References and Notes

1. J. Walsh, *Science* **147**, 382 (1965).
2. The correlation between parents' and childrens' intelligence-test scores has typically been found to be between .40 and .60. See M. P. Honzik, *Child Develop.* **28**, 215 (1957); J. V. Higgins, E. W. Reed, S. C. Reed, *Eugen. Quart.* **9**, 84 (1962).
3. L. Erlenmeyer-Kimling and L. F. Jarvik [*Science* **142**, 1477 (1963)] review evidence which suggests that a substantial proportion of the variance in ability is attributable to differences in heredity. This does not necessarily mean, however, that extreme environmental deprivation cannot result in large decrements in ability, since most studies of the heritability of intelligence have used groups of subjects who were relatively homogeneous with respect to environmental opportunity.
4. N. C. Crawford, *J. Assoc. Coll. Admissions Counselors* **8**, 11 (1962), has shown that the income tax paid by a student's family corresponds closely to the expected family contribution to the student's college education as calculated by the College Scholarship Service's system of needs-analysis. These considerations led to the use of income tax as the index of family financial status for Merit Finalists in Table 1. Ideally, the figures for all families should also have been based on tax, but these data were not available. Exact comparisons between the figures for Finalists and those for all families are not possible in any event, because the latter are not limited to those families with children graduating from high school. This defect in comparability causes relatively little error in the ratio between the two figures as an index of differences between states in representation of poor families among Merit Finalists.
5. Since all existing states are included, this correlation is completely accurate as a descriptive statistic; and, since the variables involved do not change greatly from year to year, it can be expected to be reliable over time. However, in drawing inferences from such correlations about the lawful relationship between variables, the states must be considered as merely a sample from a universe of possible states, and the usual sampling fluctuation of the correlation must be considered. With a sample of 51 a correlation of .31 is significant at the .05 level.
6. For example, in the Presidential Scholars Program all national testing programs contribute names of their highest-scoring students. Practically all of these students are also Merit Program participants.

7. This study is part of the research program of the National Merit Scholarship Corporation and was supported by grants from the National Science Foundation, the Carnegie Corporation of New York, and the Ford Foundation.

News and Comment

Defense: McNamara's Comptroller, Charles J. Hitch, Leaves after Four Pioneering Years at DOD

Just down the hall from the offices of the Secretary of Defense on the executive "E Ring" of the Pentagon is the office of the Assistant Secretary, Comptroller. The occupant of this post for the past four years has been economist Charles J. Hitch, and his propinquity to the Secretary's office symbolizes Hitch's part in what has been called the McNamara revolution.

By common assent, in which even his critics join, McNamara is the first Secretary of Defense to succeed in making civilian control of the government's biggest department a working reality. Under McNamara, unification of the military services has been achieved through control of the budget. And the comptroller's office has served as the fulcrum for McNamara's lever.

President Johnson gave McNamara's managerial accomplishments the highest endorsement at his news conference last week when he announced that he had asked Cabinet officers and other heads of federal agencies "to introduce a revolutionary system of planning and budgeting and programming throughout the vast federal system so that through the tools of modern management the full promise of a finer life can be brought to every American at the lowest possible cost." There was no doubt in anyone's mind that the Defense Department was the model the President had in mind.

Hitch himself, however, has resigned the comptroller's job and left on Tuesday to assume the post of vice president for financial affairs at the University of California, an institution which has some management problems of its own.

Hitch returns to university life after a break—save for short interludes—of 25 years which began and ended with government service. The middle dozen years were spent in the quasi-academic precincts of the RAND Corporation.

Now 55, Hitch is a first-generation member of a new breed of public servant. Like his boss of the past four years, Robert McNamara, Hitch was part of that small band of bright junior officers and university-based civilians who during the war pioneered the systematic application of mathematics, the sciences, and the social sciences to problems of logistics and strategy and to management of the military establishment.

An early-Depression graduate of the University of Arizona, Hitch spent a year (1931–32) doing graduate work at Harvard and then went to Oxford as a Rhodes scholar, taking a first in philosophy, politics, and economics. In 1935 he was elected a fellow of Queens College, Oxford, and taught at Oxford for the rest of the decade. During those years, Hitch recalls, the great excitement among economists was the theories of J. M. Keynes, and the economists' main concerns were the problem of unemployment and matters of fiscal and monetary policy.

With the coming of the war, Hitch joined Averell Harriman's first lend-lease mission in 1941–42 and later served on the War Production Board. Inducted into the Army in 1943, he was assigned to the Office of Strategic Services and found himself back in Britain working as a member of group analyzing the effects of Allied air raids. At this stage, operations research was a far-from-sophisticated pursuit. The group in which Hitch worked was using a "collection of techniques, many of which had been used before," says Hitch. "What was new was the attempt to apply them to military problems."

Using agents' reports, aerial photographs of bomb holes in factory roofs on the continent, and analyses of British experience on the receiving end of German air raids, the group was making estimates of damage done by Allied bombing raids. The group was also able to give the night-raiding RAF clues as to where their bombs were actually landing.

By the end of the war Hitch was working on selection of targets in Japan. Immediately after the war ended he was made chief of the stabilization controls division of the Office of War Mobilization and Conversion.

When Hitch returned to Britain in 1946 he thought he was going back to Oxford for good. He discovered,

however, that professionally he was interested in other things and found the life of a don in austerity-bound Britain restricting.

By a minor stroke of fate in 1948 he participated in a conference in New York called by the RAND Corporation to explore the question of what economists and other social scientists might contribute to the work already being done by scientists, mathematicians, and engineers at RAND as consultants to the Air Force on weapons development and strategy.

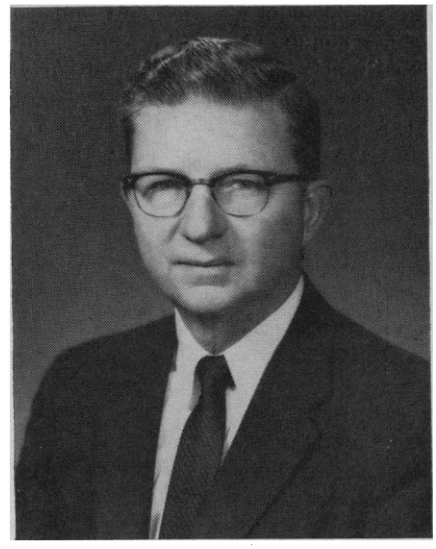
An upshot of the conference was that Hitch was asked to organize an economics department at RAND. Hitch says that at first he had no idea of taking the job, but a few months later he found himself in Santa Monica.

The first task was to decide what economists could do best for RAND, and the most conspicuous need, says Hitch, was for a cost-analysis section. The enormous expense of modern weapons systems made it necessary to develop accurate methods of estimating long-term costs. At RAND cost analysis involved economics, statistics, and engineering inputs, as well as estimates of future operational demands. Cost analysis evolved into the "cost-effectiveness" studies which began to be employed a decade ago as a management and planning tool by the Air Force and which have played so conspicuous a part in the McNamara era at the Pentagon.

"The core problem at RAND," says Hitch, "is what is the economic way to do things." Evidence for the accuracy of this appraisal is to be found in the fact that Hitch became chairman of the RAND planning and research council which is responsible for planning and directing the research of the organization.

While at RAND, Hitch, with coauthor Roland N. McKean, a RAND research economist, wrote a book, *The Economics of Defense in the Nuclear Age* (Harvard University Press, $9.50), which was to be one of *the* books which influenced the Kennedy program and has served as a sort of handbook for the McNamara regime. The Secretary of Defense paid the sincerest kind of compliment to author Hitch by recruiting him as comptroller in the preinauguration days of the Kennedy great talent hunt.

A sort of sequel to the book, based on the experience of the past four years, will be found in the Gaither lectures which Hitch delivered in April at the University of California at Berkeley and which will be published by the University of California Press this fall.



Charles J. Hitch

Hitch and others have suggested that McNamara has simply exerted exceptional vigor and ability in promoting the unification of the military services and the assertion of civilian control, which were intended in the creation of the Defense Department after World War II. A sequence of legislative steps was taken in the 1950's to strengthen the central direction of the military establishment, the latest in that decade coming in 1958 when a Directorate of Defense Research and Engineering was created particularly to supervise the selection and development of new weapons systems.

Innovations in Management

At the time of the change of administrations in 1961, further major organizational changes for Defense had been recommended and were expected. It was McNamara's decision that innovations in management would make them unnecessary.

The first of these innovations profoundly affected the planning-budgeting process, an unwieldly instrument shaped by old ways and new demands. In the Gaither lectures, Hitch describes pre-McNamara practices as follows:

> The civilian secretaries had taken control of the over-all level of the defense budget and brought it into line with the fiscal policy of the administration. The primary method of so bringing the defense budget into line, used by all secretaries before the present incumbent, was to divide a total defense budget ceiling among the three military departments, leaving to each department, by and large, the allocation of its ceiling among its own functions, units and activities. The Defense Secretaries used this method because they lacked the management techniques needed to do it any other way.

Military planning in the main was done in terms of missions, and budgeting was done in terms of bookkeeping categories such as personnel, construction, and procurement. The shape of the budget was dictated (and still is) at least in part by the structure and preferences of congressional committees which deal with military affairs.

To overstate the matter slightly, planning was done by the military and budgeting by civilians. As a result, the critics argued, the military forces were unbalanced and in some respects unprepared. The Air Force, for example, emphasized its strategic bombing force at the expense of troop-transport capability and tactical aircraft. The Navy stressed its carrier striking force with the result that antisubmarine warfare languished. The Army sought to maintain its active divisions at a maximum number and as a consequence some divisions were underequipped and below strength.

The service secretaries were inundated with information and advice, often intensely subjective, during the few weeks into which the budget review was crammed, and programs were often cut or kept on highly arbitrary grounds.

McNamara set out not only to bring order to the budget-making process but, at the same time, to improve the decision-making system up and down the line.

The focus of this effort became the comptroller's office. In addition to the comptroller's conventional duties—development of the annual budget, supervision of accounting and auditing policy, statistical services—two major new responsibilities were lodged there which radically changed the green-eyeshade and sharp-pencil stereotype of the government comptroller's office. The added duties embodied a new "programming" system and a systems-analysis operation.

Hitch has been quoted as saying that the programming system is the most important innovation in DOD decision-making machinery. It is viewed as the link long needed to join planning and budgeting activities.

New weapons and new tactics have blurred traditional lines between services. The first step in the programming

effort was to identify elements of the armed forces in terms of "building blocks." In Hitch's words, program elements are "integrated combinations of men, equipment and installations whose effectiveness could be related to our national security objectives."

Examples are (i) the B-52 bomber force with all the manpower, weapons, and supplies on which it depends for its effectiveness, (ii) recruit training, and (iii) the manned orbiting laboratory which last week got a Presidential go-ahead worth $1.5 billion.

A necessary part of the job is to determine the full cost of training and equipping men and of operating an element over several years. Only then, says Hitch, is it possible to compare the effectiveness of one system with others designed to do similar jobs.

The second major part of the programming task was to relate the program elements, which number perhaps a thousand, to the major missions of DOD. There are now nine major mission groupings: (i) strategic retaliatory forces; (ii) continental-defense forces; (iii) general-purpose forces; (iv) airlift and sealift; (v) reserve and guard; (vi) research and development; (vii) general support; (viii) retired pay; (ix) military assistance.

The program elements with their costs, grouped under missions, represent, in the new Pentagon vocabulary, the Five Year Force Structure and Financial Program. And, according to Hitch, the annual budget "now represents a detailed analysis of the financial requirements of the first annual increment of the appoved five-year program."

In theory, programming brings budgets into line with plans, and in fact it appears that considerable progress has been made. Difficulties still remain, however, and Hitch discusses some of these in the Gaither lectures. The ultimate test of McNamara's policies, of course, lies in Vietnam and on putative battlefields of the future.

Programming has been generally well received inside and outside the Pentagon, says Hitch, but the second major innovation—systems analysis, or cost-effectiveness studies, as they are more familiarly known has roused considerable controversy.

The systems analysts see a clear necessity for economic choice when resources are limited. Cost-effectiveness studies are viewed as a logical way to make quantitative analyses of comparative benefits to provide decision-makers with a rational basis for choice.

Cost-effectiveness studies, however, have been interpreted by critics as a justification for penny pinching. The tradition that only the best in weapons and equipment is good enough for the American fighting man (a tradition not infrequently honored in the breach) is difficult to square with the analysts' objective of getting the most from available resources.

Cost-effectiveness studies have become most important at the planning level, traditionally a preserve of professional military men. It is perhaps not surprising that it is here that the greatest heat has been generated and that the charge is heard (often from Congress) that computers manned by bright but callow civilians have usurped the rightful place of experienced military men.

Hitch and his colleagues have sought to counter these attacks. In the Gaither lectures, for instance, he avers, "I am the last to believe that an 'optimal strategy' can be calculated on slide rules or even high speed computers. Nothing could be farther from the truth. Systems analysis is simply a method to get before the decision-maker the relevant data, organized in a way most useful to him. It is no substitute for sound and experienced military judgment and it is but one of the many kinds of information needed by the decision-maker." Despite these efforts to explain, suspicions have not been quelled. (The state of systems analysis in the Defense Department will be discussed in more detail in a later article in this space.)

It seems generally agreed, however, that neither McNamara's planning-programming-budgeting process nor the systems analysis work that supports it will go out of style at the Pentagon. Hitch is leaving now that his pioneering period is over, but he has been replaced by Harvard Business School professor Robert N. Anthony, who takes a similar economist's view of the job. And the systems analysis work, which has been done in the comptroller's office, has been institutionalized by the creation of a new subcabinet post—Assistant Secretary of Defense for Systems Analysis. The new assistant secretary is Alain C. Enthoven, an economist and Ph.D. and perhaps the best known among the group of academically trained young civilians who came to be called in the Pentagon, with a mixture of respect and spite, the "Whiz Kids." As a deputy to Hitch, Enthoven ran the systems analysis section in the comptroller's office but often dealt directly with McNamara.

The triumph of McNamara's management innovations is attested by efforts within the military services, made in self-defense, to develop their own competence to prove their points with pickproof cost-effectiveness studies. Systems analysis techniques are now being taught at the service academies.

Abroad, Britain, Canada, and West Germany are adapting American ideas for the unified management of the military services to their own needs. And, as he leaves the Pentagon, Hitch can take ironic pleasure in the knowledge that a printing of 10,000 copies of *The Economics of Defense* reportedly was ordered (sans royalties) in the Soviet Union—JOHN WALSH

Aerospace: Congressional Study of AF Contractor Raises Questions About Proper Role of Nonprofits

A congressional study of the Aerospace Corporation published late last month has prepared the way for renewed discussion of one of the more ambiguous forms of American enterprise, the nonprofit corporation. The report* of the special investigations subcommittee of the House Armed Services committee is formally a limited analysis of Aerospace's fiscal and management policy. Committee researches on this subject uncovered a variety of abuses, some sensational, some comical, that were featured headlines when the report was issued. These make amusing reading. But, more important, the particular issues reflect an underlying uncertainty about what the proper role of the nonprofits ought to be, and about how they should conduct themselves.

The term "nonprofit" is currently applied to about 450 institutions so varied that they defy orderly classification. They range from small groups of eight to ten scholars affiliated with universities and conducting foundation-sponsored research on farm policy, for example, to giant quasi-industrial operations like Aerospace, which employs over 4000 people and operates on an

* The report, entitled *The Aerospace Corporation, A Study of Fiscal and Management Policy and Control*, is available from the Government Printing Office, Washington, D.C. 20402, for 25 cents.