GENERAL SCIENCE

Need of Scientific Manpower

Soviets, sacrificing all to their ambitions, force U. S. spurt in professional skills to keep us strong. Re-examination of manpower supply underway for defense needs.

By DONALD A. QUARLES

Assistant Secretary of Defense (Research and Development)

Excerpts from an address at the awards banquet of the Fourteenth Annual Science Talent Search, in Washington, Feb. 28.

➤ LIKE IT or not, we are in a race for technological supremacy with the Communist world and this Science Talent Search has a direct bearing on the outcome of this race. Out of deference to the erudition of those in the audience who have passed the Science Talent Search examination, and by courteous leave of the rest, I will try to develop this thesis in a strictly logical manner.

My first theorem is that within the memory of even the youngest of us, science and technology have revolutionized the art of warfare. I will cite three or four pieces of evidence to show that this is true.

It was apparent before World War II began that airplanes would play a vastly more important role in any future war than ever before. The events of the early months of World War II left no doubt that air supremacy would be decisive. Air supremacy, however, meant much more than just airplanes. In the Battle of Britain, for example, the British attributed the success of their relatively weak interceptor force in stopping the German night bombers to the fact that their recently developed and installed radar network gave them vision in the darkness and thus early enough warning to enable their interceptors to track down and destroy the invading bombers. Thus, military electronics joined aeronautics as a decisive factor in the Battle of Britain.

Electronics Was Decisive

Another instance of the decisive role of electronics was in October 1944 when the Japanese Navy decided to make an all-out attempt to envelop and destroy the U. S. Naval forces in Leyte Gulf. The southernmost of the three Japanese task forces attempted to pass through Suragao Strait under cover of darkness. They were met by U. S. Naval forces which were equipped with precision fire-control radar. The Japanese task force was almost completely annihilated by our radar-directed gunfire in a night engagement that left the Japanese gunners blindfolded.

The ability of radar to see and measure position at night was the decisive factor.

It was toward the end of the war that nucleonics entered as the third decisive element of the new technology. U. S. air power in the far Pacific, including the electronic equipment required to make it effective, had already broken the back of enemy resistance. It was, however, the atomic bombs over Hiroshima and Nagasaki that clinched the victory.

The war ended with general recognition by the experts that the new technology, with nucleonics, aeronautics and electronics in stellar roles, would thenceforth be dominant in any all-out war.

Events in the following decade have confirmed and strengthened this conviction. Both sides have made great efforts to capitalize on the new technology, and to extend and perfect it to maximum military advantage. Great strides have been made. World War II planes would be completely outclassed by the jet planes of today which fly at altitudes and speeds that were only dreamed of a decade ago. Electronics has been pushed ahead so far and its performance so greatly extended that World War II designs now seem crude and ineffective by comparison. And finally, the nuclear sciences have been advanced to the point where explosive forces have to be measured in millions of tons of TNT equivalent rather than tons of World War II blockbusters and the thousands of tons of the Hiroshima and Nagasaki bombs.

Were Too Complacent

As we look back on the period immediately following World War II, we see that we were too complacent in assessing our technical position relative to the Communist world. We knew we had left a lot of equipment of advanced design with the Communists and that the Germans had been the unwilling donors of a lot more.

We knew also that a lot of the German scientists who had worked on the development of new weapons had been persuaded by unspecified methods to move behind the Iron Curtain and continue their work for the Communists. Still we were quite smug about it all. Even when it was learned that some very important secrets had been passed covertly behind the Iron Curtain, we still couldn't believe the Soviets were serious technical competitors.

Many things have since conspired to force us to change our estimate. It will suffice to mention one in each of the three major fields. The Soviet atomic test in the fall of 1949 showed that the Communists had broken our monopoly in this field; their thermonuclear test in August of 1953 left no doubt that rapid progress in nucleonics was being made behind the Iron Curtain.

The large numbers of jet fighters the Communists used in Korea, together with the jet bombers of very advanced design which they flashed in their May Day air show last year in Moscow left no doubt of their progress in aeronautics.

The evidence in electronics, although a bit more obscure, is equally convincing. Perhaps the best single example was afforded by the U.S.S.R. light cruiser Sverdlov when it appeared at the British Coronation ceremonies a year or so ago. Most of the electronic equipment on one of our cruisers of similar class is out of sight but the antennas have to be out where they can see and therefore be seen. Moreover, to the expert, the antenna design tells a lot about the rest of the equipment.

Face Strong Competition

Suffice it to say that the Sverdlov showed up with about the same number and kind of antennas that one would find on the superstructure of one of our own cruisers of similar class. These could have been fakes and the guns could have been made of wood but the time is past when we can derive any comfort from that kind of reasoning. It is clear now that in nucleonics, aeronautics and electronics——in fact, in military technology broadly—we are confronted in this race by a strong competitor. This is my second theorem.

My third deals with the mechanism by which our competitor has made his progress. Technological position is a complicated thing, involving industry, skilled manpower, raw materials and other factors. We know that at least in the first two of these, the Communists were way behind us at the end of World War II. But Communism has always worshipped materialism and the Soviets have always been willing to sacrifice everything else to advance their ambitions for world domination.

Specifically, they have been willing to apply much more of their resources to their heavy industries, which in large measure were war or war-supporting industries, leaving much less to consumer goods than we, in this country, would be willing to accept as a steady diet. In fact, Mr. Malenkov, who placed more emphasis on consumer goods, has just been allowed to listen to a confession of his incompetence and to step aside.

Russian Raw Materials

As regards raw materials, the Communists now dominate a sizable part of the world. On the basis of an austere military-oriented economy, raw materials, with the possible exception of oil, should not pose

too serious a problem for them.

It is perhaps in the scientific and technical manpower area that the Soviets have shown the greatest resourcefulness. Recognizing that material progress is paced by science and technology, they have multiplied by a factor of ten the number of their institutes of higher learning in these fields. Moreover, where less than a third of the students in our universities specialize in engineering and the physical sciences, more than two-thirds of their comparable students specialize in these fields.

Scientists in U.S.S.R.

Numerically, their results are impressive. They are now graduating well-trained scientists and engineers at more than twice the rate we are in this country. If present trends continue, it will be only a matter of a few years before their scientific and technical manpower pool passes the size of our own.

This, of course, is not conclusive—the results depend, too, on how well their professional people are trained and how effectively they are used. Parenthetically, I must make it clear that I believe that the freedoms and incentives of our system give us a big advantage in this regard, and that their pool would have to be considerably larger before it equalled the effectiveness of our own.

Nevertheless, these statistics must give us pause. We certainly can no longer take our superiority in military technology for granted. We must take stock of our own manpower resources and make sure we are developing and using them to our best advantage.

Perhaps at this point we should digress a few moments to consider the principal claimants for scientific and engineering manpower in our modern society and under present conditions of world tension.

Probably the most important claimant for a share of our scientific and technical personnel is our educational system and the basic research activities carried on in our universities and institutes of higher learning. This is the seed corn that must be saved out to insure the next crop of scientists, and also the next crop of scientific discoveries. Nothing could be more shortsighted than to consume our seed corn in our current applied programs, unless, of course, the danger becomes so acute that all else must be sacrificed.

Next, industry is a claimant for a large share of our skilled manpower. Our long-term economic health and military strength depend heavily upon the forward progress of industry; and upon its opening up for our expanding labor forces whole new fields of industrial activity.

There, too, is the requirement for a strong military research and development program to advance military technology and to improve our weapons and our systems of using them. Our present program utilizes directly or indirectly about half of the scientists and engineers available in the country for this kind of work. We could be hopelessly outclassed if we dropped this part of our program.

Finally, the military departments require a certain quota of scientists and engineers to support the very highly technical operations that are being developed and tested for use by our armed forces. Some of this quota of professionally trained people will be in uniform; most will be working in military laboratories, test stations and the like.

Need May Get Worse

Altogether, as the pages of "Engineers Wanted" advertisements in our daily newspapers indicate, there are many more claimants than there are scientists and engineers. Moreover, studies indicate that this imbalance may be expected to get worse rather than better in the years immediately ahead.

There are a number of things happening today that have an important bearing on this problem. The President has sent to the Congress proposed legislation to modify and extend the Selective Service Act and to revamp the National Reserve Plan in order to align these with present day realities. One of the features of the new plan will be to sharpen up our practices in the utilization of scientific and engineering manpower—to see that professional skills are used to best advantage both inside and outside of the armed services.

The objective is not to relieve scientists and engineers of the obligation to serve. They are as conscious of this obligation as any others—perhaps even more so—because their whole training is directed toward service. Nor is the objective to find safer places for them to serve. There just aren't going to be any safe places in the next world conflict, and particularly not in the laboratories and factories where important things are being done. The point here is that in planning and organizing for the utilization of skilled manpower we must put the national interest first.

This means that in spreading equitably the obligation to serve we must use the professional skills where they are most essential to our national security and welfare. This principle applies to doctors and it applies to nuclear physicists, aeronautical scientists and electronics engineers.

Most Precious Resource

My third theorem is then that scientific and technical manpower is our most precious commodity, our real critical resource; that our competitor is being very smart in fostering and conserving his stock of this precious commodity; and that we must sharpen up our own practices all along this line.

This leads me to my fourth and last theorem which is that our system of supply of scientific and technical manpower needs a critical re-examination.

This is a big subject that touches on

Continued on p. 157

Scientific Manpower

Continued from p. 155

almost all phases of our social and educational system. It is, in the first instance, a personal problem involving the interests and ambitions of our individual young people. It is next a local problem involving the will and ability of the community to provide educational facilities. Beyond this it is a state problem involving state aid to the local schools, and state support of institutions of higher learning.

It gets to be a federal problem, as the President has pointed out in his message to Congress earlier this month [Feb.], where circumstances make it impossible for state and local agencies to handle the problem adequately. As we cannot afford to let such situations go by default, the President's message proposes new legislation that will lend federal assistance, with a minimum of federal interference, in those critical cases most in need of aid.

The proposal would make some $3 billion available for such federal assistance in the years immediately ahead. This, of course, is only one of the ways the federal government is promoting education and research. Others, for example, are research and development contracts, research grants, and special scholarships, which all together support more than half of the research and development in the country today. The new proposal would, however, help to plug an important gap in our present skilled manpower supply system.

Teacher Shortage

In our secondary schools today there is a serious and growing shortage of teachers in mathematics and the physical sciences. The local communities, with the help of local industries can do a lot to make up for this shortage.

My fourth theorem is that it is a matter of national necessity that we strengthen our system of supply for professional-grade scientists and engineers.

These four theorems bring me back to my original thesis — that this Fourteenth Science Talent Search has a direct bearing on national security. I believe the logic is clear. The Science Talent Search is one means, and a very effective one, for stimulating the interest of our young people in professional careers in the physical sciences and the related engineering fields.

I am happy to pay tribute to Westinghouse for the great national service it is rendering through this program. The group of award winners gathered here is excellent testimony to the effectiveness of the program. My sincere congratulations to you on your long head start toward a professional career in scientific fields! One feels your excitement in the air. I have no doubt your future careers will be just as exciting.

Preserve Moral Fiber

In closing I want to correct an impression. I realize that in placing emphasis as I have on technology I have been guilty of a kind of materialism, an implication that material well-being is the highest aspiration of mankind. I do not believe this. We are, however, in a cold war with a ruthless Communism that makes materialism its highest aim and so long as our security is threatened we have to give first priority to the material means of defending and preserving our way of life.

We must also recognize, however, that our success in this competition in the long pull depends on preserving and strengthening our moral and spiritual fiber and on preserving and continually improving our social system so that we may demonstrate to the rest of the world that we do in fact have the best system and that the individual dignity and freedom which we cherish is in fact worth fighting for, and, if necessary, worth dying for.

We in Defense must give first thought to the material means of securing our country and the Free World against aggression. We all hope and pray that this may be achieved without resort to military force.

Again, my congratulations to the contestants; my sincere appreciation to Westinghouse for sponsoring, and to SCIENCE SERVICE for organizing, this Science Search program; and my warm thanks to those who have arranged this wonderful gathering and have permitted me to play a part in it.

Science News Letter, March 5, 1955

The average person in the United States consumes more than three times as much *lettuce* as he did in 1919.

Watering house plants with rain water is suggested if there is sodium in the water system from water softeners.