also try to characterize the activities of the Office of Science Information Service, and finally to take a look at some of the problems that face the Service in the future. We must make some basic assumptions, assume that these are sound, and go on from there. All my assumptions are open to challenge, and I hope you will challenge them.

Dr. Waterman mentioned in his written statement the legislation with which we are mainly concerned. We are directed by the National Defense Education Act of 1958 to set up a Science Information Service to provide or arrange for the provision of indexing, abstracting, translating, investigation of new techniques, and virtually anything else that would help to improve information services in the United States. To make sure that the Foundation is not restricted in this program, Congress referred to the Act of 1950 which established the agency and said that all authority under that Act was retained. This ensures there will be no adverse affect on our authority to make grants and contracts, and to foster exchange of information between scientists of this country and foreign countries. There is nothing in the field of scientific information that we do not have authority to do. The right to publish was in the 1950 Act.

Our legislation has not defined information: Many think of it only as that which is published while others insist that unpublished material is one of the main resources. Should we consider the raw data collected by scientists and engineers? For example, are weather records collected from all over the world part of the problem? If so, then we really have a big job.

The Cabinet action referred to by Dr. Waterman, and the January 22 letter from the President to Dr. Waterman increased the responsibility of the Foundation in effecting coordination of information services within the Federal Government. The letter says that the lead in effecting coordination in this field is to be taken by the National Science Foundation. Considerable stress has been laid on furthering coordination and cooperation among Federal and non-Federal agencies. Copies of the President's letter have gone to all Federal agencies which have information services. The President has asked the Foundation to take the lead, and we hope that you will help provide some ideas of how this should be done. The problem is very big, and we can dissipate our energy on little things if we are not careful.

What does this information problem look like? I want to try to paint here the general picture as I see it, illustrated in the diagram attached as Exhibit I. On this diagram scientific information activity is divided into three large segments separated by solid lines. On the left side are the producers which is the largest group. Moving to the right, you have after the dotted line what they produce. Next, after the first heavy line, are listed the people who put information together, organize it and distribute it and the means by which these things are done. To the right of the second heavy line are listed the users of information. The flow of information described by this chart can be from left to right or right to left. For example, libraries produce abstracts, bibliographies and catalogs. Some even prepare "state-of-the-art" papers. The flow could be diagonal, too, so it is impossible to construct this chart in terms of direction of flow.

The center section is the most important, it seems to me. The lag is here, in the collection, organization and distribution of information. Producers and users must become more active participants in that middle column. We must stress this.

In the Foundation's program up to now the emphasis has been on the information needs of the research scientist, but do we not have to recognize and consider the needs of the development engineer, research administrator and others? Chemical Abstracts is a good example. It is thought of primarily as a tool for the use of research scientists and engineers, but other categories of users depend on it also. The research scientist may be able to wait for his information, but an information delay in production and fabrication may prove disastrous economically.

Many additions could be made to this chart, but I hope it will be helpful in presenting the broad outline of the problem.

The job is very big in terms of numbers of people who need information and in terms of the vastness of the literature we are attacking. I do not have any really good figures on the second point; however, the second chart indicates one aspect of the problem, namely, growth of research literature in chemistry and related fields. The data indicate that this literature doubles in volume every 8.5 years. We have Chemical Abstracts to thank for this information. The Library of Congress has also given us information on the

size of their science and technology collection in 1938 and in 1958. In 1938 their collection contained something over 600,000 items. In 1958 the count was 1½ million. The Library does not count as a separate item every article and periodical issue in its collection. They count issues of periodicals bound in one volume as an item. In this 20-year period the Library of Congress more than doubled its science and technology collection.

The third chart which is based on rough estimates gives some idea of the size of the literature and its annual growth. The figures are from two sources, and strictly speaking do not belong to either one. No one can give you a really accurate count of the number of periodicals or books published throughout the world, let alone the number of articles. To give some impression of the magnitude of the literature we must make educated guesses. The fact remains that we are dealing with a tremendous problem which is growing very rapidly. What are we to do with it?

[Note: Immediately following is a summary of discussion which was interpolated at this point. Since no attempt was made to transcribe the meeting verbatim, the remainder of this report will include comments made by Council members during Dr. Adkinson's presentation.]

The best estimates of the quantity of world literature are those derived from specialized services like Chemical Abstracts which are able to find out what the situation is in their fields. There has been some counting in chemistry, some in engineering, some in biology, for example. The best estimated totals are simply extropolations of data such as those from Chemical Abstracts plus other special sources such as lists of publications based on national surveys.

The data undoubtedly include a great many publications of border-line importance such as local medical journals. If we are thinking just in terms of journals of wider use to scientists generally, the figure for responsible journals published in 1957 would probably be less than the 55,000 shown on the chart. Many irregular or non-periodic serial publications are probably included.

In spite of the flaws in this chart it does give us a feel for the magnitude and the growth of scientific and technical information. Twenty years ago each scientist and engineer could keep track of the information himself. Now language is another problem to consider on top of the quantity problem. Twenty years ago a scientist was required to read two languages besides English in order to keep track of information produced outside of the United States. He could use English, German and French. Today he must add Russian, Japanese and probably Chinese. If he actually does this, the scientist must become more a language expert than a scientist. More than one-third of the total production of the world's scientific and technical literature is produced in the USSR, Japan and China. Statistics indicate it can be read by less than 2 percent of United States scientists and engineers. Translating solves an infinitesimal part of the problem. It has been estimated that about 50 percent of all scientific and technical

literature appears in English, but at least a third of the world's literature is a closed book to U. S. scientists unless it can be approached through abstracting, indexing and translating.

Chart No. 5 is based on a recent study which shows how industrial chemists spend their working time. Over half their time is spent in getting or receiving information. There is increasing demand for greater speed in transferring the results of basic research to the drawingboard. All countries are striving to cut down this lag. An increased number of languages is being used in scientific publications, yet the demand to handle information faster is growing. Will the means we used before and which once worked very well continue to work, or must we change them drastically? The study of chemists was done mainly to develop study techniques, but we also got some good information.

If we now concentrate on the situation in the Federal Government and refer to the first chart again, we find we cannot talk about individual agencies as specializing in generation of information, nor in gathering it or publishing it. Part of the problem lies in the great variety of ways in which information is generated. The Department of Defense, for example, supports a large number of laboratories, both within the Department and through contractors. There are some 125 of these research and development laboratories. I do not know how many research and development contracts they have, but approximately 500 take 90 percent of the research money.

From how many sources, then, does the Armed Services Technical Information Agency collect information? How many "customers" does it have? They have 6,000 accessions sources, including some NATO sources. The majority is either within Government or under Government contract.

The Atomic Energy Commission has widely dispersed sources which generate information, but they have centralized control over all information generated by or for it. Everything is closely coordinated under one program. The National Institutes of Health has many places from which information is generated and no centralized place to go to find it.

The other main Government producers are Agriculture; Health, Education and Welfare (Public Health and National Institutes of Health), Interior, and Commerce, under which we have the National Bureau of Standards, the Weather Bureau, Coast and Geodetic Survey and the Patent Office. The National Aeronautics and Space Administration has suddenly appeared on the scene with a tremendously expanded research program, but their information organization is not yet clear.

Who are the distributors? One of the largest is the Government Printing Office. We have a tendency to forget this at times. ASTIA, within the Department of Defense, distributes information obtained from hundreds of places. The Atomic Energy Commission is a major distributor; Commerce has directives from Congress to collect information and distribute it to industry and the public. The Office of Technical Services is not the only place to

go in Commerce. The National Bureau of Standards and the Weather Bureau are other Commerce agencies which distribute information. The Coast and Geodetic Survey has regional offices as does the OTS. The Government Printing Office, Commerce and the Atomic Energy Commission all have depository systems, but there is no unified depository system for the Government. At least parts of this story can be repeated for the Department of Interior and some of its components such as the Geological Survey and the Bureau of Mines; in addition there are the Library of Congress; National Library of Medicine; and the Library of the Department of Agriculture.

Almost every agency has a publication program, a library, or an information service to collect and organize information. The three major libraries in the country are the Library of Congress, the National Library of Medicine, and Agriculture. The Library of Congress is one of the largest in terms of acquiring material and organizing it. They maintain some great bibliographic tools, such as the National Union Catalog. They produce a tremendous amount of information on information, and the indicate location of publications in the Catalog. The National Library of Medicine tries to get everything useful in the field of medicine, and Agriculture does the same in its fields. The three together constitute probably the best research library in the world.

The military and intelligence agencies collect information not only from within this country but from outside. They work with other Federal agencies, but they have their own programs and priorities. Some intelligence-collected information has begun to flow out to the public through the Office of Technical Services as well as through other outlets.

Almost every agency has its own library and tries to make it effectively serve agency needs, but many of them are also willing and able to serve the public in certain fields. The Department of Interior, for example, states they have the best organized and most complete collection in the country on oil.

Outside the Federal Government, information activities are widely varied and dispersed. University, industrial and private non-profit laboratories probably produce over half the research and development data of the United States. Many non-Federal collectors of information are also in the business of producing it.

Who collects and organizes this material and distributes it? First of all publishers: Professional societies and universities publish in great quantity and variety, and there is a strong effort by private publishers. One aspect of this problem which we frequently forget is that the primary collectors and organizers of this information are the research libraries. If they become impotent, we are in trouble. Some of these libraries are in serious trouble today.

There are also specialized information centers, and if these are not well organized, our information system will not be efficient.

Let me digress for a moment and take a brief look at the historic role of the scientific societies and academies. If we go back, and we need not go back a century, we see that the academies and societies were set up for the dissemination of scientific information. Scientists got together in small groups and discussed their research. Then they wrote papers and then published journals. Libraries were a similarly logical development. As the number of journals grew, a need for abstracting and indexing services was created. Here the societies have participated actively. As proportionately less information was exchanged through scientific conferences, conferences gave way to scientific publications which in turn increased the relative importance of libraries of science and technology. The societies and academies have little by little stepped out of their major roles in information. They have withdrawn as the principal collectors, organizers and distributors of scientific information and so have relinquished much of their former responsibility for publication in their fields.

The scientific society must, I feel, take a new lease on life in this area and assume a major responsibility for information from the time it is developed in meetings through to the point where it is abstracted or indexed and presented to the user.

When we identify our problems, we then must ask, "Where do we go from here as far as the Foundation is concerned?" The Foundation has supported short-range programs to meet immediate needs. It also tries to support some long-range activities with more generalized goals. I shall mention a few of these long-range projects and give you a little background on how we have attempted to foster a coordinated system. Then I shall do some crystal gazing.

First, in the long-range work, we support studies and research on the use of machines in literature storage and retrieval and in translation. For example, we are supporting a number of different research approaches to mechanical translation. We recently began to support an experiment aimed at compiling and printing coordinate indexes for bibliographies. We need a lot more knowledge about language, and mechanical translation has forced us to take a good look at the problem. If we can learn to translate a language by machine, we will probably know a great deal about using machines for other language handling purposes.

We have discovered we do not know enough about the characteristics of the information problem. We supported studies by Case Institute and Columbia University to get a picture of the information requirements of scientists. But this problem is far from solved. Another long-range program of studies has been initiated by the National Federation of Science Abstracting and Indexing Services. All aspects of the study program are now really just in their starting phases.

We are also supporting studies of the organization of research in foreign areas, concentrating on the methods they use to distribute the results of their research. What are the Japanese doing? How do the Russians,

Germans and others handle information? Studies in these areas will give us clues that may be useful. At the same time, information on foreign information programs will help U. S. organizations take better advantage of foreign research.

We are studying the size and characteristics of Federal information services. One bulletin on the information services of the Department of Agriculture has been published. We hope that this series of inventories will not only improve public access to Federal research but will give us a change to take a detailed look at Federal information services so we can make an intelligent approach to the problem of identifying overlap and improving coordination.

We have established a Federal Advisory Committee on Scientific Information, made up of people from each agency with a stake in the information business. The Committee will help decide what to do to improve cooperation in order to develop better overall information services in the Federal Government. They are hoping that the Science Information Council will put its finger on some problems the Advisory Committee should work on.

In our shorter range activities we support publications provided they satisfy certain criteria. We have also helped launch new journals where there seemed to be a real need.

The Council on Library Resources, Inc., and the Foundation are jointly supporting a research information center on information processing in order to collect in one place, at the National Bureau of Standards, an up-to-date, complete record on research into the mechanization of information handling. An organization interested in this kind of research can check with the Bureau to learn who has been doing what in the field.

The biggest program in terms of dollars is that for the translation of journals. This we consider only a stopgap program, although it is difficult to predict how long we may have to keep our finger in the dike. Emphasis is now on support of translations of Russian journals into English. Sixty-seven such journals are now published in the U. S. with about thirty-four directly supported by the Foundation through grants to universities and scientific societies. Other Federal agencies support some of them; commercial translators do the balance. No translated journal produces a profit; most have to be subsidized. Translation is a very expensive proposition.

Then there is short-range support for long-range programs. We are giving assistance to OTS to improve its ability to collect and catalog foreign translations and to make them publicly available. We have assisted the Library of Congress in certain areas such as the report literature and foreign science information and as a result they have improved their Russian and Japanese programs. We are thinking seriously of establishing several collections of Government reports where people can get to them more easily. There is a study under way now with the Department of Defense and the Department of Commerce on relations between the Armed Services

Technical Information Agency and the Office of Technical Services to determine whether such forms of cooperation as cataloging in a common system and coordinated acquisitions would not improve the services of both these important Federal information services. This study has just gotten under way and will probably broaden in scope.

Within the Federal Government we have a new coordinated program based on Public Law 480 funds. These funds are available for scientific information purposes under sections 104(k) and (n) of the Agricultural Trade Development and Assistance Act of 1954. The Library of Congress takes care of 104(n). Ours is the responsibility for coordinating Government allotment of 104(k) funds for information activities. Development of new budgets for this program are also the responsibility of the Science Information Service. We administer the program under a directive from the Bureau of the Budget, and we hope to work closely with the Library of Congress. If it is successful, the Public Law 480 program could make a notable increase in the quantity of foreign publications and translations available in the U. S.

A minor area in which the NSF has achieved coordination is in the field of cold region bibliographies. There are now five such bibliographies being supported by the Federal Government. We found that some of the same bibliographic searching was being done over and over again, and so we assembled representatives from the five supporting agencies to look at the problem. A study of the situation is being made by the Librarian of the Department of Interior who is to make recommendations on how we can support one bibliographic effort to serve the purposes of the various agencies who need cold region information

The Federal Advisory Committee on Scientific Information has been established to help Federal agencies keep better informed and to provide a forum for discussion of common problems. It should help considerably on this coordination problem.

There is also an interdepartmental committee on acquisitions which concentrates on obtaining hard-to-get foreign material in order to help make programs in foreign science more effective.

The Bio-Sciences Information Exchange is supported by a number of Government agencies in order to keep track of research projects in biology. They cover who is working on what in biology and medicine, how much money is being spent, etc. The Exchange is heavily used by the National Institutes of Health, Atomic Energy Commission, Department of Defense, National Science Foundation, and the Veterans Administration, and it has proved an effective way of achieving research coordination by having information readily available to these agencies.

The new foreign information program of the Office of Technical Services is the result of cooperative effort of many agencies. Their first journal, Technical Translations, came out in January. Information on translations has become more generally available through OTS which operates in cooperation with the Special Libraries Association.

Outside of Government we have given a number of grants which we hope have effect on cooperation and coordination. One is to the Office of Critical Tables at the National Academy of Sciences-National Research Council to get information on who is collecting data on certain kinds of substances and how to make these data available. Data centers are being established in the U. S., and the Office of Critical Tables wants to effect coordination among these groups.

Many people have come to us for money to compile and publish bi-lingual technical dictionaries. We decided that before we could do anything, we should survey the field carefully, and we are doing so through New York University and the Engineers Joint Council.

We are also trying to help improve coordination in the international field. The Public Law 480 program is one example. Partial support of the Internatinnal Council of Scientific Unions Abstracting Board is another. This Board has an effective program for closer international cooperation and more uniformity in abstracting. The kind of cooperation which the Board has made possible enables Chemical Abstracts, a Board member, to serve as the principal abstract service in English for chemistry. Similarly, the British Physics Abstracts, also a Board member, is the service upon which the U. S. depends in physics. Chemical Abstracts, by Russian admission, is the best abstracting service in the world in chemistry, and the Russians are trying to pattern their methods after those of Chemical Abstracts.

We are also working with the European Productivity Agency and the Federation Internationale de Documentation. We felt that the recent International Conference on Scientific Information was a way to pass on information which we hoped would result in better cooperation and coordination. Fourteen Government agencies participated in that Conference, in addition to representatives from 13 foreign countries and 40 private organizations. It was a big cooperative effort. No great decisions were made, but informal agreements were reached with Great Britain, Scandinavia, and Canada that more English language versions of Soviet scientific and technical journals were needed. We shall work closely with them.

We have given money for a dictionary which American mathematicians are compiling in cooperation with the Russians. It is a small field so close liaison between the two countries seems feasible. Last week, however, I heard that the U. S. group is becoming disillusioned with the Russian version of cooperation.

What about the future? I will not attempt to develop a detailed program for you because I want your suggestions. I will make some basic assumptions, however, and our discussion might begin from there.

1. The present U. S. information system is basically sound, but it does need to be materially strengthened. We are assuming that what we have in this country is good but weak.

2. There will continue to be active participation in information activities by Government, universities, scientific societies and private enterprise. There is cooperation and coordination but also sometimes competition among these groups. Each should be encouraged to strengthen its contribution.

3. There has been a lag in support of information services when compared to the marked increase in apport of research and development in the U. S. This has been especially true within the past ten years, and the lag has to be corrected. More support of information services is required not only from the Government but from all participants in the national program. Some industrial concerns should realize they have a greater responsibility than they have been discharging.

4. The Federal Government must not only maintain adequate information services for its own needs but must also contribute to other information services upon which it has and will continue to depend.

What are some problems to which this Council might give attention? Should the program of exploration for new techniques be strengthened? Should we explore this field a great deal? Should we be in the business at all? A great deal is going on in this area of documentation research, but is it enough? We have never considered supporting the development of a specific system. We have tried to concentrate on basic studies, the results of which could be generally applied by developers of systems. Should there be more studies of the requirements of the different categories of users of scientific information? Is there need for expanded support of basic studies on the characteristics of language as it relates to information storage, search and distribution? What can be done to eliminate delay in publication and distribution of scientific material? Should we think of scientific newspapers to complement or maybe replace journals and monographs?

How can the present confusion regarding the use of copyrighted scientific material be eliminated? Some say chage the law; and others say "no." It seems to be the consensus that there is a need to simplify procedure.

Should the scientific societies be stimulated to participate actively in the development of a better plan, and if so what should be their role? Seventy-five years ago they were predominant in this area.

How should the great research libraries be strengthened so they can contribute more effectively to the research and development efforts of this country? Should they be strengthened? What is the responsibility of the research library? Some are destitute; they cannot get material or they cannot organize the material they have.

5. Along what lines should international cooperation in scientific information activities be stimulated? What should our relationship be with the International Federation of Library Associations, the International Federation of Documentation (FID), UNESCO?

All these problems face us as a Government agency. The solutions to the problems of responsibility, policy, program and funds is a most important part, if not the key, to vitally needed improvements in world-wide scientific communication and scientific progress.

Burton W. Adkinson

Burton W. Adkinson, Head
Office of Science Information Service
National Science Foundation

Attachments

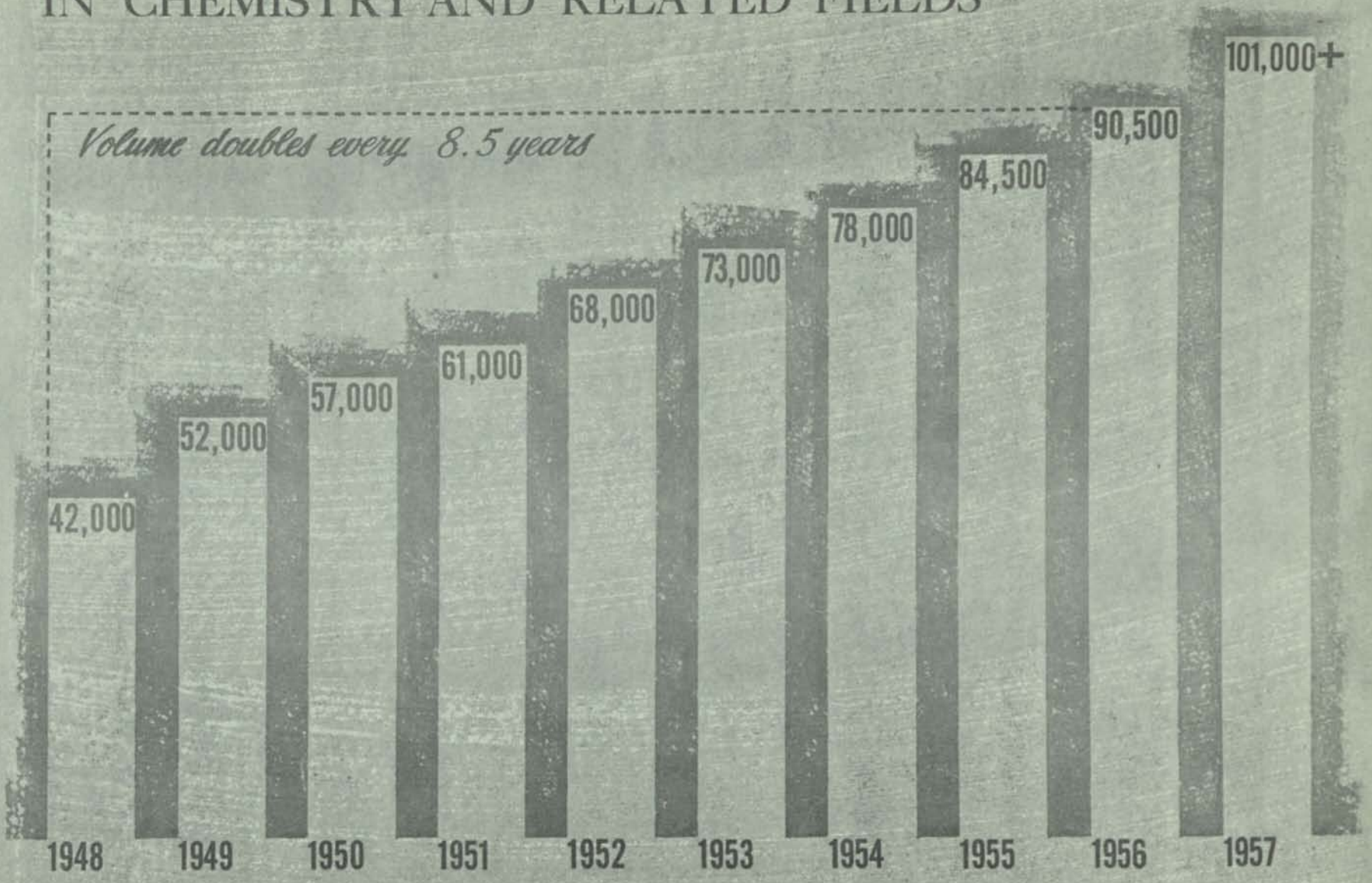
SCHEMATIC DIAGRAM OF THE FLOW OF SCIENTIFIC INFORMATION (1)

PRODUCERS	Products in Manuscript Form:	COLLECTORS, ORGANIZERS, DISTRIBUTORS			USERS
		Publishers of:			
Research scientists and engineers	Papers Formal reports Memoranda	Monographs Scientific periodicals Reports	Abstracts	Libraries	Scientists Engineers
Symposia Conferences	Working papers Records of discussions	Reports Proceedings	Indexes		Research administrators
Graduate students	Papers Theses		Bibliographies	Information centers	Policy Makers Budget planners
Development engineers and scientists	Papers Informal reports Notebooks	Technical journals Reports Patents	Reviews "State of Art Papers"		Development administrators and engineers
Production engineers	Notebooks Informal reports Occasional papers	Reports Patents	Catalogs	Data centers	Production engineers

(1) The flow may be from left to right or diagonally. Also flow may be right to left in many cases.

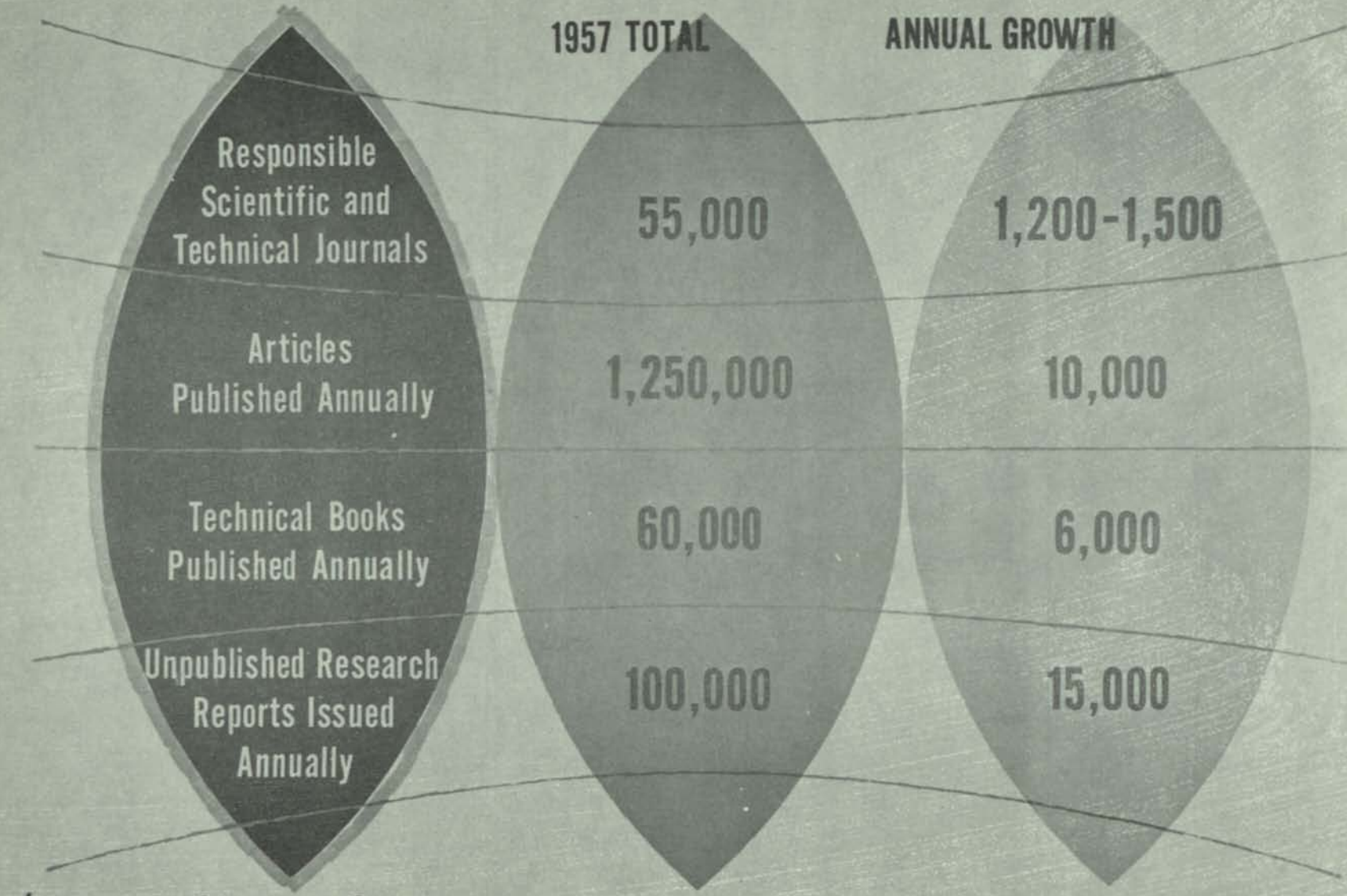
National Science Foundation
Science Information Service
January 27, 1959

GROWTH OF RESEARCH LITERATURE IN CHEMISTRY AND RELATED FIELDS



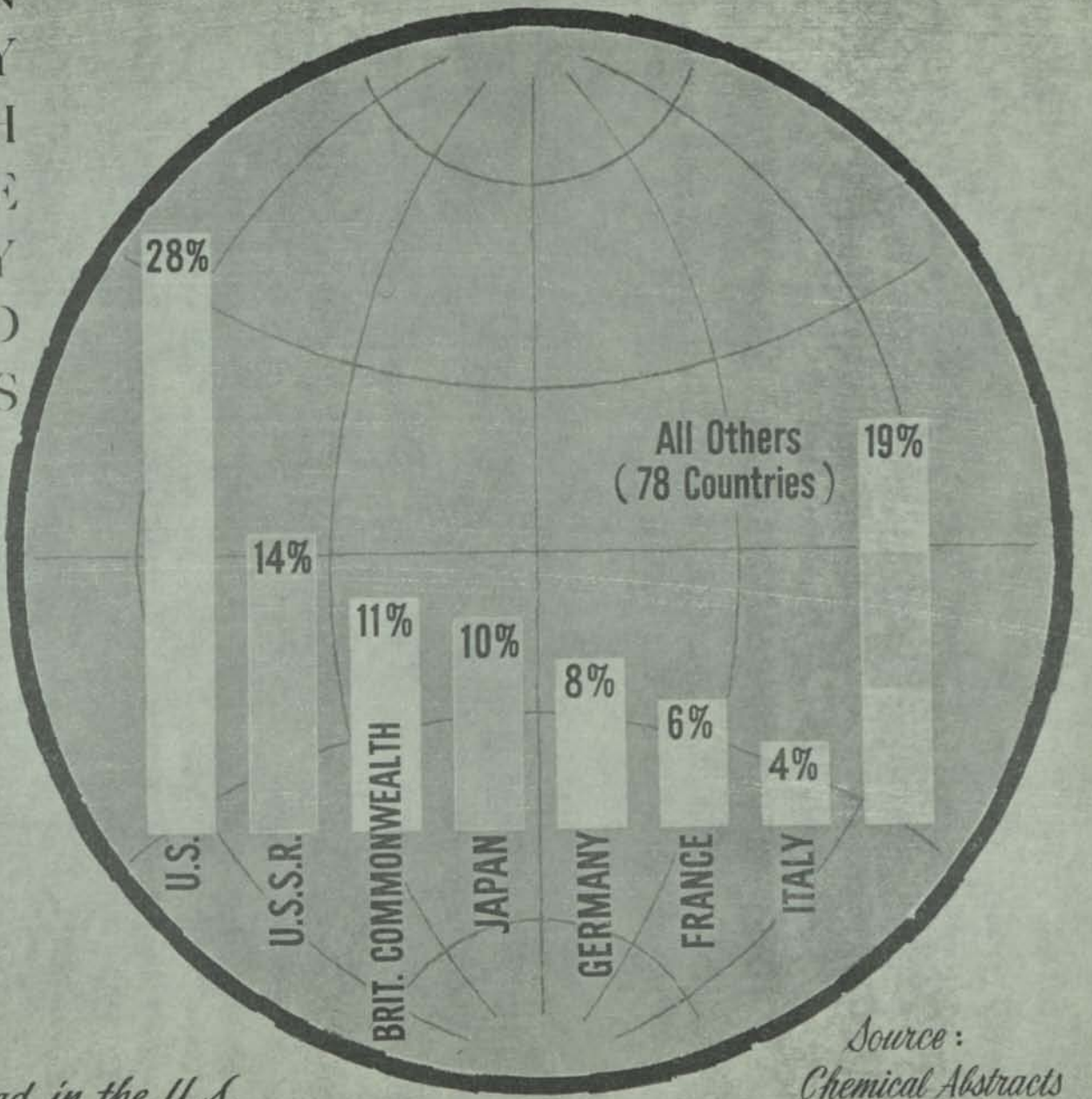
Source: Chemical Abstracts

WORLD GROWTH OF TECHNICAL LITERATURE



Sources: Library of Congress
Stanford Research Institute

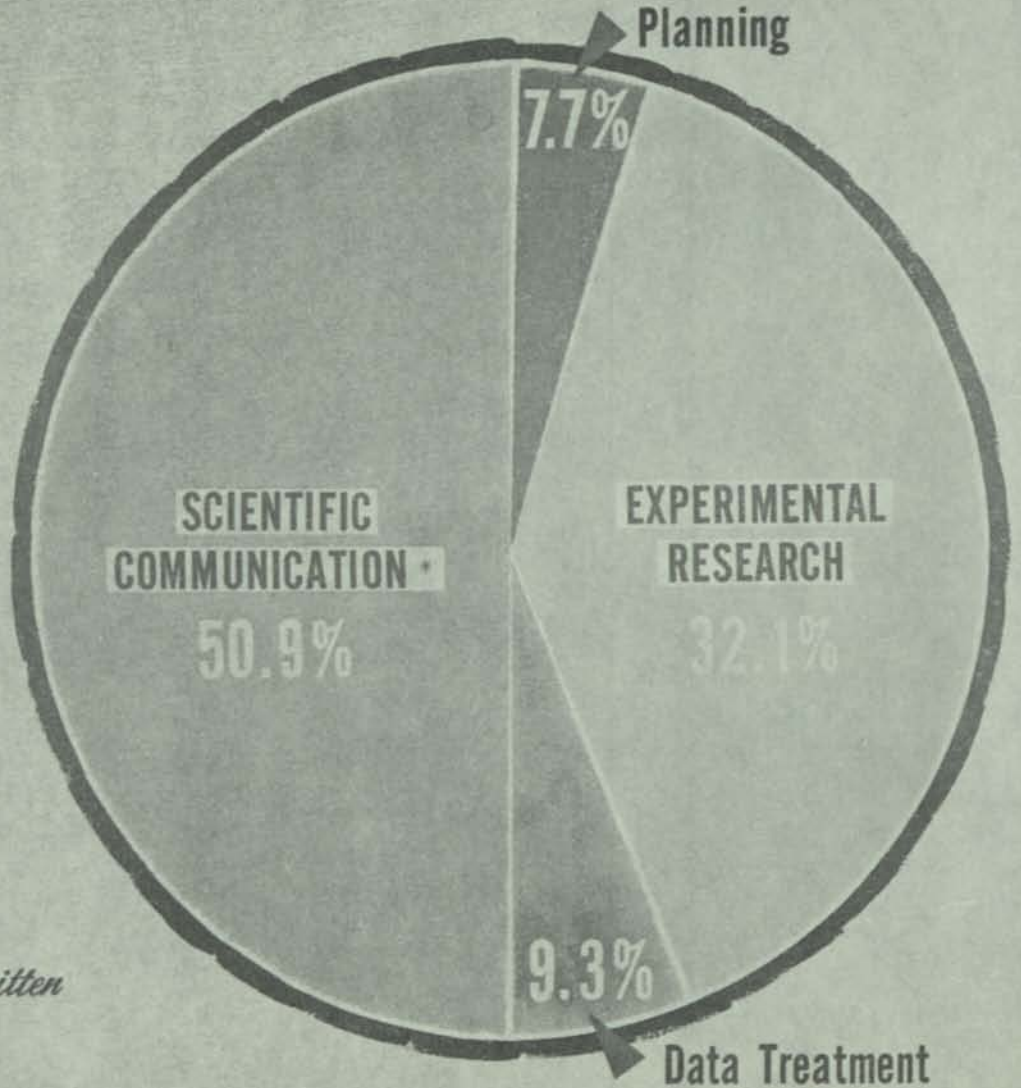
PRODUCTION BY COUNTRY OF RESEARCH LITERATURE IN CHEMISTRY & RELATED FIELDS



Language not generally read in the U.S.

Source: Chemical Abstracts

HOW INDUSTRIAL CHEMISTS SPEND THEIR WORKING TIME



* *Oral or Written*

Data from Case Institute of Technology for N.S.F. 1957 - 1958

FEDERAL AGENCIES
HAVING MAJOR SCIENTIFIC INFORMATION ACTIVITIES

	Abstract & Index	Translate	Research Reports Prepare	Public Sale	Information Research
A.E.C.	X	X	X	VIA COMMERCE	X
AGRICULTURE	X		X	VIA G.P.O.	
C.I.A.	X	X	X	VIA COMMERCE	X
COMMERCE	X		X	X	X
DEFENSE	X	X	X	VIA COMMERCE	X
H.E.W.	X	X	X	VIA G.P.O.	
INTERIOR	X		X	VIA G.P.O.	
LIBRARY OF CONGRESS	X	X		X	X
N.A.S.A.	X		X	VIA G.P.O.	
N.S.F.	X	X			X

IMMEDIATE RELEASE March 13, 1959

James C. Hagerty, Press Secretary to the President

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THE WHITE HOUSE

The President today signed an Executive Order establishing the new Federal Council for Science and Technology. The Council will promote closer cooperation among Federal agencies in planning their research and development programs, and will recommend ways in which the Federal Government can assist in advancing and strengthening the nation's scientific effort as a whole.

In establishing the Council, the President said:

"Less than twenty years ago, Federal support of science was about 100 million dollars annually. Today, this annual investment in research and development has grown to over five billion dollars, and a large fraction of these Federal funds is spent in laboratories owned and operated by private groups. It is the responsibility of the Federal Government to encourage in every appropriate way the scientific activities of non-government institutions; but it is apparent from the size of these Federal expenditures that the policies and practices of the Federal Government can exert an immediate and substantial effect on the nation's private scientific institutions as well as on Government laboratories.

"I believe that the new Federal Council for Science and Technology can effectively aid the objective of improving the ways in which the Federal Government uses and supports science. Moreover, the report of my Science Advisory Committee on "Strengthening American Science" also pointed to a number of opportunities for advancing our total national program. I expect the new Council to consider and evaluate these opportunities and to encourage all Government agencies further to increase the quality of their efforts in these fields. By fostering greater cooperation among Federal agencies in planning their research and development programs, by facilitating the resolution of common problems, and by reviewing the impact of government policies on the programs of non-governmental institutions, the Council should be able to contribute greatly to the development and advancement of our national programs in these important and critical areas."

The President has asked Dr. James R. Killian, Jr., his Special Assistant for Science and Technology, to serve as Chairman of the Council. Its membership will include representatives of the Departments and agencies of the Government which play a major part in this field. This includes Defense, Interior, Agriculture, Commerce, Health, Education, and Welfare and the Director of the National Science Foundation, the Administrator of the National Aeronautics and Space Administration and the Chairman or another member of the Atomic Energy Commission. The Chairman may invite other persons to attend meetings when appropriate and representatives of the Secretary of State and the Director of the Bureau the Budget will attend as observers. Attention has been called to the

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fact that the task of further strengthening United States science is so broad that Government, industry, universities, foundations, and individuals all have essential roles to play. For the future growth and strength of American science will depend upon the efforts of all of these parts of our national community if we are to rise to the demands of our times.

To assure the Council the benefit of continuing advice from the career scientists in the Federal service, the order provides for a standing committee of the Council composed of scientist-administrators principally responsible for the direction of research and development programs in Federal agencies. Such a committee may include representatives from other agencies having important scientific and technical activities and not named as members of the Council. The standing committee will undertake studies for, and make reports to the Council, and will be called upon to provide a continuing source of recommendations to the Council. In this way an organized means will be established for bringing to the President the advice and recommendations of both the policy officials and the career scientists in the major research and development agencies. Executive Order 9912 which established the Interdepartmental Committee on Scientific Research and Development is revoked by the new Executive Order.

The President has also directed Federal agencies to cooperate with and assist the National Science Foundation in its role of providing leadership for improving the availability and dissemination of scientific information.

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EXECUTIVE ORDER

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FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

WHEREAS science and technology are essential resources for the security and welfare of the United States; and

WHEREAS Federal programs in science and technology will advance our security, health, and economic welfare and the quality of education in the United States; and

WHEREAS closer cooperation among Federal agencies will facilitate the resolution of common problems in science and technology, promote a greater measure of coordination, and otherwise improve the planning and management of Federal programs in these fields:

NOW, THEREFORE, by virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

Section 1. Establishment of Council. (a) There is hereby established the Federal Council for Science and Technology (hereinafter referred to as the Council).

(b) The Council shall be composed of the following-designated members: (1) the Special Assistant to the President for Science and Technology, (2) one representative of each of the following-named departments, who shall be designated by the Secretary of the Department concerned and shall be an official of the Department of policy rank: the Departments of Defense, the Interior, Agriculture, Commerce, and Health, Education, and Welfare, (3) the Director of the National Science Foundation, (4) the Administrator of the National Aeronautics and Space Administration, and (5) a representative of the Atomic Energy Commission, who shall be the Chairman of the Commission or another member of the Commission designated by the Chairman. A representative of the Secretary of State designated by the Secretary and a representative of the Director of the Bureau of the Budget designated by the Director may attend meetings of the Council as observers.

(c) The Chairman of the Council (hereinafter referred to as the Chairman) shall be designated by the President from time to time from among the members thereof. The Chairman may make provision for another member of the Council, with the consent of such member, to act temporarily as Chairman.

(d) The Chairman (1) may request the head of any Federal agency not named in section 2(b) of this order to designate a representative to participate in meetings or parts of meetings of the Council concerned with matters of substantial interest to the agency, and (2) may invite other persons to attend meetings of the Council.

(e) The Council shall meet at the call of the Chairman.

Section 2. Functions of Council. (a) The Council shall consider problems and developments in the fields of science and technology and related activities affecting more than one Federal agency or concerning the over-all advancement of the Nation's science and technology, and shall recommend policies and other measures (1) to provide more effective planning and administration of Federal scientific and technological programs, (2) to identify research needs including areas of research requiring additional emphasis, (3) to achieve more effective utilization of

the scientific and technological resources and facilities of Federal agencies, including the elimination of unnecessary duplication, and (4) to further international cooperation in science and technology. In developing such policies and measures the Council, after consulting, when considered appropriate by the Chairman, the National Academy of Sciences, the President's Science Advisory Committee, and other organizations, shall consider (i) the effects of Federal research and development policies and programs on non-Federal programs and institutions, (ii) long-range program plans designed to meet the scientific and technological needs of the Federal Government, including manpower and capital requirements, and (iii) the effects of non-Federal programs in science and technology upon Federal research and development policies and programs.

(b) The Council shall consider and recommend measures for the effective implementation of Federal policies concerning the administration and conduct of Federal programs in science and technology.

(c) The Council shall perform such other related duties as shall be assigned, consonant with law, by the President or by the Chairman.

(d) The Chairman shall, from time to time, submit to the President such of the Council's recommendations or reports as require the attention of the President by reason of their importance or character.

Section 3. Agency assistance to Council. (a) For the purpose of effectuating this order, each Federal agency represented on the Council shall furnish necessary assistance to the Council in consonance with section 214 of the act of May 3, 1945, 59 Stat. 134 (31 U.S.C. 691). Such assistance may include (1) detailing employees to the Council to perform such functions, consistent with the purposes of this order, as the Chairman may assign to them, and (2) undertaking, upon request of the Chairman, such special studies for the Council as come within the functions herein assigned to the Council.

(b) Upon request of the Chairman, the heads of Federal agencies shall, so far as practicable, provide the Council with information and reports relating to the scientific and technological activities of the respective agencies.

Section 4. Standing committees and panels. For the purpose of conducting studies and making reports as directed by the Chairman, standing committees and panels of the Council may be established in consonance with the provisions of section 214 of the act of May 3, 1945, 59 Stat. 134 (31 U.S.C. 691). At least one such standing committee shall be composed of scientist-administrators representing Federal agencies, shall provide a forum for consideration of common administrative policies and procedures relating to Federal research and development activities and for formulation of recommendations thereon, and shall perform such other related functions as may be assigned to it by the Chairman of the Council.

Section 5. Security procedures. The Chairman shall establish procedures to insure the security of classified information used by or in the custody of the Council or employees under its jurisdiction.

Section 6. Other orders; construction of orders. (a) Executive Order No. 9912 of December 24, 1947, entitled "Establishing the Interdepartmental Committee on Scientific Research and Development," is hereby revoked.

(b) Executive Order No. 10521 of March 17, 1954, entitled "Administration of Scientific Research by Agencies of the Federal Government," is hereby amended:

(1) By substituting for section 1 thereof the following:

"Section 1. The National Science Foundation (hereinafter referred to as the Foundation) shall from time to time recommend to the President policies for the promotion and support of basic research and education in the sciences, including policies with respect to furnishing guidance toward defining the responsibilities of the Federal Government in the conduct and support of basic scientific research."

(2) By inserting before the words "scientific research programs and activities" in section 3 thereof the word "basic".

(3) (i) By adding the word "and" at the end of paragraph (a) of section 8 thereof, (ii) by deleting the semicolon and the word "and" at the end of paragraph (b) of section 8 and inserting in lieu thereof a period, and (iii) by revoking paragraph (c) of section 8.

(4) By adding at the end of the order a new section 10 reading as follows:

"Section 10. The National Science Foundation shall provide leadership in the effective coordination of the scientific information activities of the Federal Government with a view to improving the availability and dissemination of scientific information. Federal agencies shall cooperate with and assist the National Science Foundation in the performance of this function, to the extent permitted by law."

(c) The provisions of Executive Order No. 10521, as hereby amended, shall not limit the functions of the Council under this order. The provisions of this order shall not limit the functions of any Federal agency or officer under Executive Order No. 10521, as hereby amended.

(d) The Council shall be advisory to the President and to the heads of Federal agencies represented on the Council; accordingly, this order shall not be construed as subjecting any agency, officer, or function to control by the Council.

DWIGHT D. EISENHOWER

THE WHITE HOUSE,

March 13, 1959.

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NATIONAL SCIENCE FOUNDATION
OFFICE OF SCIENCE INFORMATION

March 31, 1959

DOCUMENTATION RESEARCH PROGRAM
PROGRESS REPORT, FEBRUARY - MARCH 1959

Since the first meeting of the Science Information Council in February 1959, the Documentation Research Program has assembled material for the fourth edition of its semiannual report on current research and development in scientific documentation. The copy has gone to the printer and the report should be available for distribution early in May.

The new Research Information Center and Advisory Service for Information Processing at the National Bureau of Standards, for which the Foundation made a grant toward the end of calendar year 1958, now has two full-time staff members. The Center is having a great deal of difficulty finding technically qualified staff, and this delay in staffing will mean a delay in getting the Center into full-scale operation. At the Foundation's request, the Federal agencies supporting research and development projects in the field of information processing have added the Center to their distribution lists for future reports and publications in the field; and the Center staff is working now to complete the Bureau's collection of pertinent existing documents and publications. The Documentation Committee of the intelligence community has made Dr. Samuel N. Alexander of the Bureau of Standards a technical advisor to the Committee and has invited him to attend all Committee meetings on behalf of the new Center. In addition, a sizeable collection of intelligence community

reports in the field is being made available for study by the Center staff.

With respect to studies of the uses of scientific information and of the information requirements of scientists, the Program is about to make a grant to the Columbia University Bureau of Applied Social Research for a critical review of all studies in this field. They are to be evaluated with a view toward determining which of them have been done with sufficient care to produce relatively reliable results; and a synthesis of these results will be the principal outcome of the review. A discussion of the merits and deficiencies of the various methods that have been used to date in these studies will also be a part of the review.

The Program has under active consideration at the present time proposals for continued support of research projects in the fields of information retrieval and mechanical translation and a few proposals for new projects. Probably three or four grants will be made before the end of this fiscal year, June 30, 1959.

For the past six months the Program has arranged and participated in a series of informal monthly meetings of persons responsible for the administration of research programs in the field of scientific documentation. The meetings have been attended by representatives of the Office of Naval Research, the Air Force Office of Scientific Research, the Rome Air Development Center, the Central Intelligence Agency, the National Science Foundation, and the Council on Library Resources. Thus far the meetings have been concerned primarily with an exchange of information on the programs of the various

organizations. The March meeting, for example, was devoted to a discussion of the current program and future plans of the Rome Air Development Center by Dr. Libby, chief of the Intelligence Laboratory there. At the next meeting, toward the end of April, the group plans to discuss the advisability of scheduling a number of small working conferences of researchers that might aid in the solution of common research problems or in the coordination of current work in specific fields.

The Council will be interested to know that one of its members, Dr. Mauchly, has been named an honorary vice-chairman of the International Conference on Information Processing, to be held in Paris in June, 1959. The following investigators on mechanical translation projects supported by the Foundation have had papers accepted for discussion at the Conference: Vincent Giuliano and Anthony Oettinger of the Harvard Computation Laboratory; Victor Yngve, Massachusetts Institute of Technology; and A.F. Parker-Rhodes and R. M. Needham of the Cambridge Language Research Unit, England. Mrs. Margaret Masterman Braithwaite of the Cambridge Unit has been asked to serve as vice-chairman of the plenary session on mechanical translation. The organizer of the special symposium on the problems of syntax in mechanical translation, which is to be a part of the Paris conference, has invited others working on NSF grants to participate in the symposium: Paul Garvin of Georgetown University, and Zellig Harris of the University of Pennsylvania. The other principal participants in the syntax symposium will include Dr. Swanson (Ramo-Wooldridge), another member of the Science Information Council.

Dr. Adkinson has agreed to organize and chair a special symposium on the collection, storage and retrieval of information at the Paris conference.

The discussion will be opened by three or four speakers who will summarize current research activities in their respective countries or areas, with Dr. Mauchly speaking for the United States. It is expected that several NSF grantees will participate in the symposium discussion, together with other research workers in the field in this country and abroad.

NATIONAL SCIENCE FOUNDATION

Office of Science Information Service

Progress Report for February and March, 1959

Foreign Science Information Program

The purpose of the Foreign Science Information Program is to assure the comprehensive availability of the results of foreign scientific research and development to United States scientists. Projects developed under this program to date generally fall into categories as follows:

1. Translation and republication of foreign scientific literature

2. Support of translation pools

3. Study of foreign scientific information systems

4. Improvement of United States resources of foreign science publications.

The Foreign Science Information Program has made significant progress since its last report. From January through March 31, 1959, grants to accomplish the above purposes in the amount of $394,321.00 were processed. Of this total grants in the amount of $178,026.00 have been approved for payment. Mr. Scott Adams, formerly of the National Institutes of Health, has joined the program as its new Director. Mr. Paul Feinstein, formerly Acting Director, has become the Assistant Director.

I. In support of translations, the program has processed the following grant applications:

A. Optical Society of America, for translation and publication of the Russian journal Optics and Spectroscopy; $74,750.00

B. American Rocket Society, for the translation of selected Russian papers dealing with space and astronautics; $30,200.00

C. Acta Metallurgica, for increased coverage of the Russian literature in the abstract journal "Metallurgy"; $21,025.00

D. American Society of Mechanical Engineers, for translation of the Russian monograph "Theory of Elastic Thin Shells"; $13,500.00

E. Earthquake Engineering Research Institute, for translation of the Russian book Construction in Seismic Regions, and partial translation of the book, Norms and Regulations in Seismic Regions; $4,350.00

F. American Mathematical Society, for extension of translation program to include probability and statistics; $7,602.00

G. Annual Reviews Inc., for cintinuing support of the preparation and publication of reviews of Russian scientific fields; $1,400.00

Public Law 480 Translation Program

Progress has been slow for several reasons. First, authorization for

expenditure of funds in Israel, where the pilot project is to be conducted, was not received from the Bureau of the Budget until March. Second, the Israeli signature of the pilot contract has been delayed by further requests for dollar currency with which the Israel Foundation might purchase printing machinery. Third, the Bureau of the Budget has requested agencies submitting requests for FY 1960 supplemental programs to relate such programs to dollar-financed programs, leaving the agencies to infer that their own direct appropriations will be adversely affected by participation.

Preliminary inquiry in Poland suggests that translation will be cheaper than in Israel, and can be accomplished with less difficulties. The Program will send a representative to negotiate contracts with Poland and possibly Yugoslavia in May.

II. Operations of the John Crerar Library Translation Center

in coordination with the translation dissemination program of the Office of Technical Services, Department of Commerce, is proceeding along lines previously described.

At the request of the Deputy Director, European Productivity Agency, the program is planning to lend Mr. Karl Olsoni to EPA for a three month period to provide information and technical guidance to European member countries of EPA in organizing a proposed European Translation Center.

III. Studies of Foreign Scientific Information Systems

To provide information of use to the Program as well as to the

American scientific public on the organization and functioning of foreign systems for scientific information, the Program has initiated a series of studies as follows:

A. New York Library, to study the organization of scientific information in Poland; $8,050.00

B. The Pacific Science Board (National Academy of Science, National Research Council), to study the organization of scientific information in Indonesia; $8,000.00

C. The Pacific Science Board, to study the organization of scientific information in Japan; $7,000.00

Proposals for increasing the number of studies in both European and Pacific areas are under consideration.

The Program is interested in support of national and international directories as aids to scientific communication. It has made an agreement with the Scandinavian Committee for Applied Research to help distribute copies of a directory of research organizations of northern Europe. It has started negotiations with the National Academy of Science--National Research Council for the preparation of a directory of scientific research organization within the USSR.

IV. Improvement of U.S. resources of foreign science publications.

The Program is concerned with the supply of foreign science publications in strategically located centers throughout the United States. The pilot project for collecting chemistry and biology literature in the Midwest Inter-Library Center, Chicago, is making steady

progress. Other projects being developed in this area are:

1. The improvement of mechanisms for the international exchange of publications.
2. The creation by the National Federation of Abstracting and Indexing Services of a union list of scientific journals which will note under the journal titles those services which index or abstract them.

March 31, 1959

NATIONAL SCIENCE FOUNDATION

OFFICE OF SCIENCE INFORMATION SERVICE

March 31, 1959

INTERDISCIPLINARY SCIENCE COMMUNICATION PROGRAM

This program has been started since the last meeting of the Council. A few of the program functions were inaugurated prior to the start of the program, but these were largely actions taken in response to specific needs or requests.

The four principal activities of the program are:

1. Investigate means of communication between different disciplines to determine (a) the actual and potential magnitude of this type of communication, (b) the extent to which present methods and existing channels are fulfilling these communication needs of scientists, and (c) those areas which need additional development, coordination and OSIS support.

2. Studies on the uses of scientific research films and audio-visual techniques in interdisciplinary communication and support of possible operations, such as a film indexing center, suggested by the findings of these studies.

3. Through graphics and publications inform scientists of the current status of the national effort to improve the dissemination of science information and of the results of OSIS grant findings not otherwise published.

4. Through exhibits at selected scientific society meetings (a) present the national pattern of the resources for science information dissemination, (b) outline the associated problems with possible solutions, (c) describe the remedial steps being taken through cooperative programs among government, academic and scientific groups, (d) explain the OSIS program as it relates to these problems and cooperative programs.

Accomplishments of the program thus far include the establishment of the periodical Science Information News; the development of a special exhibit for use at the International Conference on Scientific Information; participation with the U. S. Committee for the International Conference on Information Processing; publication of a special-purpose brochure, Information for Scientists; a grant to the Chicago Museum of Science and Industry for installation of the Brussels science exhibition; and a small, but active, traveling exhibit project based primarily on IGY rockets and the IGY satellites program; discussions with the National Academy of Sciences on a research film program.

NATIONAL SCIENCE FOUNDATION

PROGRAM REPORT, FEBRUARY & MARCH 1959
PUBLICATIONS & INFORMATION SERVICES PROGRAM

(Prepared March 1959 for the 14-15 April 1959
meeting of the Science Information Council)

I. Grants Made

1. National Bureau of Standards (Irene A. Stegun), $40,000 for preparation of a Handbook of Mathematical Tables.

2. National Academy of Sciences/National Research Council (Clem O. Miller), $198,500 for three-year support of the Office of Critical Tables, which coordinates critical data-compilation projects, makes available information about them, and stimulates the establishment of new projects where needed.

3. Case Institute of Technology (Russell L. Ackoff), $5,000 for maintenance of a Comprehensive Bibliography on Operations Research (1957 through 1959).

4. University of California (Charles L. Camp), $25,050 for the compilation of Volume VII of the World Bibliography of Fossil Vertebrates and Paleolithic Anthropology.

5. American Institute of Biological Sciences (Hiden T. Cox), $13,248 for a preliminary study program for improving and coordinating the communication of biological information.

6. American Association for the Advancement of Science (Alaska Division), (Dr. A. Johnson), $2,610 for the expenses of a committee to study the question of a central Alaskan reference and information service on research activities in the Arctic, to overcome geographic isolation.

7. American Society of Mechanical Engineers (Stanley A. Tucker), $5,000 for publication of a book entitled Spray Literature Abstracts, compiled by Kalman J. DeJuhasz, covering the literature on the theoretical and technological aspects of sprays (an interdisciplinary field).

8. Leo T. Samuels (individual), $1,095 for travel in Australia and the Orient to visit laboratories studying steroid endocrinology, where procedures he has developed are in use or have been modified (transferred from Division of Biological and Medical Sciences).

II. Meetings and staff visits

1. Second annual meeting of National Federation of Science Abstracting and Indexing Services, Washington (Grant 7215). Considerable progress has been made in coordinating the efforts of the 14 members. Two preliminary proposals to NSF, one for a Union List of all the journals abstracted by member services, and another for an international list of journals, by country, were discussed.

2. Second Annual Conference for Sponsors of the Thermophysical Properties Research Center, Purdue University.

3. Study Committee of AIBS, Berkeley, California., to consider problems involved in improving and coordinating information services in the biological sciences (Grant 7820).

4. American Institute of Physics, New York City, to discuss the AIP study on information services and journal problems in the field of physics (Grant 5605).

III. Progress

1. The American Institute of Physics (Ed Tober) has completed a study of the back issues problems of professional journals (Grant 4132). For the first time, as far as is known, formulae for calculating print orders and storage quantities have been derived. The results will be published in American Documentation (July, October 1959). Meantime we have requested permission to reproduce both articles for distribution to journal editors and business managers in other fields of science.

2. The first issue of the new GeoSciences Abstracts (Grant 7000), published by the American Geological Institute, is available.

3. The first issue of Wildlife Disease, new experimental journal published on Microcards (jointly financed by the Council on Library Resources and NSF, Grant 6958, and undertaken by AIBS) has appeared.

4. The Pharmaceutical Manufacturers Association, R&D Section, recently formed a literature committee, which visited P&IS for information about national projects and to discuss the possibility of cooperative efforts in the future.

5. OSIS received the report of Paul Howard, Department of Interior Library, on the NSF-supported study he has been making of the 4 or 5 Government-supported cold-region bibliographies, looking toward coordination of these separate efforts.

6. Work has been initiated on a comprehensive questionnaire that will be sent to several hundred editors of scientific journals. It is hoped that vital "yardstick" information on publication costs and practices will be obtained, as well as a clearer picture of the publication of basic research results in the U.S. A second questionnaire is being developed to obtain pertinent information about professional scientific societies.

7. In cooperation with the Office of Special Studies, Industrial Surveys Section, a questionnaire will shortly be distributed by the Bureau of the Census seeking information on industrial policies and practices regarding publication of research results.

IV. Problems

(See "Background Information on OSIS Support of Publications", to be sent to the Council prior to the April meeting.)

Office of Science Information Service
March 31, 1959

UNPUBLISHED RESEARCH INFORMATION PROGRAM
PROGRESS REPORT

February & March 1959

PROGRAM ACCOMPLISHMENTS

1. Program Reorientation

Within the past month considerable attention has been given to the overall planning of a course of action upon which the Unpublished Research Information Program should proceed to accomplish most effectively the objective of systematic optimum dissemination of all unclassified scientific and technical research information. As a result of this effort it has been decided that a more substantive and definitive approach toward solution of the problem will be provided if long-range program emphasis is reoriented toward minimizing the generation of "unpublished" research information through encouragement of prompt publication of all significant material in the conventional journal and book media.

Thus the URI Program objective is now stated as:

(a) To attain systematic optimum public dissemination of all significant unclassified scientific research information not published promptly; and

(b) To minimize the issuance of such unpublished information by encouraging its flow into conventional scientific publication channels.

2. Program Planning

Because of the lack of original proposals from outside sources for studies pertaining to the area of unpublished research information, the URI staff is engaged in developing suitable study areas in which qualitative

and quantitative information and data are needed for the effective planning and development of improvements which will lead to achievement of the program objectives. Study proposals will then be solicited for priority-selected projects developed by the URI staff.

3. URI Inventory Project

The second of the NSF bulletin series on "Scientific Information Activities of Federal Agencies" has been completed for the Office of Naval Research and has been sent to the printer for publication. The large number of requests following the issuance of the first bulletin, which covered the U.S. Department of Agriculture, indicates a real need for this type of information by the national scientific community. Effort is now being concentrated on a bulletin for the Department of Commerce.

4. Study Group on ASTIA-OTS Relationships

The Report of the Study Group, with recommendations, was submitted on January 30, 1959 to the agencies represented in its membership, and it has been accepted. The recommended actions which were referred to the Federal Advisory Committee on Scientific Information have been accepted and steps toward the establishment of appropriate ad hoc working groups by that body have been taken. ASTIA and OTS have been directed and have accepted the responsibilities to study jointly their respective working relationships to develop and coordinate mutual improvements of their operational and procedural activities. Following acceptance of and the completion of primary actions recommended in the Report, the Study Group was officially inactivated on March 25, 1959.

5. Overseas Dissemination of Unclassified DOD Reports

It has been clarified through meetings and discussions between

representatives of the Department of Defense, the Office of Technical Services, and the National Science Foundation that:

(a) DOD places or requires no restriction on the foreign dissemination of unclassified, unlimited scientific and technical reports issued by DOD agencies and contractors;

(b) OTS requires no special clearances or registration from foreign requesters, and exercises no restrictions on filling foreign requests;

(c) The Department of Commerce favors exchange of unclassified U.S. scientific and technical reports with other countries of the world.

Formal confirmation of these understandings have been requested from DOD and OTS.

National Science Foundation
Office of Science Information Service
March 31, 1959

NATIONAL SCIENCE FOUNDATION

Office of Science Information Service

April 1, 1959

BACKGROUND INFORMATION ON OSIS SUPPORT OF PUBLICATIONS

(Prepared March 1959 for the 14-15 April 1959 meeting of the Science Information Service Council)

This paper presents brief descriptions of a series of representative grants made by OSIS for the support of publications and information services, together with short discussions of the requirements and principal problems associated with each type of proposal. The examples are typical of the kinds of situation as a result of which OSIS receives proposals in these fields. Within OSIS, these grants fall administratively under the Publications and Information Services (P&IS) and the Foreign Science Information (FSI) programs. Items I through X concern the former, XI the latter. Attached is a copy of P&IS' leaflet "NSF Grants for Scientific Publication" which states our current general criteria for supporting publications and gives instructions for the preparation of proposals.

The principal basic criteria that are applied within OSIS in the assessment of proposals of these kinds are:

1. The good of Science - not that of the proposer - must be the paramount consideration

2. A number of representative scientists in the subject field concerned must believe the proposed publications or services will make a worthwhile contribution to research in that field

3. A subsidy must be necessary for the materials or services to be made available

4. The mechanics of the proposed program must appear to be set up on an efficient and economically sound basis (Factors considered here include subscription or sales prices; support by sponsoring societies, if any; income from such other sources as page charges, sale of reprints, and advertising; estimated production costs; and the like)

Under each of the categories of support listed below the following kinds of information are presented; (a) Full data on a specific example; (b) <u>special</u> requirements for support of that <u>category</u> of project - i.e. requirements in addition to the basic ones spelled out above; and (c) an indication of the principal problem areas associated with that category.

I. SUPPORT TO ESTABLISH A NEW SCIENTIFIC JOURNAL

A. Example
1. Journal of Mathematical Physics
2. Grantee - American Institute of Physics
3. Amount - $64,800 for 3 years; grant made 31 December 1958

B. Special requirements for this category
1. Especially strong recommendations from scientists in the field because of the already excessively high birth rate among journals
2. Reason to expect the journal will become self-supporting within 2-3 years

C. Principal problem areas in this category
1. How rigid a policy should we follow in requiring attainment of a self-supporting status within X years; under what conditions, if any, should the possibility be favorably considered of giving very long-term support, and when does "long-term" become "permanent"? (On one hand, the precedent-setting implications of OSIS "adopting" a journal more or less permanently must be kept in mind; on the other, a very struct policy in this respect might eliminate a valuable journal which happens to be in a field that is important but sparesely peopled with research scientists.)
2. How can we be fairly sure of having reliable yardstick information upon which to base decisions regarding reasonable cost and other data?
3. Should the provisions of the grant include anything on recovery of grant funds from possible proceeds and, if so, what should these conditions be?

II. ASSISTANCE TO AN EXISTING PRIMARY JOURNAL IN FINANCIAL DIFFICULTIES

A. Example
1. Genetics
2. Grantee - Genetics Incorporated
3. Amount - $35,000 for 1 year; granted 14 January 1959
4. Purpose - To permit the journal (a) to eliminate a backlog of 1,000-1,200 printed pages by issuing a supplemental volume and (b) to convert from a bimonthly to a monthly. (Purposes in other cases in this category include: To expand subject coverage; to meet suddenly rising costs while steps can be taken to increase regular income; and in general to help the journal weather a financial crisis

B. Special requirements for this category
1. That the grant be recognized as temporary aid
2. That steps either already be taken or be definitely planned to put the journal on a self-supporting basis after the emergency for which the grant is made is over. (In the Genetics case subscription prices were raised and there was reason to believe the better coverage of the monthly would attract many more sub-

scribers. In other cases, page charges have been instituted; industrial support has been sought; lower cost printing has been obtained.

C. Principal problem areas in this category

1. Those listed under I-C
2. What constitutes "reasonable" support by the subscribers or sponsoring society; for example, in deciding what dues or subscription prices are adequate, what weight should be given to claims that scientists in some fields are better paid than those in others, that a scientist whose research interests encompass more than one field (e.g. a biochemist or a geophysicist) should not be expected to pay as high dues and subscription rates as a one-field researcher (e.g. a mathematician or a "pure" physicist)? (NOTE: Steps are being taken by P&IS to obtain comprehensive information on median salaries of scientists in various fields, and on the dues and journal subscription structures of various scientific societies)

III. ASSISTANCE TO LAUNCH AN EXPERIMENTAL PUBLICATION

A. Example
1. Wildlife Disease (A quarterly journal of the Wildlife Disease Association)
2. Grantee - American Institute of Biological Sciences
3. Amount - $11,274 for three years; granted 24 November 1958
4. Purpose - To sponsore jointly, along with the Council on Library Resources, the establishment of the first scientific journal to be published only in microform (in this case, on Microcards). Manuscripts are edited and reviewed just as for conventional journals. Subscribers receive quarterly both the Microcards containing that issue's papers and a full-sized leaflet which lists and abstracts them. Association members, as of the beginning of the experiment, were supplied with hand readers at a reduced price. An experiment of this kind has long been needed to test reader acceptance of primary microform publication. Difficulties in the past have been that no existing journal wanted to take a chance on converting to microform, while to have paralleled a conventional journal with a microform edition would have been both very expensive and not a good test of user acceptance; obviously no one will use microfilm or a Microcard if a full-sized edition is readily available. The "Wildlife" situation seemed to offer a relatively ideal opportunity because the association is relatively small, making the experiment comparatively inexpensive, and it had no tradition of a conventionally published journal.

B. Special requirement for this category - that the experiment shows good promise of producing results applicable beyond its immediate boundaries

C. Principal problem areas in this category
   1. To make reasonably certain the proposed experiment has a good chance of developing generally applicable results
   2. To some extent, those of I-C, although within reason these take second priority to "Is it a promising experiment?"

IV. SUPPORT OF A CUMULATIVE INDEX TO A JOURNAL

A. Example
   1. Index to Vols. 26-40 of the Journal of Parasitology
   2. Grantee - American Society of Parasitologists
   3. Amount - $3,410 for 18 months; granted 26 June 1958
   4. Purpose - To make available a complete cumulative subject index to an important scientific journal in a situation where the journal itself is unable to carry the full financial load. (Vols. 1-25 were covered in a 1941 index)
   5. Special conditions - JP itself matched the grant funds; proceeds from sales are to be used for indexing future volumes

B. Special requirements for this category - none

C. Principal problem areas in this category - perhaps a minor one with regard to use of a recovery clause in the grant letter (see I-C-3 and IV-A-5 above)

V. SUPPORT OF PUBLICATION OF A MONOGRAPH

A. Example
   1. "Mosquitoes of the South Pacific"
   2. Grantee - University of California, Los Angeles
   3. Amount - $6,000 for 1 year (approx.); granted 7 November 1958
   4. Special condition - That NSF recover, up to the amount of the grant, sales receipts during the first three years which are in excess of the grantee's cash contribution to the cost of publication

B. Special requirements for this category
   1. That commercial publishers be unwilling to publish the manuscript because of limited sales potential or high production cost. (In effect, this means we have only supported publication of manuscripts that either have been rejected by commercial publishers for these reasons or clearly would be.
   2. That the sales price of the volume be neither artificially high nor low; particularly we have frowned on supporting publications to be given away
   3. That some kind of recovery clause be included in the grant agreement. (Typically, such a clause permits NSF to recover along the lines stated in V-A-4 above

C. Principal problem areas in this category - These concern specifically the three special requirements just cited:
   1. Are we being too strict, not strict enough or about right in limiting our support to manuscripts which in effect have been turned down by commercial publishers? What about university

presses in this connection? Suppose the X Research Center has prepared, say, a handbook which a commercial publisher would like to publish but offers the Center a return less than it believes it would receive if NSF were to provide (and later recover) "risk capital" and the Center or an appropriate society publish and sell the volume; what should our policy be assuming the Center plans to put all profits from the volume into basic research? (NOTE: NSF's mission is the support of basic research)

2. Our reasoning on Requirement No. 2 has been (a) that giveaway publications represent too great a subsidy to the user and (b) that our fundamental job of disseminating information is interfered with if the price is too high; is our reasoning sound?
3. In applying the recovery clause in monograph support grants ordinarily we have permitted out-of-pocket costs of the grantee and/or printer to be paid before NSF recovery begins; is this sound?

VI. SUPPORT OF AN ABSTRACTING SERVICE

A. Example
   1. Biological Abstracts
   2. Grantee - Biological Abstracts, Incorporated
   3. Amount - $150,000 for 1 year; granted 14 January 1959
   4. Purpose - To permit BA to expand its coverage at a faster rate than would be possible with its own resources. (Purposes in other cases in this category have included enabling a new abstracting service to get started and assisting an existing service to weather a financial crisis.)
   5. Special conditions - That steps be taken to make continuing subsidy unnecessary

B. Special requirements for this category
   1. In effect, those of II-B with perhaps a somewhat less rigid interpretation of "temporary."
   2. That the plans and operations of the service (whether existing or new) be consistent with the over-all aims and objectives of the National Federation of Abstracting and Indexing Services which was established in January 1958

C. Principal problem area in this category - That of interpretation of the "temporary support only" requirement. It can be argued that this condition is much more restrictive for abstracting services than for primary journals since they have fewer possible ways of increasing income than do primary journals and have almost no control over their potential work load if they are to provide comprehensive coverage. Should we ever consider providing permanent support for an abstracting service and, if so, under what conditions?

VII. SUPPORT OF THE PREPARATION OF REVIEWS

A. Example
   1. A series of critical reviews in physics
   2. American Institute of Physics

3. Amount - $29,325 for two years; granted 31 December 1958
4. Purposes - (a) To conduct an experiment in the subsidy of scientific review preparation and (b) to make available in one field articles of a kind which almost everyone says is very badly needed. (These reviews are being written at three technical levels and degrees of comprehensiveness.)

B. Special requirements for this category - None

C. Principal problem area - This opens the door a little for the support of the writing of material to be published; how far should OSIS go in this respect? Typically in the past scientists have written books and articles on their own or "company" time and taken their chances on getting it published. Where should OSIS draw the line in supporting such writing? Is the review type of paper as far as we should go? Or can we go somewhat further, basing our policy on the good-of-Science criterion?

VIII. SUPPORT OF PUBLICATION STUDIES

A. Example
1. Preliminary study program for improving the communication of biological information
2. Grantee - American Institute of Biological Sciences (AIBS)
3. Amount - $13,248 for three months; granted 24 February 1959
4. Purpose - To permit an AIBS study committee of leading biologists to develop and recommend a broad program for the improvement and unification of communication in the biological sciences. (Purpose of another grant in this category was to study, evaluate and make recommendations for improving a centralized scientific publishing program of some years standing)

B. Special requirement for this category - To make certain as far as possible, that the study is well planned and will produce results applicable beyond the immediate field in which it is made

C. Principal problem areas in this category - Simply making reasonably sure that the above requirement is met

IX. SUPPORT OF DATA COMPILATION PROJECTS

A. Example
1. Critical Compilation of Crystal Data
2. American Crystallographic Association
3. Amount - $11,500 for 1 year; granted 8 December 1958
4. Purpose - To cover final preparation and publication of this important reference work for solid state research; this was a supplementary grant to a previous one for $6,300
5. Special condition - That NSF recover up to the amount of the two grants from the first three years' sales of the compilation

B. Special requirements for this category - No generalized ones since cases vary; recovery condition like the above is imposed where

applicable; in some cases care is taken to spell out that NSF is not committed for support beyond the period of the particular grant

C. Principal problem areas in this category - None beyond the general ones cited previously

X. SUPPORT OF COOPERATIVE PROJECTS

A. Example
1. Office of Critical Tables
2. National Academy of Science - National Research Council
3. Amount - $198,500 for 3 years; granted 13 February 1959
4. Purpose - To support a project whose responsibilities in the present situation of vastly expanded quantities of available critical data encompass those formerly discharged through the NAS publication "International Critical Tables". (Purposes in other cooperative projects may include elimination of areas of overlap between programs, division of labor in filling gaps in service, joint attack on mutual problems, and the like)
5. Special condition - That the OCT serve as a clearinghouse, evaluation center, and dissemination activity for critical data coming from a large number of different critical data compilation projects; and that it issue directories of such projects, subject indexes to what project is developing which kinds of data and, when appropriate, actual data sheets or compilations

B. Special requirement for this category - That OSIS be satistified its grant funds will accomplish a useful unification and integration of information projects and achieve increased efficiency of operations as compared with the independent projects, whatever they may be

C. Special problems in this area - Those associated with making certain that the requirement just stated is being met.

XI. SUPPORT OF COVER-TO-COVER TRANSLATION OF A SCIENTIFIC JOURNAL

A. Example
1. The USSR Journal of Experimental and Theoretical Physics (JETP)
2. Grantee: American Institute of Physics (AIP)
3. Amount: $46,900 for continuing support for a period of approximately one year, effective on the 7 November 1958.

B. Basis for making the grant
A thorough investigation of the desirability and feasibility of a Russian-to-English translation service in the field of physics was conducted in 1954-55 by AIP under a grant from NSF. The investigation indicated that the scientific community was overwhelmingly in favor of the establishment of such a service and the journal has been enthusiastically received. A majority of the physicists concur that the work in the translated journal is comparable to that reported in other major physics journals.

AIP administers the translation and publication of JETP. The journal is edited by Mr. J. George Adashko, Assistant Professor of Electrical Engineering at the City College of New York. The translations are done by physicists having Russian language competence, working on a part-time basis in the fields of their specialties and related subject areas. The circulation of the journal continues to increase, and now stands at 747 subscriptions. The time lag (6 mos.) is comparatively short between the publication of the Russian Journal, and the appearance of the English version. The actual printing, binding, and mailing is done by a printing company under subcontract with AIP.

C. Problem Areas

1. How long should such a journal receive subsidy? (It was expected that the JETP would become self-supporting, based upon subscription growth curves and on expectation of a continued lowering of costs. The approximately 140% increase in the size of the translation project has eliminated the possibility of self-sufficiency for the publication for at least one more year. It is hoped that a new and vigorous promotion plan, along with the lowering of subscription rates to academic libraries, will result in an increase in the number of subscriptions. The current subscription rates are as follows:

	Domestic	Foreign
Regular	$75	$79
Special	$35	$39

In all probability there are many concepts to be explored before one can attempt to determine the exact value of a certain journal. It may very well be that with the constant rise in cost a journal will never be self-supporting, and will require continuous support. This is a problem that undoubtedly must be faced, but cannot realistically be done in the relatively short period of time.)

2. How can time lags be reduced? (The difficulties in printing journals has contributed seriously to the time lag in the translation process. The problem is how to enable a typesetter to handle more readily the complex nomenclature that is used by scientists. A constant check must be make to prevent mistakes that could be very serious in reporting research results. The process of sending out proofs, getting them back, making corrections, takes a considerable amount of time. The time that is required to receive Russian publications from Moscow accounts for as much as eight weeks of the Russian to English time lag.)
3. How can scientific quality be maintained most effectively? (At present, every effort is made to obtain individuals with both linguistic and technical competence. Also, in the physics field, members of the AIP Abstracting Committee attempt individually to take some responsibility for the adequacy of translations. However, the quality problem continues to be troublesome.)

NSF GRANTS FOR SCIENTIFIC PUBLICATIONS

These instructions supplement the NSF booklet "Grants for Scientific Research" and are specifically applicable to the preparation of requests for support of scientific publications. Part I presents the principal criteria which are applied in the evaluation of proposals in this field. Part II lists particular items of information that should be included in such proposals.

I. GENERAL CRITERIA GOVERNING SUPPORT OF SCIENTIFIC PUBLICATIONS

Publications considered for support may be either primary (original) or secondary (reference) publications, and must deal either with original basic research in science or engineering, or with the history, philosophy or sociology of science. The principal general criteria which requests for support must meet are:

1. The publication must be judged by authorities in its subject field to promise enough of a contribution to the scientific literature to warrant the requested expenditure of public funds.

2. If a primary journal, the publication must have an adequate referee system to insure a high level of scientific quality of its contents.

3. The costs of publication must be judged to be reasonably economical for the type of material contemplated.

4. For a proposed new journal, there must be reason to expect that it can become self-supporting within a reasonable period; for an existing journal in financial difficulties, there must be reason to expect it to continue on a self-supporting basis once the emergency that led to the proposal is over.

5. The sales price of the publication should not be set at an artificially low or high level.

II. INSTRUCTIONS FOR PREPARING PUBLICATION PROPOSALS

A. All Publication Proposals

1. Follow all of the recommendations in the NSF booklet "Grants for Scientific Research" that are applicable.

2. Indicate clearly the name, address, and official title of the person authorized to receive and administer grant funds and to make fiscal reports.

3. Select the appropriate category below and include in your proposal as many of the items listed as are pertinent and can be obtained.

B. Periodical Publications

1. State the nature of, and the reasons for, the need for additional funds and describe how the funds will be used if granted (e.g. to initiate a new journal, to meet an operating deficit, to eliminate a backlog of manuscripts, to publish an especially long paper, etc.)

2. Describe briefly the procedure used (or, if a new journal, to be used) in selecting papers for publication or in obtaining abstracts or reviews

3. Describe the steps being taken (or, if a new journal, that will be taken) to put the journal on a financial basis that will make further Federal support unnecessary

4. Include a complete financial statement covering the operation of the journal for the last fiscal or calendar year (except for new journals) and a prospective budget for the current year; indicate all sources of income (e.g. subscriptions, sale of back issues, page charges, society dues, subsidies, etc.) and all major expenditures (e.g. editorial and other salaries, costs for composition printing and binding, distribution, overhead, promotion, etc.)

5. For the period covered by the above financial statement indicate the number of pages, the number of copies per issue, the number of issues, all categories of subscription rates (e.g. to society members, non-members, etc.), and the number of subscribers at each rate

6. Include a copy of the periodical with the proposal (for a new journal, a copy of the dummy if available)

C. Single Publications That Will be Sold Separately (Monographs, handbooks, bibliographies, and the like)

1. Indicate the contents of the proposed publication by outline, table of contents or general description. (If possible, include sample pages or sections of the material or, if feasible, a carbon copy of the entire manuscript. Do not send the original or printer's copy)

2. State the need for or the particular usefulness of the proposed publication

3. If funds are needed to complete preparation of the manuscript (e.g. for additional research, typing, editing, indexing, illustrations, travel, etc.), include as accurate estimates as possible of the cost of each item and indicate why each is necessary

4. Include specific estimates of printing and binding costs as obtained from a printer or publisher. (If possible, give estimates also from several other printers or publishers and state why the one was selected.)

5. Indicate what portion of the total cost of publication is being requested from the Foundation, and state what other sources of support, if any, will be available

6. Give the following production and distribution information:

   a. Total number of printed pages (printer's or publisher's estimate)
   b. Quantity to be printed
   c. Method of printing (if known)
   d. Proposed selling price
   e. Expected method of distribution
   f. Number of free copies to be distributed (if any)
   g. Whether cost of distribution is included in the printing and binding estimates given above

(NOTE: - In its grants for support of single publications, the Foundation ordinarily includes a provision requiring that all proceeds from sales during the first three years after publication, over and above the amount contributed by the grantee or publisher, and up to the amount of the grant, be returned to the Foundation. This provision can be adapted to fit individual circumstances where necessary.)

D. Other Types of Scientific Publication Requests

1. Include as many of the items of information listed in the preceding categories as seem pertinent to the particular proposal

2. In general, provide in the proposal as complete information as possible on the nature of the publication; the reason support is being requested; the income, cost, and pricing pattern; and plans for publication and distribution

National Science Foundation
Office of Science Information Service
Publications & Information Services

April 9, 1959

EXAMPLES OF MECHANICAL TRANSLATION

Prepared by the

Office of Science Information Service

National Science Foundation

1. Ramo-Wooldridge Mechanical Translation
2. Harvard University Word-for-Word Mechanical Translation
3. Georgetown University Mechanical Translation
4. Georgetown University Partially Mechanized Translation
5. Cambridge Language Research Unit Simulated Mechanical Translation

March 5, 1959

Explanation of Figure 1.

RESEARCH GROUP:	Ramo-Wooldridge
TRANSLATION:	Russian to English
SUBJECT:	Physics
SOURCE:	Journal of Theoretical and Experimental Physics, Vol. 32, No. 1, page 61, Oscillations in a Fermi Liquid, by L. D. Landau
MEANS:	IBM 704
APPROXIMATE SPEED:	10,000 words per hour (computer only).

In order to produce mechanical translation like that shown in Fig. 1, it is necessary for a typist who can recognize Russian letters to type the Russian text on an IBM keypunch, thereby producing punched cards which can be fed into the computer. Furthermore, after the translation is completed on the computer, it must be printed in readable form on another device, usually at a rate of several hundred words a minute. The time required for the typing and printing steps is also necessary in other mechanical translation programs. It is not included in the speed shown above.

This program does not select a unique English equivalent in every case. For example, in the second line, the program could not resolve the choice between "WHEN" and "IN WHICH". Therefore, both were printed, one above the other.

Although the program can recognize and process for about four thousand words in all their different forms, other words are frequently encountered. In such cases a transliteration of the Russian word is printed out instead of the English equivalent. "SPLOSNUTOJ", in line ten, is an example.

Some symbols not conveniently typed, such as Greek letters and mathematical symbols, must be added later. For example, "(EQN)" in line six means that an equation should be filled in at this point. Some words and phrases are abbreviated or telescoped in this program. For example, "OFTHE" occurs several times instead of "OF THE".

Mechanical Translation	Human Translation
WE [redacted] INVESTIGATE AS THE EXAMPLE THE CASE, [redacted]	As an example, let us investigate the c[redacted]
WHEN THE FUNCTION ( ) IS REDUCED TO BY CONSTANT -BY IN WHICH	in which the function F (χ) reduces to a constant
(WE WILL DESIGNATE ITS ( )). THE INTEGRAL IN THE RIGHT CORRECT	(we denote it by F_0). The integral on the right
SIDE OFTHE EQUATION (11) DOES NOT DEPENDS HERE ON DIRECTION	hand side of Eq. (11) does not depend, in this case, on
ANGLES ( ). THEREFORE THE SOUGHT FUNCTION () HAS THE	the angles θ, φ. Therefore the desired function ν has the
FORM (EXPONENTIAL THE MULTIPLIER WE OMIT).. (EQN.).(13) FACTOR	form (we omit the exponential factor): $\nu = \frac{const \cdot \cos\theta}{\eta - \cos\theta}$
THE BOUNDARY FERMI SURFACE GAINS THE FORM OFTHE SURFACE OBTAINS	The limiting Fermi surface has the form of a surface
OFTHE ROTATION, EXTENDED IN THE DIRECTION AHEAD STRETCHED	of revolution, elongated in the forward direction
WITH RESPECT TO THE DIRECTION OFTHE PROPAGATION OFTHE	of the propagation of the
WAVE AND SPLOSNUTOJ IN THE INVERSE DIRECTION. WE OPPOSITE	wave, and flattened in the opposite direction.
WE WILL INDICATE FOR THE COMPARISON, WHICH THE USUAL	For comparison, let us point out that the ordinary
SOUND WAVE CORRESPONDS THE FUNCTION () OFTHE FORM (EQN.).	sound wave corresponds to a function ν of the form $\nu = const \cdot \cos\theta$
REPRESENTING BY ITSELF THEMSELVES THE DISPLACEMENT OFTHE FERMI BIAS	which represents the displacement of the Fermi
SPHERE AS WHOLE , WITHOUT THE CHANGE OF ITS FORM. INTACT INTEGRAL	sphere as a whole, without a change in shape.

Figure 1.

Mechanical Translation - Ramo-Wooldridge

Explanation of Figure 2.

RESEARCH GROUP:	Harvard
TRANSLATION:	Russian to English
SUBJECT:	Electronics
SOURCE:	Radio-Engineering and Electronics, Vol. II, No. 12, page 1497, Mass-Spectrographic Determination of Composition of Residual Gases in Electron Devices with Porous Metal-Film Cathodes, by Yu. G. Ptushinskii and B. A. Chuikov.
MEANS:	UNIVAC I
APPROXIMATE SPEED:	1,000 words per hour (computer only).

In Figure 2 is shown a sample output of the Harvard mechanical dictionary. Here, for each successive Russian word, one or more columns are printed, representing the dictionary entry or entires for that word. At this stage of the work, no use is made of the grammatical endings of the words by the machine. This kind of translation is usually called word-for-word translation. While the processing is very simple, the dictionary is very large, and includes approximately 11,000 entries. Furthermore, any word can be recognized in any of its forms, so that the effective size of the dictionary is probably over one hundred thousand Russian word forms. For comparison, it should be noted that the Ramo-Wooldridge dictionary contains about 4,000 words which can be recognized in all of their forms, probably numbering over 40,000, while the Georgetown program recognizes 2,300 words in approximately 4,500 forms.

When a word not in the Harvard dictionary is encountered, it is printed in transliterated form and the triple symbol "###" is printed on the second line as an indication. An example is the word "PORIST-OGO" in the first line of Figure 2. When a word has more than one column of meanings, all columns except the first carry the indication "+++++(HOMOGRAPH OF PREV)".

Mechanical Translation								Human Translation
BALANCE BALANCING NETWORK COMPENSATING NETWORK		ATOM	BARIUM	ON UPON IN AT TO	SURFACE	PORIST-OGO METAL ###	- TAPE FILM	The balance of barium atoms at the surface of a porous metal-film
(PMP-) ###	CATHODE FILAMENT	,	IN AT INTO FOR ON	CERTAINLY OF COURSE	END ULTIMATE TERMINAL FINAL KONECHN-OM +++++(HOMOGRAPH OF PREV)			(PMF) cathode, in the final
COUNTING CALCULATION ACCOUNT BILL METERING		,	DEFINING DETERMINING APPOINTING		BEING DESTINED FOR ENLISTING ONESELF OPREDELJAJUSHCH-IJ +++++(HOMOGRAPH OF PREV)	HIM (IT) OF HIM (IT) HIS ITS		analysis determining its
EMISSION	ACTIVITY	,	ARE ABLE TO CAN		ESSENTIAL VITAL CONSIDERABLE IMPORTANT	TO DEPEND		emission activity, can depend substantially

Figure 2

Word-for-Word Mechanical Translation

Harvard

Machine Output						Human Translation
FROM AWAY FROM OF ON AT	FROM AWAY FROM OF ON AT +++++(HOMOGRAPH OF PREV)		PRESENCE AVAILABILITY	IN AT INTO FOR ON	TUBE VALVE BULB	on the presence in the tube
TUBE ND11F000 ELECTRONIC LAMP-E +++++(HOMOGRAPH OF PREV)		REMAINING RESIDUAL	GAS GAUZE	GASSY GAS GASEOUS GAZ-OV +++++(HOMOGRAPH OF PREV)		of residual gases.
GAS GAZ-OV +++++(HOMOGRAPH OF PREV)		. INFLUENCE	THIS	GAS GAUZE	GASSY GAS GASEOUS GAZ-OV +++++(HOMOGRAPH OF PREV)	The influence of these gases
GAS GAZ-OV +++++(HOMOGRAPH OF PREV)		ON UPON IN AT TO	EMISSION	PROPERTY CHARACTERISTIC VIRTUE		on the emission properties
CATHODE FILAMENT	, ON ALONG BY THROUGH IN	- APPARENTLY EVIDENTLY		VISIBLE OBVIOUS APPARENT VIDIM-OMU +++++(HOMOGRAPH OF PREV)		of the cathode evidently

Figure 2 (continued)

Machine Output				Human Translation
SEEN VIEWED PERCEIVED VIDIM-OMU +++++(HOMOGRAPH OF PREV)	,	TOOK BROUGHT TOGETHER REDUCED REMOVED	TO TAKE TO BRING TOGETHER TO REDUCE TO REMOVE SVOD-ITSJA ++++++(HOMOGRAPH OF PREV)	lies

TO TOWARD	CHEMICAL	SVJAZYVANI-JU	ATOM	BARIUM	ACTIVE		in the chemical combination of the barium atoms with active
		###					

COMPONENT	, BUT WHILE AND YET	TOO EITHER	TO TOWARD	CATHODIC CATHODE		components, and also in the cathodic

PULVERIZATION ATOMIZATION	FILM PELLICLE	BARIUM	.	dispersion of the barium film.

Figure 2 (concluded)

Explanation of Figure 3.

RESEARCH GROUP:	Georgetown
TRANSLATION:	Russian to English
SUBJECT:	Chemistry
SOURCE:	Radiation-Chemical Processes in Inorganic Systems, by V. I. Veselovsky (a paper submitted to the International Conference on the Peaceful Uses of Atomic Energy, held in Geneva, August 8-20, 1955), page 4.
MEANS:	IBM 704
APPROXIMATE SPEED:	2,000 words per hour (estimated; computer only).

This is a sample mechanical translation of the "Code Matching Technique" group of the Georgetown University mechanical translation project. In this translation "BLANK" indicates that a Russian word was not translated because it was not found in the dictionary. It should be noted that the dictionary used in this program was derived from organic chemistry texts, while the text translated here is from the field of radiation chemistry. Nevertheless, it will be noted that many of the missing words are not highly specialized terms, but words which might occur in any scientific text. In this technique each form of each word is coded and entered separately. Only 4,500 different forms of 2,300 words have been included in the machine dictionary up to the present time. The large number of blanks encountered indicates that this process will not be practical until the mechanical dictionary is much larger. A sample translation in which the dictionary entries for the missing words have been added by hand is shown in Figure 4.

Mechanical Translation	Human Translation
BLANK BLANK OF PROCESS	The activation of an electrochemical process
UNDER ACTION BLANK ON BLANK	by the action of radiation on an electrochemical
BLANK CAN BLANK BLANK SOLUTION, BLANK BLANK	system can be induced
WITH DIRECTION ACTION BLANK	by the direct action of radiation
ON BLANK AND ON	upon an electrode or upon
BLANK-COMPOUNDS	the potential-governing surface compounds
ON BLANK BLANK BLANK-BE BLANK	at the electrode-solution interface, or
BY ACTION ON SOLUTION,	by action on the solution,
BLANK TO BLANK BLANK IN BLANK.	leading to radiation-chemical changes in the latter.
IN THIS CASE BLANK AND BLANK COMPONENTS,	In this case, the oxidizing or reducing products,
BLANK AS RESULT BLANK BLANK BLANK	arising as a result of primary acts of radiolysis,
BLANK ON BLANK AND BLANK	act on the electrode and stimulate
ON BLANK BLANK PROCESS, THE CORRESPONDING	an electrochemical process on it, determined by the
BLANK BLANK (BLANK AND KINETIC)	electrochemical parameters (thermodynamic and kinetic)
BLANK BLANK AND SYSTEM IN BLANK.	of the radiolysis products and of the system as a whole.

Figure 3.

Mechanical Translation

Georgetown

Explanation of Figure 4.

RESEARCH GROUP:	Georgetown
TRANSLATION:	Russian to English
SUBJECT:	Chemistry
SOURCE:	Journal of General Chemistry, Vol. XXII, No. 9, page 1591, New Types of Terpene Transformations, by D. Tishchenko and V. Foliadov.
MEANS:	IBM 704
APPROXIMATE SPEED:	2,000 words per hour (estimated; computer only).

The first step in the production of this partially mechanized translation was the compilation by mechanical means of a list of all of the word forms in the text to be translated which did not occur in the mechanical dictionary. This list of new word forms was then processed by hand to add the necessary English meanings and the numerical coding required for translation. The resulting material was then fed back into the machine and the translation completed. It should be noted that in contrast to the mechanical translation procedure shown in Figure 1, where two or more alternative translations for a given Russian word may be shown when the rules did not permit a clear-cut choice, in this technique a choice is always made, arbitrarily if necessary, and the alternatives are suppressed.

Mechanical Translation

[redacted]MOTERPENES ARE THE PRODUCTS OF THE SUBSTITUTE[redacted] OF ONE OR THE SEVERAL ATOMS OF HYDROGEN IN TERPENES FOR HYDROCARBONACEOUS RADICALS - UP TO NOW THEY WERE CONDUCTED BY INTERACTION OF ORGANOMAGNESIUM COMPOUNDS WITH ALDEHYDES OR KETONES OF DIHYDROTERPENE SERIES WITH SUBSEQUENT THE REMOVAL OF THE WATER FROM FORMED DIHYDROTERPENE SECONDARY OR TERTIARY ALCOHOLS - THE THIS THE METHOD OF THE SYNTHESIS WAS IN THE SERIES OF THE CASES WAS USED BIANK BLANK BY NAMETKIN AND BY PUPILS - HOWEVER IT NOT IS BY GENERAL AND ALWAYS APPLICABLE = AS THE INITIAL ALDEHYDES AND KETONES ARE ACCESSIBLE BY FAR NOT ALL = AND THE MANY AND AT ALL NOT ARE KNOWN - SAVE FOR THAT = THE REMOVAL OF THE WATER FROM DIHYDROTERPENE ALCOHOLS VERY DOES CONDUCT OFTEN TO DEEP TO ISOMERIZATIONS = THAT NOT DOES PERMIT TO ASCRIBE OR THE OTHER STRUCTURE TO OBTAINED HOMOTERPENE ONLY THE FOUNDATION OF THE METHOD OF OBTAINING-

Human Translation

Homoterpenes result from the replacemen[redacted] of one or more hydrogen atoms of the terpenes by hydrocarbon radicals. Up to now they have been obtained by the reaction of organo-magnesium compounds with dyhdrotepenyl aldehydes and ketones, followed by the removal of water from the secondary and tertiary dihydroterpenols that were formed. This method of synthesis was used a series of reactions by S.S. Nametkin and his students. However, it is not generally applicable, as the initial aldehydes and ketones are not always available, and may even be unknown. In addition, removal of water from the dihyroterpenol often leads to profound isomeric changes, so that the structure of the homoterpene obtained cannot be assigned only on the basis of the method of preparation.

Figure 4.

Partially Mechanized Translation
(Vocabulary added by hand)

Georgetown

Explanation of Figure 5.

RESEARCH GROUP:	Cambridge Language Research Unit (England)
TRANSLATION:	Italian to English
SUBJECT:	General
SOURCE:	Genetica Agraria, 1946:1:38
MEANS:	By hand
APPROXIMATE SPEED:	Unknown

This simulated machanical translation was prepared by hand, since the procedure has not yet been programmed for a computer. A special dictionary containing 4,000 words and word-fragments was used. One word-fragment yielded the translation "-ness", even though the remainder of the word was not translated. The result was the hybrid word "granulness", half Italian and half English, the underlined text being untranslated.

Mechanical Translation	Human Translation
The colour of the caratteristic flour of which	The color of flour, a characteristic to which
very big importance is thought	great importance is attached
in connexion with commerce is conditioned naturly	in the trade, depends mainly
by the color natural present substance	on the natural coloring substances present
in the same flour. But different accessor	in the flour. However, various secondary
causes and especially presence of	causes and above all the presence of
dark estrane substances influences the colour.	extraneous dark substances affect the color.
The same granulosss of the flour	The very gramulation of the flour
has an effect in connexion with the colour	affects the color
because the big granuls projett a shade	because large granules project a shadow
that gives the flour a blueish sfumatur.	which gives the flour a bluish hue.

Figure 5.

Simulated Mechanical Translation

Cambridge Language Research Unit

By FOSTER E. MOHRHARDT

Critique on Developments in the Mechanization of Information Systems

THE DEVELOPMENT of microreproduction, computing machines, and similar devices has stimulated the imagination of scientists, management experts, and librarians concerned with problems of handling research information. It is evident from previous reports that we have moved from imaginative visions to practical uses for machines in the handling of communication problems. In each development we assume that the mechanical device has directly contributed to the efficiency of the work performed. However, many of us watching these pilot programs do not have sufficient data from the individual experiments to determine what applications they might have for our work. When the cumulative effect of small staffs and increased workloads directs us toward automation, we are blocked by a lack of specificity, clarity, and practical data of progress by those using machines.

Again, when we attempt to form an integrated picture of the total progress in the use of automation in information handling, we are baffled not only by the rapid development of new experimental techniques and the highly specialized application of many of the experiments, but most formidably by esoteric jargon. The air for many of us was cleared by Bar-Hillel's article, "A Logician's Reaction to Recent Theorizing on Information Search Systems," particularly his statement:

> The inclination to seek a remedy for the present unsatisfactory situation of information searching by "going to the fundamentals" seems to have been reinforced by the use of certain fashionable phrases and slogans that sound appealing enough as long as their inherent vagueness and lack of clarity is not exposed. I am referring to such catch words as "semantic" and "structure," to such statements as "information retrieval systems should not concern themselves with words but with *concepts*," and to the invocation of Boolean Algebra and Symbolic Logic.[1]

I present my plea, or critique, as one of the potential users of these devices, who seeks guidance through the morass of vagueness to a ground of understanding.[2]

President Clyde Williams of Battelle Memorial Institute, at an ACS Symposium in 1954, gave the practical basis for our interest in his statement:

> But the chief reason for management's interest is the mounting cost and the complexity of literature studies. The volume of technical literature in our libraries is becoming so great that the mere process of finding what is needed at a given time often is exceedingly costly. It has been estimated, in fact, that in some instances as much as one-third of the cost of a research investigation may be absorbed in literature searching. This is probably the extreme, but to the cost of literature searching must be added the cost of maintaining a library and finally the cost of assimilating the literature retrieved. As the cost of searching, plus the cost of maintenance, plus the cost of assimilation, approaches the cost of repeating the work,

Mr. Mohrhardt is Director, U. S. Department of Agriculture Library.

[1] Yehoshua Bar-Hillel, "A Logician's Reaction to Recent Theorizing on Information Research Systems," *American Documentation*, VIII (1957), 104.

[2] Paper presented at a "Symposium on Mechanized Data Handling" before the Division of Chemical Literature, American Chemical Society, New York, September 10, 1957.

Reprinted from COLLEGE AND RESEARCH LIBRARIES, September 1958, Vol. 19, pp. 395-397

the value of a technical library declines. Unless there is a net gain in the "technical energy" required to retrieve and assimilate accumulated information over what might be used in repeating the work, the library has not fulfilled its function.[3]

The implied challenge applies both to the developers and ultimate users of new techniques which will reduce the time and cost of these searches. Many of us who cannot afford experimentation are anxious to consider the adoption of these new devices, but we need more information than is now available. The planners and developers, as well as those who are experimenting with methods and machinery for handling information, should provide extensive factual data on both the economic and sociological aspects of use.

To make an economic evaluation of the new device we need to know:

1. Conversion costs from the conventional to the new system.
2. Whether the new system fully replaces the old method or provides partial supplementary assistance.
3. The effect on staff size.
4. The effect on the type of staff needed and how the old staff will be utilized.
5. Complete and objective cost figures.
6. Physical characteristics of equipment—weight, size, special wiring, etc.
7. Comparative time needed to provide comparable service under the old and new systems.
8. Present status of the machine—experimental or commercially available.
9. Adaptability and limitations of the equipment.

Having established the efficiency rating of a machine, we should be equally interested in the reactions of those whom it serves. Concern with the personal reaction of the ultimate consumer—the research worker or scientist—is not theoretical. Studies in research methods have shown that scientific research follows no set pattern and is a highly individualized procedure. The importance of this as related to machines was pointed out by Dr. J. E. Burchard:

> The benign chance must not be dismissed as a wrong way. Conceivably, the human being what he is, it may be the best way. It is not to be hoped that the mechanical proposals . . . are ever to replace this last way of finding what one ought to read.
>
> Indeed so much reliance is placed upon the benign hazard by many first-rate scientists that it is not at all uncommon to find men of the first class who do not believe that more organized and more rapid methods of search are even necessary or desirable. Nor is it enough to say that these men are reactionary or smug.
>
> Indeed my personal impression is that a very substantial number of the best of the working scientists are not convinced that the situation is in any way one of crisis. Most scientists, when pressed, will admit that more is published which *might* interest them than they ever see. But it does not follow, they argue, that drastic measures need be taken. In fact, the greatest pressure for improved techniques has been exerted by a relatively few scientists and engineers, including especially the distinguished American, Vannevar Bush, and by a large number of librarians.[4]

Dr. Bush is unquestionably the originator and stimulator of much of the work in this area. However, even his proposals are essentially conservative when compared to those of some of the machine enthusiasts. Two of Dr. Bush's statements indicate his limitations on the use of machines in this field:

> There is no reason why Man should not relegate to the machine all those parts of his processes of cerebration which are repetitive in nature, or subject to exact formulation.[5]
>
> For mature thought there is no mechanical substitute. But creative thought and essentially repetitive thought are very dif-

[3] Clyde Williams, *The Problem of Literature Organization—from the Viewpoint of Management.* (Columbus, Ohio: Battelle Memorial Institute, 1954.)

[4] J. E. Burchard, "The Waterloo of Science," *Revue de la Documentation,* XVI (1949), 96.

[5] Vannevar Bush, *Today's Research and Tomorrow's World.* (Stanford, Calif.: Stanford Research Institute, 1954), p. 12.

ferent things. For the latter there are, and may be, powerful mechanical aids.[6]

Since creative research has never followed a precise methodology and has depended upon cross fertilization and chance association of ideas, one may well question the extent to which research workers should be encouraged to depend upon automation in research endeavor.

Caution is further advised in reporting on new projects and machines. Reports on automation are confusing not only because of their jargon but often because of a lack of critical analysis. Some verbal reports have inadvertently been misleading. A good example is the mechanical translation field where there appears to be a general idea that a machine will shortly be available which will accept articles written in foreign languages and automatically provide them to us in usable English. Careful study of reports shows, however, that many provisos pertaining to this statement are minimized or at least not properly stressed. Actually, present translation machines are only useful when the following conditions are met: (1) The article must be written in a limited vocabulary. (2) The article must be preedited for insertion in the machine and it must later be post-edited after the machine has completed its work. There are still many unsolved problems in sentence structure and word content that have not been satisfactorily solved for machine application. I doubt that there is any immediate prospect that machines will solve this problem for us.

Relatively few of us will be able to justify elaborate equipment until we are better informed about the costs of conventional library search and the actual savings which they provide in the total research project. A factory manager can easily justify new equipment that will cut down the cost of a $150,000 steel forging. If we are to justify automation in information and library work, it will be necessary for us to accumulate objective data indicating the economic importance of using recorded information in current research studies.

For most of the libraries, documentation centers, and information centers in this country, our immediate needs are for minor improvements that will enable us to carry on our current work in a more effective manner. The Western Reserve Center for Documentation and Communication Research has summarized the general needs as follows:

> We have not suggested doing away with the older bibliographical services and techniques. Most of them will continue to serve adequately in limited spheres for a long time to come. The new systems may in a few instances replace older services, but in many more instances they will supplement or implement more familiar types of services.[7]

This is a reassuring statement for many of us who have not been certain about the perspective of the documentation centers. We have seen instances where emphasis on devices and methods has obscured our objectives. All of us working in this field can subscribe to Dr. Bush's statement:

> Civilization proceeds because Man can store, transmit, and consult the record because the accomplishments of one generation are available to the next, because every man can share the experience of his fellows.[8]

Whether we are using manual or machine methods, each of us is concerned with making it possible to "share the experience of his fellows." Our objective is clear, and it is hoped that we can be satisfied with gradual and steady progress in a civilization that daily becomes more complex.

[6] V. Bush, *Endless Horizons*. (Washington, D. C.: Public Affairs Press, 1946), p. 24.

[7] Yehoshua Bar-Hillel, "Center for Documentation and Communication Research. Comments on 'A Logician's Reactions,'" *American Documentation*, VIII (1957), 122.

[8] Vannevar Bush, *Today's Research and Tomorrow's World*, p. 13.

NATIONAL SCIENCE FOUNDATION
Washington 25, D. C.

Summary of
First Meeting of
Federal Advisory Committee on Scientific Information
Held on
January 20, 1959

PRESENT:

Atomic Energy Commission	Melvin S. Day
Central Intelligence Agency	Paul W. Howerton
Department of Agriculture	Foster E. Mohrhardt
Department of Commerce	
National Bureau of Standards	Samuel N. Alexander
Office of Technical Services	John C. Green
U. S. Patent Office	Donald Andrews
Department of Defense	
Office of the Assistant Secretary (R&E)	Ben G. Huff
	Dr. R. B. Stegmaier, Jr.
	Dr. Albert Sanford
Department of the Air Force	
Air Force Office of Scientific Research	Dr. Harold A. Wooster
Air Research and Development Command	Charles H. McCabe
Armed Services Technical Information Agency	Col. Woodrow W. Dunlop
Department of the Navy	
Office of Naval Research	Dr. Lewis Larrick
Department of Health, Education, and Welfare	
National Institutes of Health	Scott Adams
Department of the Interior	Paul Howard
Library of Congress	John Sherrod, Jr.
National Aeronautics and Space Administration	Bertram A. Mulcahy
National Science Foundation	
Director	Dr. Alan T. Waterman
Office of Science Information Service	Bernard M. Fry
	Gregory Abdian
	Paul S. Feinstein
	Dr. Dwight E. Gray
	Ralph E. O'Dette
	Richard See

Dr. Waterman opened the meeting by citing the growing problems of producing, disseminating and making use of scientific and technical information. The general feeling at the highest levels in the Federal Government is that the problem has grown beyond our capacity to handle it and we must try to catch up. This feeling has grown particularly since World War II when there began considerable increase in the number of research reports written but not fed into the conventional literature.

Dr. Waterman cited the work of the President's Science Advisory Committee and Congressional action, which favored a national information program based on cooperation rather than the establishment of a strong centralized information agency. He pointed out that the existence of a Federal agency can often ease cooperation between private groups which otherwise may lack a forum for discussion of mutual problems.

Dr. Waterman stated that the Foundation's Science Information Service has been directed by the President to assume leadership in promoting coordination and that the National Science Foundation does not intend to assume program responsibilities which are being or can be adequately discharged by other agencies. In order to assure the success of the national effort agencies must operate their own programs in proper balance with each other and with the total Federal program. In this connection Dr. Waterman emphasized that some agencies are now conducting adequate programs, others may be doing more than their fair share, while still others may need strengthening.

Dr. Waterman also pointed out that the Federal Advisory Committee on Scientific Information and the Science Information Council would in some instances operate in parallel, although they are distinctly different kinds of groups. The SIC is a statutory body to "advise, consult with, and make recommendations to" the Head of the Science Information Service on all aspects of policy and program formulation. SIC consists of four Government representatives as ex-officio members, plus 15 appointed members from among whom a chairman is elected. FACSI, on the other hand, was set up by the Foundation in order to systematize communications between Federal agencies with information activities. Close liaison between SIC and FACSI is assured because Mr. Mohrhardt, Dr. Mumford, and Dr. Rogers are members of both groups; Dr. Adkinson is Chairman of FACSI and a member of SIC; and Mr. O'Dette, Special Assistant to the Head, SIS, is serving as Secretary to both groups.

In response to a question, Dr. Waterman said that it has been agreed after discussions at the highest levels in the Executive Branch that other agencies are expected to hold up their own ends of the Federal information program.

Mr. Green pointed out that he and other agency representatives had to defend their own budgets and that he feared Congress might confuse the roles of the new SIS with those of other organizations such as OTS. Dr. Waterman stated that since the Federal effort was by definition a coordinated and cooperative one, various agencies had to be responsible for defined parts of the total effort. He said that the Foundation would be glad to assist, such as at budget hearings, if this would help clarify and support the roles of other agencies in the information field.

It was pointed out that administrative officers in many agencies are caught between the White House Directive to reduce total budgets and the request to support information programs adequately. In many cases there is an understandable tendency for these administrative officers to lean in favor of the budget-paring directive.

It was the consensus of the meeting that coordination of information budgets and indoctrination of agency administrative people on the information responsibilities of their agencies was a most important problem on which FACSI should take action.

Dr. Waterman stated that the Committee should establish priorities since it was obviously impossible for us to do "everything at once." This statement was not made in response to the paragraph immediately above.

Mr. Fry, acting as chairman in Dr. Adkinson's absence, described briefly the status of SIS programs and emphasized that while the Foundation had always had a measure of responsibility for coordination, our efforts to assume the role dictated by the National Defense Education Act and the Presidential Directive of December 7, 1958, were just in the growing stage. He said that in his opinion FACSI should serve in three ways: (1) As a medium of communication between Federal agencies with information responsibilities; (2) to help identify Federal agency information problems; and (3) to recommend courses of action to the SIS in its role of coordinator of Federal information activities. He said that it might prove necessary to draft a more detailed frame of reference for the Committee but that for the present the Committee could operate within the areas outlined.

Mr. Andrews questioned the relationship between the SIS and the National Academy of Sciences information committee. Mr. Fry said he believed the Academy interests stemmed from recommendations of the last Western Reserve Conference and that the Academy was probably waiting to see what course of action the Foundation would take. Mr. Fry said the Foundation had urged the Academy to set up a council on information, and had suggested that such a council might be particularly helpful in the international field.

Mr. Adams recommended that better cross-fertilization among various Federal and non-Federal information committees be seriously considered in terms of duplicated memberships or systematic reporting between

committees. It was felt by most of the members present that it was essential to clarify the responsibilities and areas of interest of each of the many committees which existed or were being created to consider Government information activities. Mr. Fry stated that to his knowledge no committee had been created without a specific prior need and that we must concentrate on ordering and controlling the committees so they do not duplicate activity, but rather fill the real needs for which they were created.

Mr. Howerton stated that the most important problem may be that of teaching people to use services which are already available, and it was agreed that this problem was a proper concern of FACSI.

Mr. Adams suggested that FACSI might use task forces to work on special problems but that the task forces would need staff assistance to make them effective. Mr. Fry agreed that the task force approach was a logical one and said that the Foundation expected to provide the required staff assistance or, if necessary, funds to support such special FACSI activities. For example, if FACSI decides a specialist should be hired to study a specific problem, the Foundation could consider providing the necessary support. A specific example of this kind of activity is the reimbursement to the Department of the Interior by the Foundation for the services of Mr. Howard to do a special study of Government-supported cold region bibliographies.

Mr. O'Dette cited the establishment of the Office of Technical Services' Foreign Technical Information Center as a good example of how a special interagency task force could accomplish effective work. This action also illustrates the role which the Foundation expects to play in the information field in that, in this instance, the Foundation was primarily a means for getting concerned agencies together in order to design the necessary program and present it to Congress.

Mr. Huff stated that in his opinion the SIS was simply a formal recognition of existing NSF functions in such a manner as to facilitate necessary expansion of information activities.

Mr. Alexander discussed the International Conference on Information Processing to be held in Paris, France, on June 13 to 23, 1959. UNESCO is acting as host for this meeting, but the group which has organized the meeting hopes to establish itself independently. The emphasis in this meeting will be on the use of data processing machines. Mr. Alexander said that more information would be available by mid-February 1959.

The question was raised as to whether FACSI could suggest changes in the directions of Foundation programs, and Mr. Fry stated that such suggestions would be appropriate since FACSI should consider itself an advisory group. Mr. Alexander pointed out that in the information field

there always seemed to be a number of problems in which everyone was interested but for which no one would assume responsibility. He felt that FACSI could help correct this situation.

The meeting adjourned following the suggestion that the next meeting be held early in March and that the group plan tentatively to meet monthly after that, at least for the next several meetings. Representatives were invited to suggest items for future discussion.

Prepared By: Ralph E. O'Dette
Secretary
Federal Advisory Committee on Scientific Information

February 25, 1959

NATIONAL SCIENCE FOUNDATION
Office of Science Information Service
Washington 25, D. C.

Summary of Second Meeting
Federal Advisory Committee on Scientific Information
Held on March 17, 1959

PRESENT:

Atomic Energy Commission ---------- Melvin S. Day

Central Intelligence Agency ---------- Paul W. Howerton

Department of Agriculture ---------- Foster E. Mohrhardt

Department of Commerce
- National Bureau of Standards ---------- Mary E. Stevens
- Office of Technical Services ---------- John C. Green
- U. S. Patent Office ---------- Donald Andrews

Department of Defense
- Office of the Assistant Secretary (R&E) ------- Ben G. Huff
- ------- Dr. R. B. Stegmaier, Jr.
- ---------- Dr. Albert Sanford
- Department of the Air Force
  - Air Force Office of Scientific Research ----- Dr. Harold A. Wooster
  - Air Research and Development Command -------- Charles H. McCabe
  - Armed Services Technical Information Agency - Col. Woodrow W. Dunlop
- Department of the Army
  - Office of Chief of Research and Development - Charles E. McCabe
- Department of the Navy
  - Office of Naval Research ---------- Dr. Lewis Larrick

Department of Health, Education, and Welfare
- Public Health Service ---------- Irving Goldberg

Department of the Interior ---------- Paul Howard

Library of Congress ---------- Rutherford D. Rogers

National Aeronautics and Space Administration ---- Bertram A. Mulcahy

National Science Foundation
- Office of Science Information Service --------- Dr. Burton W. Adkinson
- --------- Bernard M. Fry
- --------- Gregory Abdian
- --------- Scott Adams
- --------- Dr. Dwight E. Gray
- --------- Ralph E. O'Dette
- --------- George J. Rothwell

Office of the Special Assistant to the
President for Science and Technology ---------- Frank G. Naughten

The Chairman opened the meeting at 10:00 a.m. by pointing out that the Committee should consider itself a joint agency group and that members be willing to submit problems for Committee consideration. It should not be assumed that the Foundation alone has the initiative in setting up problems for FACSI consideration.

Executive Order No. 10807 dated March 13, 1959 was discussed briefly. This Order sets up the new Federal Council on Science and Technology, and Section 10 restates the scientific and technical information responsibilities of the Foundation and other Federal agencies as originally set forth in the President's January 22nd letter to Dr. Waterman. The Order also dissolves the Interdepartmental Committee for Scientific Research and Development. The Chairman reminded the group that a Subcommittee of ICSRD had been meeting to consider specific problems of foreign scientific information, and he proposed that the activities of this Subcommittee be assumed by FACSI.

Dr. Adkinson discussed his recent meeting in Europe with the Bureau of the Federation Internationale de Documentation (FID). The Bureau is the governing board of FID, and Dr. Adkinson met with it in his capacity of Vice President for the Americas.

Over the past few years the main activity of FID has been promotion of the Universal Decimal Classification, but it is now felt that the interests of the organization should be broadened to encompass the international aspects of scientific documentation problems.. In spite of its present weakness, FID is probably the major international group in documentation. The International Federation of Library Associations is not particularly strong, and there are indications that the position of UNESCO in this field may be weakening. The Abstracting Board of the International Council of Scientific Unions has been successfully active in a narrow field. Special agencies of the United Nations such as the World Health Organization and the Food and Agriculture Organization have been active, but they are highly specialized. There is need for a single strong international group, especially in view of Russian strength in documentation and the increasing activities of Communistic China in this field.

Dr. Alexander King, President of FID, promised to submit a draft of a proposed new FID program by May 1959. This draft will be given to FACSI members in time for comments to be prepared before the next FID meeting in Warsaw in the early part of September of this year.

The Chairman suggested that FACSI members consider the problem of international organizations in documentation and make recommendations for a Federal agency point of view.

Dr. Adkinson also attended a meeting of the European Productivity Agency on the utilization of Eastern European scientific information. At this meeting it was agreed that an attempt would be made to set up a European translation center similar to the Office of Technical Services-Special Libraries Association activity in the United States. The U. S. would be asked to cooperate with such a center which might be housed in the British National Lending Library of Science and Technology. The center would collect all available scientific and technical translations but would concentrate at first on translations from difficult languages into easier ones. EPA has asked the U. S. to provide an expert for three to six months to help set up the center and its network for acquiring translations.

Most nations represented at the EPA meeting were enthusiastic about the translation center. The French were reticent, however, because some groups there are trying to promote a translation scheme based on tape recording. It was suggested that U. S. information people traveling to France might bear in mind the name of M. Piganiol, secretary general of the top level French science policy group; M. Brilhac, the top man on Russian documentation; and M. Poindron of the French National Library.

The EPA meeting also brought out the fact that Scandinavian countries are planning the translation of three to five Russian journals into English, Great Britain has contracts for fourteen, and Canada is planning one. (Secretary's note: The first two British translations, "Machines and Tooling", Vol. No. XXIX, specimen issue, and "Automatic Welding", No. 8(65), August 1958, translated January 1959, arrived at the Foundation during the last week in March. Attached is a list of titles being considered by the British.) The Germans asked for detailed information on journal translation projects indicating they may also enter this field.

Mr. Howerton asked how much use was being made of translations on which the Foundation has stated it spends almost one million dollars per year. Dr. Adkinson said that in Europe the Swiss, Dutch, and Belgians said that these Foundation projects, plus material available from the Office of Technical Services, were supplying most of their needs for translation of Russian information. It would seem that there are very few individual subscriptions to these journals, with most of them going to libraries where a large number of scientists use a single subscription.

Mr. Howerton also suggested a study of literature references in U. S. journals to determine the extent to which translated Russian journals are cited by U. S. authors. It was suggested that this might prove both difficult and misleading because it is not always possible to tell when a scientist has used the original Russian rather than a translation or when he may have profited from Russian work but not in a way which lent itself to specific citation.

Mr. Green questioned the effectiveness of liaison between FACSI and the Science Information Council. It was pointed out that such liaison is assured by virtue of Dr. Adkinson's Chairmanship of FACSI and membership on the Council. Liaison is considerably aided by the fact that the Department of Agriculture and the Library of Congress are represented on both groups.

The Chairman distributed a draft memorandum from the Foundation to Dr. Killian concerning interchange of information between the U. S. and foreign countries. The draft had been very hurriedly prepared with the assistance of a number of agencies, but prompt comment was requested from all FACSI members so that a final draft could be prepared within the next few days after the FACSI meeting.

The meeting next turned to consideration of the report of the Study Group on ASTIA-OTS relations, which report had been circulated in advance to FACSI members. The Study Group had asked FACSI to assume certain responsibilities and in so doing to permit the Study Group to dissolve. The principal topics proposed by the Study Group for FACSI consideration were:

(1) Federal agency field office scientific information services.

(2) The effect of inaccessibility of unclassified research information.

(3) The need for standardization of report format and handling procedures; and

(4) The effect of various restrictions on dissemination upon the usefulness of research information.

Mr. Huff suggested that the field office problem be looked at first. He felt that money to implement recommendations might prove to be a problem but that the general situation should definitely be studied.

Dr. Adkinson said that this Study Group recommendation did not imply that the present situation was bad but that it was confused and uncoordinated. Mr. Rogers cited the recent GPO Depository Bill as further complicating the picture of Federal depositories and information field offices. Mr. Howard said the Bill doubles the number of depositories. Mr. Abdian said that the Government Printing Office was interested in this problem but did not wish to expand its present depository activity.

With the agreement of the Committee the Chairman appointed a subcommittee to look into the field office problem. The subcommittee is made up of Rutherford D. Rogers as Chairman, and Melvin S. Day, Col. Woodrow W. Dunlop, John C. Green and Foster E. Mohrhardt as members.

The Chairman felt that topic (3), above, might also be attacked, but he said he would prefer to discuss it with individual members of FACSI before taking definite action.

It was agreed that topics (2) and (4) were extremely broad and complex and that the Committee should think about them further before taking action.

Dr. Wooster said that publication of Federally conducted or sponsored research results is often very difficult. The rules governing such publication are complex, and there is usually not enough money available. One very basic problem concerns what can legally be published.

Dr. Larrick said this was not a major problem at the Office of Naval Research. Their own work is published by OTS while much contractor work appears in professional journals. He said they have problems but these are not insurmountable.

Dr. Wooster said that even the purchase of reprints was sometimes difficult.

Mr. Howerton said that his agency wanted a statement of the missions of OTS and ASTIA. He referred specifically to paragraph 5, page 2, of the Study Group report of January 29, 1959. He also said that subparagraphs 5(a) and (b) were unclear but at the same time seem to cover the same thing. Mr. Abdian said that these subparagraphs merely described different ways of doing the same thing. Other members of FACSI joined Mr. Howerton, however, in complaining that certain of the recommendations of the Study Group were not clearly enough stated for their agencies to have been able to take a stand on them.

Col. Dunlop said that he and Mr. Green were concerned primarily with recommendation 5(b). They feel that if this problem can be solved the other subparagraphs under 5 will become relatively unimportant. If 5(b) is not feasible, the other subparagraphs must be looked at carefully.

It was the consensus of the Committee that, regardless of the reservations expressed on details, the Study Group request be accepted. The Secretary was therefore instructed to notify the Secretary of the Study Group that FACSI would assume the responsibilities as requested.

The Chairman asked Mr. Howerton to discuss the problem of indices to foreign language literature now published by the Library of Congress. These now consist of the Monthly Index of Russian Accessions and the East European Accessions Index. A similar index to Chinese literature is being considered.

There are only 1,200 subscriptions to these indices, world-wide. The product is felt to be good but it seems to be serving a very limited audience. Including estimates of the cost of a Chinese index, the three indices cost about one million dollars annually. The MIRA increases in cost by about $25,000 per year. Sixty percent of the publications covered are in science and technology.

It is felt that the present sponsors of the indices should not have to carry the total financial burden. Mr. Howerton said that his agency, for example, had a much greater language ability among its staff than when the indices were started; they have little need for the indices now but doubt they should be discontinued, so that alternate means of financing should be considered.

The Chairman asked each member of the Committee to determine his agency's response to this proposal. He said he would set up a special committee to consider the problem after comments were received from the members. Mr. Howerton offered to brief such a committee on the detailed aspects of the problem.

The Chairman said he had conducted a limited personal survey of the use of the indices. He found that in three large universities he had visited in different parts of the country, science faculty was making heavy use of the indices although each university had only one subscription. University research people strongly supported continuation of the indices. He added that the problem of supporting these indices was part of the still larger problem of cooperative support of other generally used information media.

Dr. Sanford said that certain aspects of mechanization of information should be considered. He said that, for example, industry seemed unaware of the payoff for developing a workable character sensing system. Such a system is the keystone to information mechanization. Very little is being done on character sensing systems or devices even though, he estimated, $80 million per year was being spent on information system research and development.

Mary Stevens, National Bureau of Standards, concurred and said that there was a need for character sensing equipment in virtually every activity where man used his eyes to collect information. Work on this kind of problem seems to be the responsibility of everyone and no one. Worthwhile projects have died for lack of funds. Associated with this problem is the one raised by the ASTIA-OTS Study Group on standardization of reports.

Mr. Howerton said that some agencies were considering a depository for little-used reference material patterned after the Midwest Inter-Library Center. Perhaps larger scale cooperative consideration of this problem should be undertaken not only by agencies such as his but by the many Federal agency libraries.

The Chairman announced the forthcoming publication by the Foundation of Science Information News, a bi-monthly devoted to news items on the scientific information field. He asked other agencies to contribute items about specific activities of which they were aware.

The meeting adjourned at 12:00 noon.

Prepared By:

Ralph E. O'Dette
Secretary
Federal Advisory Committee on Scientific Information

March, 1959

ATTACHMENT to: Summary of Second Meeting of Federal Advisory Committee on Scientific Information

Russian Journals which Great Britain plans to translate into English

Antibiotiki (Antibiotics).

Avtomaticheskaya Svarka (Automatic Welding). (Publication starts with January 1959 issue).

Avtomobil'naya Promyshlennost (Automobile Industry).

Derevoobrabatyvayushchaya Promyshlennost' (Wood-working industry).

Kauchuk i Rezina (Crude and Vulcanised Rubber). (Publication starts with January 1959 issue).

Khimicheskaya Nauka i Promyshlennost' (Chemical Science and Industry).

Khimicheskaya Promyshlennost' (Chemical Industry).

Khimiya i Tekhnologiya Topliv i Masel. (Chemistry and Technology of Fuels and Oils).

Koks i Khimiya (Coke and Chemistry).

Meditsinskaya Radiologiya (Medical Radiology).

Priborostroenie (Instrument making).

Stal' (Steel).

Stanki i Instrument (Machine Tools and Cutting Tools). (Publication starts with January 1959 issue).

Tekstil'naya Promyshlennost' (Textile Industry).

Teploenergetika (Heat and Power Engineering).

Uspekhi Khimii (Progress of Chemistry).

Uspekhi Matematicheskikh Nauk (Progress of Mathematical Sciences.)

Uspekhi Sovremennoi Biologii (Progress in Contemporary Biology).

Vestnik Akademii Nauk SSSR. (Journal of the Academy of Sciences.)

Vestnik Rentgenologii i Radiologii (Journal of Roentgenology and Radiology).

Vestnik Mashinostroeniya (Engineering Journal).

Zhurnal Fizicheskoi Khimii (Journal of Physical Chemistry).

Zhurnal Neorganicheskoi Khimii (Journal of Inorganic Chemistry).

STANFORD RESEARCH INSTITUTE

To: ~~C. Bourne~~ CB
R. Bruce
K. Eldredge
D. Engelbart
A. O'Donnell
L. Pratt
E. Ritter

Date: December 17, 1958

From: M. L. Kastens

Subject: Science Information Council

This is the committee set up by the Defense Education Act of 1958 (Sept. 2). It is appointed by the Director, NSF (Waterman), but its composition, etc. is determined by law. Its status is definitely different from the NSF Advisory Committee, but the Government lawyers are still studying just what this difference means.

The first meeting is scheduled for about January 21.

MLK:em

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NOV 20 1958

SCIENCE INFORMATION COUNCIL

Scientists	Term of Office
Dr. William O. Baker Vice President (Research) Bell Telephone Laboratories, Inc. Murray Hill, New Jersey	4 yrs.
Dr. Graham P. DuShane Editor, SCIENCE The American Association for the Advancement of Science 1515 Massachusetts Avenue, N. W. Washington 5, D. C.	2 yrs.
Dr. John M. Fogg Director, Morris Arboretum University of Pennsylvania 3815 Walnut Street Philadelphia 4, Pennsylvania	3 yrs.
Dr. Elmer Hutchisson Director American Institute of Physics 335 East 45th Street New York 17, New York	4 yrs.
Mr. Merritt L. Kastens Assistant Director Stanford Research Institute Menlo Park, California	2 yrs.
Dr. H. W. Russell Technical Director Battelle Memorial Institute 505 King Avenue Columbus 1, Ohio	1 yr.
Librarians or Documentalists	
Mr. Verner W. Clapp President, Council on Library Resources, Inc. 1025 Connecticut Avenue, N. W. Washington, D. C.	4 yrs.

Librarians or Documentalists (Cont'd) — Term of Office

Dr. E. J. Crane — 1 yr.
Editor, CHEMICAL ABSTRACTS
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Mr. W. T. Knox — 4 yrs.
Director
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New York 36, New York

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File NAS-NRC

Miscellany

Documentation

An Advisory Committee has been appointed to the Office of Documentation of the National Academy of Sciences—National Research Council to give general guidance to the Office and to serve as the NAS-NRC advisory body to the National Science Foundation and other organizations in connection with general problems of scientific documentation. The Advisory Committee is under the chairmanship of Elmer Hutchisson, director of the American Institute of Physics, and has the following other members: W. O. Baker (Bell Telephone Laboratories), W. R. Brode (Washington, D. C.), R. G. Cleland (Indiana University), H. T. Cox (American Institute of Biological Sciences), J. M. Fogg (University of Pennsylvania), S. A. Goudsmit (Brookhaven National Laboratory), I. Igelsrud (Battelle Memorial Institute), C. Leake (Ohio State University), P. M. Morse (Massachusetts Institute of Technology), A. Opler (Computer Usage Company, Inc.), G. Petrie (IBM Corporation), and F. Y. Wiselogle (The Squibb Institute for Medical Research).

A Scandinavian Documentation Center, SCANDOC, has been opened in Washington, D. C. (2136 P Street, N.W.) for the purpose of furthering the mutual exchange of scientific and technological information and documentation between the Scandinavian countries and the United States and Canada. The participating countries are Denmark, Finland, Norway, and Sweden. SCANDOC, a nonprofit organization, will render free service to all interested parties and is financed and directed by the Research Councils and Science Academies of the participating countries through their common Scandinavian Council for Applied Research, which originated the proposal for this venture. SCANDOC is headed by Arne Sverdrup, a Norwegian science attaché assigned to Norway's Embassy in Washington. SCANDOC will procure upon request unclassified reports and documents not readily available through libraries, bookstores, and other commonly used channels. It will also report to the Scandinavian Council for Applied Research on any such significant material published in the US or Canada.

During the current fiscal year the National Science Foundation will consider proposals for additional research projects or studies of a fundamental or general nature that may produce new insights, knowledge, or techniques applicable to scientific information systems and services. Although the Foundation will consider any proposal for a project that may contribute to the general goal of improving the handling of scientific information, the following research areas are currently of particular interest:

1. *Information needs of the scientific community* (studies or experiments to provide better understanding of scientific communication processes, scientists' information needs, and the extent to which needs are met by existing publications and information services, or could be met by proposed new types of publications and services).
2. *Information storage and retrieval* (research on the systematization and mechanization of procedures for handling large volumes of scientific information, including procedures for automatic analysis of texts of documents, automatic indexing, and abstracting, automatic searching of stored materials, and tests and evaluations of existing, newly developed, and proposed procedures for handling scientific information).
3. *Mechanical translation* (new groups wishing to undertake research on mechanical translation procedures and related studies of language should give first consideration to building upon and complementing the intensive work already accomplished by established groups).*

All inquiries and proposals should be addressed to the Documentation Research Program, Office of Scientific Information Service, National Science Foundation, Washington 25, D. C.

The cooperation of all scientific and technical information centers in the United States has been requested in connection with a survey being conducted by Battelle Memorial Institute for the National Science Foundation. The survey is intended to locate all information centers in the US serving the physical and life sciences and technologies and to collect factual data relating to their activities and services. The survey results will be used to prepare a national directory of information centers and to relate the activities of the centers to the total US scientific and technical information program. Information concerning location, subject coverage, scope of collection, and types of services available, etc., will be gathered by questionnaire. The value of the survey and directory will depend upon the completeness of coverage. NSF has therefore requested that any activity which identifies itself as an information center should send its name and address to Mr. William H. Bickley, Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.

A new quarterly scientific journal, *SPE Transactions,* will be published for the first time next January by the Society of Plastics Engineers. The journal will contain articles on basic polymer theory, science, and engineering. It is available to both members and nonmembers of the Society on a subscription basis. Further information is available from the Society of Plastics Engineers, Inc., 65 Prospect Street, Stamford, Conn.

* The semiannual report *Current Research and Development in Scientific Documentation,* available from the National Science Foundation, describes these projects in the US and abroad.

October 1960

APPENDIX A

National Science Board, Staff, Committees, and Advisory Panels

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Outline of

OSIS PUBLICATION PROBLEMS

The really difficult problems which OSIS encounters in its support of scientific publications of various kinds substantially all concern some aspect of the fundamental question:

> JUST WHAT ROLE SHOULD THE FEDERAL GOVERNMENT PLAY IN SUPPORTING PUBLICATION OF THE RESULTS OF SCIENTIFIC RESEARCH?

Since the Federal Government supports a large fraction of the scientific research being carried on in this country, it quite clearly has an obligation to supply funds for the dissemination of some significant proportion of the results of the nation's research. If one accepts that national welfare depends importantly upon the state of science, and the health of science is a function of the availability of scientific information, one presumably also must believe that the Government's responsibility goes somewhat beyond just supplying money. The question is, "How far beyond?". Clear policy lines with regard to this general question obviously would provide a valuable guide to the solutions of OSIS' specific publication problems. Some of these problems are listed below in question form.

I. Temporary (emergency) support versus permanent support

A. What are legitimate "emergencies" for primary journals? (Publish an index; eliminate a manuscript backlog; expand subject coverage; provide funds for normal operating expenses)

B. Should a worth-while scientific journal be permitted to die after one or two emergency grants if it meets all the criteria except that of being in a field which has enough scientists to support it?

C. Can we afford to open the "Pandora's Box" of permanent adoption?

D. How do we draw the line between temporary and permanent support for a primary English-language journal--that is, when does a series of emergencies become the equivalent of a permanent situation?

E. How long should a translation journal be supported if it shows little promise of eventually becoming self-supporting?

F. Do abstracting and indexing services have a better case than primary journals for permanent or semi-permanent support since fewer sources of income are available to them?

G. If so, what do we do here about the "Pandora's Box" problem?

II. Eligibility for support--assuming scientific worth

A. How does one evaluate claims that some primary journals must be subsidized more generously than others because their potential users either are less well paid than other groups of scientists or have such broad interests they must subscribe to many journals?

B. When does "conscientious handling of public funds" become "unwarranted Government interference" if one makes a journal grant contingent upon the sponsoring society raising its dues, finding a cheaper printer, instituting or raising page charges, using smaller margins and less expensive paper, increasing subscription rates, and the like?

C. Is there some group in the publishing industry (or could one be established) to which we could turn for advice on production costs and the like in connection with our evaluation of publication proposals?

D. In the abstracting field, how far should we go in making grant support contingent upon operation in line with OSIS' opinions on such matters as author-versus-specialty-written abstracts, exchange of abstracts with other services, cooperative activities that may reduce individual autonomy, and the like?

III. Relation of OSIS monograph support to interests of commercial publishers

A. How should we define the boundary between the area of legitimate OSIS support of publication and that of commercial responsibility?

B. How far should we go in requiring that a manuscript be turned down by commercial publishers before it can be considered for OSIS publication support?

C. What should our position be regarding requests in the "grey" area between a commercial publisher's unqualified "yes" or "no" --that is, the case where a commercial publisher is willing to publish the manuscript but on terms which the sponsoring scientific society or nonprofit research organization thinks are unfavorable?

D. How far should we go in subsidizing preparation of manuscripts and should our attitude toward publication support be any different here than when we had nothing to do with preparation?

E. Where do university presses fit into the answers to the above questions?

F. As a Government agency we cannot recommend specific possible publishers to a scientist seeking such information regarding a manuscript; might it be possible for the publishing industry to develop some kind of recommended list of geographically scattered printers and publishers equipped to handle specific kinds of technical publication?

G. What kind of conditional recovery of funds should we impose on grants for the publication of manuscripts?

National Science Foundation
Office of Science Information Service
Publication & Information Services

April 9, 1959

THE COPYRIGHT PROBLEM AS IT AFFECTS TECHNICAL INFORMATION

This memorandum summarizes very sketchily some of the many aspects of the U.S. copyright law as it affects the publication, distribution, and use of technical information. Most of the statements were considered during a meeting of the ad hoc Copyright Panel of the Science Information Council held in New York on March 18, 1959. Members of this panel include Messrs. C. G. Benjamin, Elmer Hutchison, Frank B. Rogers and W. T. Knox. The panel meeting had the good fortune to have Messrs. V. W. Clapp and E. G. Freehafer present expert viewpoints about the copyright law.

UNIQUE CHARACTERISTICS OF TECHNICAL INFORMATION

Scientific and technical information, although presented to the general public through the medium of authors and publishers, is considerably different from information having artistic or literary purposes. In nearly all cases the results of original scientific investigation are presented to the general public by the investigator as a professional service and in order to increase the investigator's professional stature. The major part of research and development work in the U.S. takes place in industrial organizations. The National Science Foundation figures for 1956 research and development show:

$6.5 billion	-	Industrial
1.4 "	-	Government
1.1 "	-	Universities and Other

Publication of technical articles, however, results more from research than from development work, and the contribution to published technical information is weighted much more heavily for government and university groups than the above figures indicate. The scientific investigators in industry, universities, and government do not normally depend on publishing the results of their scientific studies as a direct means of earning a livelihood (although professional advancement in universities is frequently related to publications). This is considerably different from literary publications, where the author depends on selling his writings for a livelihood.

There is another important difference between scientific information and non-scientific information--related to the national security and material progress. Quoting Dr. Killian: "Our progress in science is dependent upon the free and rapid flow of information, for the rate of scientific advance is determined in a large measure by the speed with which research findings are disseminated among investigators who can use them in further research."

HISTORICAL BACKGROUND

The U.S. copyright law is based on the Federal Constitution empowering Congress "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries". There has traditionally been no limit to the

scholarly right to copy from published works for research purposes. So long as copying had to be done by hand or typewriter, there was no real problem regarding the copying of technical information--the cost was too great. With the advent of rapid photocopy methods in the early 1900's and particularly since World War II, the situation has rapidly changed. Copies can be made rapidly and cheaply using photocopying.

The situation has also changed in another respect--the volume of technical information published. The exponential increase in published technical information has made it virtually impossible for any one library to subscribe to more than a fraction of available journals, and copying must be employed to fill the gap. The aquisition problem on books is not as critical for libraries, but copying from books may be as prevalent as from journals.

Several groups have been concerned with the problem. In 1935 as "Gentlemen's Agreement" to cover copying copyrighted materials was agreed to by a joint committee representing library interests and the National Association of Book Publishers. This agreement was regarded as a mutually acceptable statement of the doctrine of fair use of copyrighted materials as applied to documentary reproduction. Both groups have since disbanded or re-organized. The Royal Society (U.K.) adopted in 1950 a fair copying declaration, which has subsequently been adopted by UNESCO. The basic problem these groups have tried to resolve is an appropriate definition of "fair use" of copyrighted material. There has been no extensive revision of the U.S. copyright law since 1909, although there have been recent changes to the British law embodying some of the recent considerations.

* * * * *

What follows is an attempt to summarize the more important viewpoints of the various groups connected with technical information.

1. Author's Function and Viewpoint

There are two widely differing functions which authors fill: (1) to report original scientific work and to supply critical reviews, and (2) preparation of textbooks, handbooks, encyclopedias, technical manuals, etc. Material in the first category is largely written, as mentioned earlier, as part of the professional obligation of the investigator and to enhance his professional prestige. Since the largest group of scientists, engineers, and other professional people are employed by industrial and government organizations, it follows that material of this type has little bearing on the individual's livelihood, nor does the copyright law encourage individuals with this background to publish. In fact, the reverse is more likely to be true. Authors of this type technical information rarely, if ever, receive payment. They are quite interested in obtaining the widest possible dissemination of the information.

On the other hand, authors of books, manuals, encyclopedias, etc., normally do this with the expectation of earning money. The copyright law is much more important, therefore, to this group of authors.

2. Publisher's Function and Viewpoint

There are in general two kinds of publishers--for profit, and non-profit. All publishers are interested in wide dissemination of their published information. One way to encourage wide distribution is to keep the price from becoming prohibitively high, and publishers try to do this. While publishers recognize the need for maximum usage of information, they want the pattern of use to develop with due regard to the economics of publishing. Many journals, especially those reporting applied scientific information, depend heavily on advertisers to allow low cost subscriptions, and publishers who depend on advertisers are particularly sensitive to photocopying of journal articles. Selling back issues of serials is also profitable to many publishers. These considerations appear to justify the publisher's viewpoint that wide-spread or multicopying of technical information appearing in journals or books cuts down the revenue they might otherwise obtain. Publishers also feel that it is most often cheaper (and yields better copy) for the user to buy a published copy than to make a photocopy.

Publishers are generally willing to permit limited copying of copyrighted technical information. Although, where the copying is extensive, a copying fee is sometimes asked. This has been a particular problem in the case of government agencies, where a fee for reproducing copyrighted material has not been an acceptable expense, under government accounting rules. Although this situation has recently improved, it is still not good.

3. User's Function and Viewpoint

It is obvious but true that only when the information has been used has it achieved any value. The user viewpoint, therefore, is quite important. Society expects material progress based on scientific research and development, and the national security demands it. The user feels that scientific information must somehow be usable with a minimum of restraint.

The average scientist, engineer, or other professionally trained person normally reads as a matter of professional current awareness, only 3 to 6 periodicals. The time available for reading remains the same while the volume of information increases at an exponential rate. The user inevitably will be aware on a current basis of less and less of the total amount of information currently produced. The user wants to absorb as much current information as is possible within the amount of time available. He, therefore, uses any device which will give him broader coverage within the same reading time. This has led to abstract journals, indices, table of contents bulletins, and may lead in the future to special compilations of current information prepared for specific individuals.

In addition to being aware of current technical progress, the user wants access on demand to specific items of information. He wants to be able to read the original article or book within a short time after he becomes aware that the information contained in it might help him. This latter problem (with journals) and the economic problem (with books) creates most of the photocopying work being carried out in libraries at present.

4. Library's Function and Viewpoint

Traditionally, libraries have always recognized a responsibility for having recorded information available when users need it. They are currently faced with the staggering problem of the rapid growth of serial publications and scientific books. As a result very few libraries, if any, pretend to maintain a complete collection of the technical information pertinent to their clienteles. Libraries have joined forces in some areas. Because of bulk, it is frequently faster and cheaper for libraries to loan material through photocopying means rather than ship the original. Libraries, however, recognize the conflict of interests between the publishers and users, and try to compromise between these groups, and fear they are compromising the law as well. This has led to a wide divergence in practice between libraries, with respect to copyrighted material. The Library of Congress made 35 million photocopies last year, under a standing copyright agreement with most publishers. It is questionable whether other libraries could obtain such widespread blanket permission for copying. The National Library of Medicine will not copy from books or from 125 basic medical journals which they feel any medical library should have in its collection.

* * * * * *

REFLECTIONS ON POSSIBLE APPROACHES

The Panel on Copyright feels that the Science Information Council might wish to recommend to the National Science Foundation that some attempts be made to clarify the position of the various groups involved in preparing, publishing, storing, and using technical information. It is felt that an expert on copyright law and practice could make specific recommendations for NSF consideration beyond the competence of the Panel to recommend. Our first recommendation to the Council, therefore, is that an expert on copyright be engaged to review the problem and come forth with a specific plan for NSF consideration. Such an expert should have the help of other experts in the publishing and business management field; this is not a problem for legalistic consideration alone.

Some of the possibilities for action which occurred to Panel members include:

(a) Adoption of a new convention by major groups in the U.S., which would detail "fair use" of copyrighted technical material. This might involve simple adoption of the UNESCO declaration, or a modification might be deemed desirable. It is our feeling that a new convention would be a very helpful guide to libraries all over the country and would eliminate the various conflicting practices in copying technical information.

(b) Consideration should be given to test case(s) in a Federal Court interpretation of "fair use" as it applies to technical information. There has never been a court ruling to our knowledge in this field. Instead, the various court actions have centered around artistic or literary creations. Court rulings might be equally acceptable as a guide to practice as would a revision of the present U.S. copyright law. A revision of the law would undoubtedly be time-consuming and very difficult.

(c) The difference in type of technical information as it is originally published and in its use can serve as a useful guide to "fair use". Such differences might be incorporated into the proposed new convention, and might also serve as a basis for different court test cases. For example, the differences between reporting original research data or critical reviews and technical manuals, textbooks, handbooks, etc., are important. Likewise, the difference between current awareness and retrospective searching is important when considering the use of scientific information.

(d) Some consideration might be given to establishing uniform fees for copying privileges. It seems to the Panel that it is frequently desirable from a time standpoint to allow copying of copyrighted material. This should be possible within rules which recognize the rights of all parties. Chemical Abstracts, for example, allows copying for a set rate. This rate is cut in half for reproducing old material, as opposed to current abstracts. The rates, however, are defined and publicized.

(e) The Panel feels that consideration should be given to author's rights, as applied to articles appearing in serial publications. The author's rights normally are fully protected in the case of textbooks, manuals, encyclopedias, etc., but in the case of journal articles, the author is legally not entitled to copy his material if it has been copyrighted by the publisher.

* * * * * * *

The Panel believes that the copyright problem, as related to scientific and technical information, is a serious one, and will become more serious in the future. It is also of the opinion that a solution must be found if the National Science Foundation and its Science Information Service are to live up to the responsibilities given it by the President, Mr. Eisenhower, and his Science Advisory Committee.

W. T. Knox/amb/dc

FROM: JOURNAL OF DOCUMENTARY REPRODUCTION (Chicago), 2:29-36, March 1939

THE GENTLEMEN'S AGREEMENT AND THE PROBLEM OF COPYRIGHT

In the Journal of Documentary Reproduction, I (Summer, 1938), p. 245, a footnote, to the effect that the "gentlemen's agreement" entered into between the Joint Committee on the Reproduction of Materials for Research and the National Association of Book Publishers had been terminated, was included. This statement was prompted by the replacement on January 1, 1938, of the National Association of Book Publishers by a new organization, the Book Publishers Bureau, Inc. It was soon pointed out, however, that the agreement had not been terminated but was still in force and was, in fact, regarded not as a contract relationship but rather as a mutually acceptable statement of the practical scope of the doctrine of fair use as applied to documentary reproduction. In view of the general interest in the subject, it was decided to reproduce the original agreement together with the pertinent correspondence upon which it was based and also the latest exchange of correspondence reaffirming the agreement.--EDITOR.

CORRESPONDENCE AND AGREEMENT ON THE PHOTOGRAPHIC COPYING BY LIBRARIES OF COPYRIGHTED MATERIAL

May 25, 1935

Mr. W. W. Norton, President
National Association of Book Publishers
347 Fifth Avenue
New York, N. Y.

Dear Sir:

On behalf of the Joint Committee on Materials for Research, I write to thank you for the consideration your organization has given to the increasing importance of the problem of conscientious observance of copyright that faces research libraries in connection with the growing use of photographic methods of reproduction. Not so long ago the scholar or student contented himself with pencil or ink transcripts of passages in the books and periodicals he consulted in connection with his studies. The increased use, first of the fountain pen, then of the standard typewriter, then of the portable typewriter, developed a corresponding increase in the number and amount of transcripts made for this same purpose. Within the past few years, the use of photography, the photostat, and now the 16 or 35 millimeter film cameras have added to the amount, the extent, the speed--and the problems--of this reproduction.

We realize, of course, that we can speak only on behalf of the publishers, libraries and research workers of this country. The problem is of importance also in connection with foreign copyrighted books, particularly the publications of academies or learned societies and the unofficial periodical press printing the results of research. As to such books and periodicals, the foreign publisher or copyright owner is the final authority. We feel,

however, that the common interests of both groups would make it fair for us to assume that the practice approved by American publishers and libraries would satisfy their brothers in other countries.

We are told that from time to time instructors in various schools and colleges have reproduced in one way or another extensive portions or whole chapters from copyrighted text books, which have been sold or given to their classes as substitutes for the text books. We see how keen an injustice and how severe a harm is done to the owner of the copyright by such practices, and we participate with you in the condemnation of such obvious violations of copyright.

The indication you have given of what publishers and authors, as owners of copyright, can suggest to archives offices and museums as a guide to a code of fair practice in connection with the commendable form of public service rendered by photographic methods of reproduction is so clarifying that we suggest it be put in the form of an agreement and published.

Very sincerely yours,
(signed) ROBERT C. BINKLEY, Chairman
The Joint Committee on Materials for Research

May 27, 1935

Dr. Robert C. Binkley, Chairman
Joint Committee on Materials for Research
Western Reserve University
Cleveland, Ohio

Dear Dr. Binkley:

We deeply appreciate your desire to work out a code of fair practice which will protect the rights of authors and research workers. As publishers we naturally do not wish to impose restrictions which might hamper students in collecting research material, but on the other hand it is necessary for us all to face this problem realistically and not permit the rapid extension of photo-copying to lead to a disregard of the fundamental principles of copyright.

The results of the conference in our office, attended by Mr. Lydenberg, Mr. Ferguson, and Dr. Keogh and members of our committee, have been discussed with Mr. Frederic Melcher, Chairman of the Association Copyright Committee, and by our Board of Directors. We are happy to have the results of these conferences put in the form of an agreement and published with this correspondence.

Very sincerely yours,
(signed) W. W. NORTON, President
National Association of Book Publishers

The Joint Committee on Materials for Research and the Board of Directors of the National Association of Book Publishers, after conferring on the problem of conscientious observance of copyright that faces research libraries in connection with the growing use of photographic methods of reproduction, have agreed upon the following statement:

> A library, archives office, museum, or similar institution owning books or periodical volumes in which copyright still subsists may make and deliver a single photographic reproduction or reduction of a part thereof to a scholar representing in writing that he desires such reproduction in lieu of loan of such publication or in place of manual transcription and solely for the purposes of research; provided
>
> (1) That the person receiving it is given due notice in writing that he is not exempt from liability to the copyright proprietor for any infringement of copyright by misuse of the reproduction constituting an infringement under the copyright law;
> (2) That such reproduction is made and furnished without profit to itself by the institution making it.
>
> The exemption from liability of the library, archives office or museum herein provided for shall extend to every officer, agent or employee of such institution in the making and delivery of such reproduction when acting within the scope of his authority of employment. This exemption for the institution itself carries with it a responsibility to see that library employees caution patrons against the misuse of copyright material reproduced photographically.

Under the law of copyright, authors or their agents are assured of "the exclusive right to print, reprint, publish, copy and vend the copyrighted work," all or any part. This means that legally no individual or institution can reproduce by photography or photo-mechanical means, mimeograph or other methods of reproduction a page or any part of a book without the written permission of the owner of the copyright. Society, by law, grants this exclusive right for a term of years in the belief that such exclusive control of creative work is necessary to encourage authorship and scholarship.

While the right of quotation without permission is not provided in law, the courts have recognized the right to a "fair use" of book quotations, the length of a "fair" quotation being dependent upon the type of work quoted from and the "fairness" to the author's interest. Extensive quotation is obviously inimical to the author's interest.

The statutes make no specific provision for a right of a research worker to make copies by hand or by typescript for his research notes, but a student has always been free to "copy" by hand; and mechanical reproductions from copyright material are presumably intended to take the place of hand transcriptions, and to be governed by the same principles governing hand transcription.

In order to guard against any possible infringement of copyright, however, libraries, archives offices and museums should require each applicant for photo-mechanical reproductions of material to assume full

responsibility for such copying, and by his signature to a form printed for the purpose assure the institution that the duplicate being made for him is for his personal use only and is to relieve him of the task of transcription. The form should clearly indicate to the applicant that he is obligated under the law not to use the material thus copied from books for any further reproduction without the express permission of the copyright owner.

It would not be fair to the author or publisher to make possible the substitution of the photostats for the purchase of a copy of the book itself either for an individual library or for any permanent collection in a public or research library. Orders for photo-copying which, by reason of their extensiveness or for any other reasons, violate this principle should not be accepted. In case of doubt as to whether the excerpt requested complies with this condition, the safe thing to do is to defer action until the owner of the copyright has approved the reproduction.

Out-of-print books should likewise be reproduced only with permission even if this reproduction is solely for the use of the institution making it and not for sale.

(signed) ROBERT C. BINKLEY, Chairman
Joint Committee on Materials for Research
W. W. NORTON, President
National Association of Book Publishers

January 4, 1939

Managing Editor
Journal of Documentary Reproduction
P. O. Box 682, Franklin Station
Washington, D. C.

Dear Sir:

In your Summer 1938 issue of the JOURNAL OF DOCUMENTARY REPRODUCTION on page 245, the article by Mr. James G. Hodgson referred to the agreement which was entered into between the Joint Committee on the Reproduction of Materials for Research and the National Association of Book Publishers in regard to microfilm copies of books. In an Editor's note at the bottom of the page you state, "This agreement has now been terminated."

On January 1, 1938, the National Association of Book Publishers was superseded by this Bureau which is carrying on essentially the same program as the old Association. We have no record that the above agreement has been terminated and, therefore, we will appreciate your verifying this statement and referring us to any correspondence or other source from which this information was obtained.

Sincerely yours,
(signed) S. HUNNEWELL
Executive Secretary

808 Beverly Drive
Alexandria, Va.
8 January, 1939

Mr. Stanley P. Hunnewell, Executive Secretary
Book Publishers Bureau
347 Fifth Ave.,
New York, N. Y.

Dear Sir:

Thank you very much for your letter of January 4 in which the continuation of the agreement between the old National Association of Book Publishers and the Joint Committee on Materials for Research is stated to hold with your superseding organization. I shall be glad to insert in the forthcoming JOURNAL OF DOCUMENTARY REPRODUCTION a news note to this effect and a correction of the note appearing on page 245 of Vol. I. In view of the general interest in this subject, do you believe that it would be desirable to reprint the text of the agreement in full?

Sincerely yours,
(signed) V. D. TATE, Managing Editor
Journal of Documentary Reproduction

January 24, 1939

Mr. V. D. Tate
Managing Editor
Journal of Documentary Reproduction
808 Beverly Drive
Alexandria, Va.

Dear Mr. Tate:

I am glad to have your kind letter of January 8th advising that you will publish a correction of the Editor's note to which we referred in our letter of January 4th.

I agree that it would be very desirable to reprint the text of the Agreement in full and hope that you will be able to do so in the next issue of the JOURNAL.

Sincerely yours,
(signed) S. P. HUNNEWELL
Executive Secretary

January 10, 1939

Vernon D. Tate, Editor,
Journal of Documentary Reproduction,
P. O. Box 682, Franklin Station,
Washington, D. C.

Dear Dr. Tate:

On Page 245 of Volume One, Part One, of the JOURNAL OF DOCUMENTARY REPRODUCTION, I have noticed a footnote to the effect that the gentlemen's agreement between the National Association of Book Publishers and the Joint Committee on Materials for Research has been terminated.

May I say that this is not our view. The agreement was not made as a contract conferring rights and imposing obligations on the parties, but was rather a statement of the practical scope of the established doctrine of fair use as applied to the making of photostat or other copies by libraries for scholars. The practice is old, has been recognized as reasonable and has never led to any litigation. The Courts have, in other cases, long recognized that copyrights are subject to fair use.

It seemed proper for two organizations familiar with the procedure and interests involved to agree on a statement of the principles of fair use, of what is reasonable and customary, within this field. This statement, made at the time when the NRA codes were going into effect, is the gentlemen's agreement. The principles of the agreement had actually been established in practice before they were put on paper and they will, I believe, continue to constitute the principles of fair use whatever may happen to the organizations and individuals who set them down. Moreover, the Joint Committee on Materials for Research has never repudiated the agreement and, so far as I know, neither has the publishing industry. In fact, it continues to be a guide to scholarly procedure.

Very sincerely yours,
(signed) ROBERT C.BINKLEY, Chairman
Joint Committee on Materials for Research