equilibrium theory, witn concentrations not unlike those of the upper troposphere, and except during periods of equatorial test operations there is a very marked increase in fission product concentration from the tropopause to at least 65,000 feet. It is therefore suggested that the radon which is found above the equatorial tropopause has been carried there by a slow rising (on the average) current, through the tropopause to at least 65,000 feet. Further, this mode of transport dominates the flux that results from turbulent vertical exchange. The history of the radiotungsten introduced during the United States 1958 equatorial tests suggests, however, that the rising current does not reach above 65,000 feet (*17*).

The mean stratospheric radon concentrations at 60,000 and 65,000 feet at both the polar and equatorial locations are very similar. It is unlikely that intense horizontal mixing in this part of the stratosphere could have produced the similarity, because even the most extreme coefficients of horizontal mixing would result in significant differences if injection into the stratosphere occurred at either location, or if injection occurred in the temperate zone.

The initial collections of radon gas in two extreme geographical locations have proven to be far more interesting than expected. In the case of the Alaskan results, the reversals in concentration with height are associated with features of the thermal structure and indicate that slices of recent tropospheric air may readily interleaf the air normally considered stratospheric. Further, semiquantitative estimates of the time scale can be given, since radon has a comparatively short half-life of 3.8 days and its presence in observable amounts would probably not allow transit times to the lower stratosphere from the troposphere longer than about a month. More radon was also found in the lower equatorial stratosphere than expected. These observations, combined with the vertical profiles of ozone and fission products whose origin is the stratosphere, suggest that a rising motion, rather than turbulent mixing, is the more likely mode of transfer. The magnitude of such rising currents of about $10^{-2}$ to $10^{-1}$ cm $sec^{-1}$ is about the magnitude predicted as upper limits by Murgatroyd (*18*) and expected by Machta (*19*).

It is expected that additional profiles can be obtained in future aircraft operations at these locations and in the southern United States. The usefulness of radon to measure the coefficient of vertical turbulent mixing has been demonstrated for the troposphere (*4*) and in this article its potential value in the lower stratosphere is equally evident (*20*).

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# News and Comment

## Playing with Numbers: The Public Wants a Balanced Budget, So the Public Gets a Balanced Budget

With the submission this week of the Economic Report, the President has completed his first full presentation of the series of three messages that begin each congressional session. The State of the Union and Budget messages were reviewed here last week. In the Economic Message, and its accompanying Report of the Council of Economic Advisers, the Administration offers its view of the state of the economy, its estimates of the economic significance of the President's program, and a rationale of the basis for the budget.

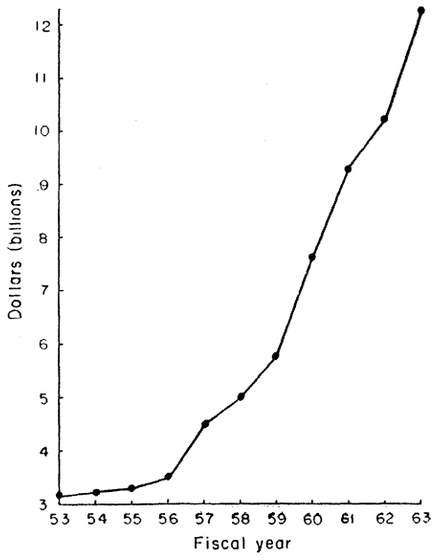
As reported last year in a review of Kennedy's and Eisenhower's approaches to economics (10 Feb. 1961) the two administrations are in basic agreement on any number of general principles (that greater investment in science and education is necessary for economic growth, that a major goal of economic policy should be to limit inflation, that deficits are useful in combatting recessions, and so forth), but are in substantial disagreement over how these general principles should be applied in practice. Kennedy obviously believes in spending more money (as reported last week, Kennedy's new budget increases spending by over $3 billion at the same point in the business cycle that Eisenhower's fiscal 1960 budget reduced spending by over $3 billion); he does not emphasize, as Eisenhower did strongly, a reduction in taxes as even a long-range goal; and he does not share Eisenhower's concern over the question of whether the budget is balanced.

Nothing contrasts so sharply between the Eisenhower Budget and Economic

messages last year and the Kennedy messages this year as the treatment of budget balances. For Eisenhower, balancing the budget, or at least attempting to balance the budget (he did not succeed too often) was in good part a question of morals, a point he has made explicitly in recent months by describing the Kennedy Administration's attitude toward budget deficits as "immoral." Kennedy, in contrast, treats the question as a business decision, with no more moral overtones than the decision of a corporation over whether to finance its expansion program by reinvesting profits, or selling new stock, or increasing its debt by floating a new bond issue.

In his final Budget Message, Eisenhower said: "Sound fiscal policies and balanced budgets will sustain sound economic growth and, eventually, make possible a reduced tax burden. . . . If, however, we deliberately run the government by credit cards, improvidently spending today at the expense of tomorrow, we will break faith with the American people and their children, and with those joined with us in freedom throughout the world." The equivalent statements from Kennedy's Message are: "The federal government is expected to operate in 1963 with some surplus. This is the policy which seems appropriate at the present time. The economy is moving strongly forward, with employment and incomes rising. . . . To plan a deficit under such circumstances would increase the risk of inflationary pressures, damaging alike to our domestic economy and to our international balance of payments. On the other hand, we are still far short of full-capacity use of plant and manpower. To plan a larger surplus would risk choking off economic recovery and contributing to a premature downturn."

The difference in attitudes carries over into the charts accompanying the messages. Under Eisenhower, these charts were drawn in a way that accentuated the size of surpluses and deficits and with sharply contrasting tones between the areas where the expenditures line rose above the receipts line, showing a deficit, and the reverse, showing a surplus. The end of the chart always showed a surplus predicted for the coming year, portending well for the future. Under Kennedy the charts have been redrawn and the shading has been eliminated. One has to look closely to see whether there was a deficit in a given year; the general impression is




Federal expenditures for research and development. The amounts for 1962 and 1963 are estimates.

the neutral one of two lines wandering upward, more or less together. Kennedy also has introduced a new chart, placed especially prominently in the brief summary version of the budget designed for the general public. It shows the federal debt as a percentage of gross national product. Looked at in this way, the debt has been declining steadily in significance ever since World War II, from about 125 percent of the gross national product in 1946 to 50 percent now.

Kennedy's budget, as submitted, is roughly balanced: A claim that the predicted surplus can be expected with any confidence actually to develop would be wholly unrealistic, and the Administration has made none. For purposes of presenting the budget to Congress, some numbers have to be put down on paper; and for purposes of presenting the budget as a document with political implication one might as well pick a number for expected receipts somewhat larger than you have picked for expected expenditures. Even a large predicted surplus is no sure sign that the budget will actually be balanced. Eisenhower had predicted a surplus of over $4 billion for fiscal 1961, ending last June, and even deducting the antirecession speedup in spending instituted by Kennedy when he took office, the deficit still would have come to over $2 billion. Kennedy's $463 million predicted surplus is really too small to have any significance at all. It took a recession to destroy Eisenhower's large predicted surplus for fiscal 1962, but Kennedy's surplus, amounting to about ½ of 1 percent of either predicted receipts or predicted spending, could be upset by almost anything, even assuming the figures had not been stretched a bit to achieve it in the first place. Since World War II, no Administration had predicted a deficit or surplus that turned out to be within $1 billion of the final figure, and although the predictions have sometimes been off on the low side, those on the high side have been far larger. In 1959, Eisenhower was overly optimistic by nearly $14 billion.

The actual basis for constructing the budget, as outlined in the report of Kennedy's Council of Economic Advisers, had nothing directly to do with aiming for a balanced budget. Briefly, the rationale is this: you calculate what the economy would be producing if it was operating at full steam. Under these conditions you would want a budget surplus of course, for any deficit under these conditions, barring tight wage and price controls, would gain nothing but inflated prices. You then pick a figure for a desirable surplus at this hypothetical full employment level which strikes you as a reasonable balance between your conflicting goals of wanting to keep the economy at a high level, but not at quite so high a level that severe inflation will result. You then prepare a budget based on tax and expenditure rates that would provide this optimum full-employment surplus. The question of whether the budget will be balanced at the actual, as opposed to the hypothetical, full-employment operation level of the economy does not come up. You have only a curve which shows the kind of surplus you might expect in the coming year if the economy is strong, or the deficit if the economy is not strong enough, or the large deficit if an actual recession should develop. Since it is not customary to present Congress with a curve, and since it is politically desirable to predict a budget balance, you pick a point on the curve high enough to produce enough taxes for a balance against your estimate of spending, but not so high as to be unreasonable, and put this down as the budget estimate. You now have a budget balance, and if everything goes very well it may still be there at the end of the year.

This last step of the procedure is not part of the stated basis for constructing a budget, but it has been followed by all recent Administrations.

This procedure, of course, is the main reason why the surplus, if it develops, is never very much higher than the predicted surplus, while the deficit may be a great deal bigger than predicted. Budgets that are balanced when submitted often turn out to be unbalanced by the end of the year, while budgets that are unbalanced when submitted, like Kennedy's revision of Eisenhower's budget last year, never turn out to be balanced. Predicting a deficit implies that even under the most optimistic assumptions you could reasonably make, you still could not get a predicted surplus, which makes it highly unlikely a surplus will develop. Under the reverse situation, predicting a surplus, a deficit is usually easily possible, and sometimes highly probable.

**Procedure**

The Eisenhower Administration never offered so explicit an explanation of how it arrived at its basic budget decisions as the Kennedy approach outlined two paragraphs above. Eisenhower's budget explanations generally asserted that he had limited spending to what was "necessary rather than merely desirable," and left the impression that it was rather a happy coincidence that the level of necessary spending, combined with the predicted level of tax receipts, always led to a prediction, at the time the budget was submitted, that the budget would produce a surplus at the end of the year. In fact, the general approach was probably similar to Kennedy's, except that the more genuine desire actually to achieve a balanced budget, combined with a more genuine desire to hold down federal spending and with less enthusiasm for efforts to stimulate the economy through federal budget policies, led to less spending than Kennedy would have recommended under the same circumstances.

The Kennedy approach was explicitly endorsed last week by a report of the Council for Economic Development, an important private group made up primarily of prominent business executives of the liberal Republican persuasion and currently chaired by Theodore Yntema, head of the finance committee of the Ford Motor Company. According to the CED, "it should be the policy of the government to set its expenditure programs and tax rates so that they would yield a constant, moderate surplus under conditions of high employment," which, of course, is just what the Kennedy economic report says his Administration is doing. If the Administration's optimistic but not wholly unrealistic assumptions about the growth of the economy prove true the budget may produce a small surplus. If not, we will have another deficit, which is just what the Administration, and such groups as the CED, would want under those circumstances.

The difference between the Kennedy and Eisenhower approaches is quite small if viewed from Senator Goldwater's viewpoint, but it is a very important difference nonetheless. Even a small shift in direction, if consistently adhered to, leads to a very substantial shift in where you would be in a few years by following the alternative lines in policy.

Kennedy and Eisenhower alike have supported increasing federal spending for science and for education. Under Kennedy there is more readiness to see the federal role in these areas grow. But the much more important difference is simply that there is more money available for spending under Kennedy. If Kennedy, and groups like the CED, and economists generally, are correct, the altered approach to fiscal policy should lead to faster growth of the economy, producing more revenues for the government, further increasing the amount of money available for government programs beyond the difference in spending stemming directly from the larger budget Kennedy would approve over Eisenhower in a specific year, under specific conditions.

One of Eisenhower's last actions before leaving office was to approve a report of his Science Advisory Committee which, among other things, put the major responsibility for financing basic research and graduate education on the federal government. The report spoke of the need for more private and state support, but the major source of funds had to be, the report argued, the federal government. In line with this, Eisenhower's last budget recommended a sharp increase for the National Science Foundation. Kennedy's budget revision then added a further sharp increase on top of Eisenhower's proposal. Kennedy's further shift upwards represented a change in policy on spending rather than a change in policy on basic research.

The accompanying graph shows the growth in federal spending for research and development. The jump between 1956 and 1957 comes mainly from the rapid rise in spending on rockets and missiles, as this area reached the expensive advanced development stages. The drop in the rate of growth between 1961 and 1962 would have been considerably sharper if Eisenhower's proposed budget, rather than Kennedy's revision of that budget, had been followed. Kennedy's increases, last year and this year, have been mostly for space, but once again, the greatest single factor in deciding to accelerate the space program seems to have been that Kennedy believed the budget could stand the extra expense and Eisenhower had strong doubts. It is a lot easier to convince yourself that something isn't worth doing if you believe you couldn't afford to do it anyway.—H.M.

## Science, Engineering Manpower: Uncertainties Cloud Nation's Future Needs

The Administration's science advisers will soon buckle down to providing the President with recommendations for increasing this nation's supply of scientists, engineers, and technicians.

The task, which has been assigned to the President's Science Advisory Committee, the Federal Council for Science and Technology, and the National Academy of Sciences, is being approached with considerable circumspection. As the President himself recently demonstrated—apparently inadvertently—the existing statistics are easily misread; at the same time the dimensions of the problem are highly uncertain and the remedy that comes readily to mind—a good dose of federal money—appears on close examination to be far from adequate.

While the size of enrollments is popularly regarded as the starting point for whatever manpower difficulties may exist, it would appear that the nation's utilization of its trained manpower may be of even greater significance. The National Science Foundation estimated in 1954 that 14 percent of the members of each graduating class in engineering were employed in other fields within a year after they left school. Though inducements to enter engineering may be one way to tackle the problem, inducements to stay in engineering may be a more direct solution.

The President reiterated his concern with the manpower problem last week at his press conference when he called