Let's Look at the Record

THE STORY OF RCA RESEARCH AT WAR

by LOREN F. JONES

In this war, as in no other, victory will depend upon the properly timed development, production, and use of highly complicated weapons and devices. Never before has an army or navy been so dependent upon elaborate technical equipment. Never before has the required equipment been so predominantly radio-electronic in its nature.

When the largest industrial radio research organization in the country swung into full war research, the results were bound to be very valuable and highly intriguing. No details of this work can be published now, of course, but a few ideas on the approach to the job, the magnitude of the work, and the broad field which it encompasses may serve as a brief "preview" of the full story which will someday be told at greater length.

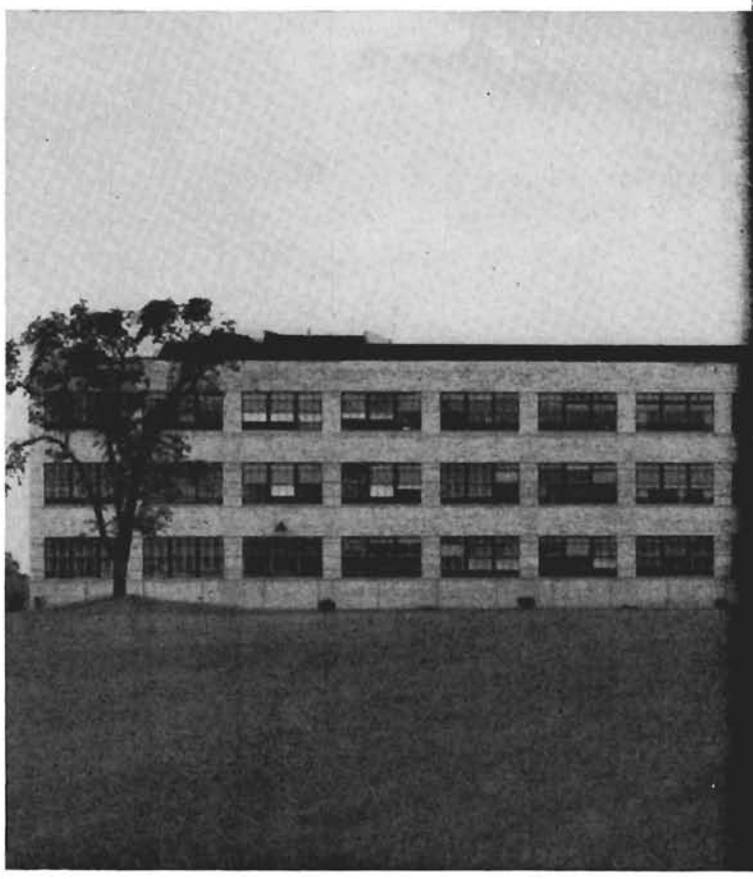
A TECHNICAL WAR

We are faced with an enemy which has devoted much effort and talent to the production of advanced types of conventional weapons and to the development of unique new weapons employing radio principles. For example, the Germans have been very clever in developing and using magnetic mines, submarine underwater detectors, and the like. The United Nations have been faced with the necessity of developing countermeasures for enemy weapons, as well as designing and producing their own offensive weapons.

Due to secrecy restrictions, even many engineers do not realize the surprising extent to which radio and similar equipment are used in this war. Few realize that a bomber carries well over $10,000 worth of such equipment. The radio engineer is the man responsible for the design, the production, and the successful operation of this equipment. As the offensive progresses, the contribution of radio-electronics will become even more apparent; the radio engineer's importance even more significant.

BILLIONS FOR RADIO

The large number of qualified scientists and engineers in the United States makes this country the natural center for the development of new weapons and devices. Through the efforts of the Army, the Navy, and the OSRD, working in cooperation with hundreds of academic and small laboratories and with the several great industrial laboratories, developments of the greatest importance have been completed and others are being intensively worked upon. In the field of radio and electronics, the developments completed in the last two years have already resulted in Army and Navy orders which, according to WPB, will require the rate of production of electronic equipment to be stepped up to four billion dollars annually by the end of December, 1943. Research and development is constantly producing new devices which will be of the utmost importance both strategically and in volume of production.



Under the pressure of war, the total time from the inauguration of research to the quantity production of finished units is appreciably less than during peacetime. Even so, research is by its very nature frequently a long time process. It must be planned and conducted well in advance of design, production, installation, and operation. Fortunately, our research directors are accustomed to such planning. Thus when the war was still primarily a defensive war in 1940, RCA began concentrating its research on new offensive weapons, confident that within several years these weapons would be of highest importance.

RCA'S PREWAR WAR RESEARCH

The great amount of research we have conducted on subjects of interest to the Army and Navy has made it possible for us to produce military equipment of superior design. During the ten years before Pearl Harbor, RCA furnished millions of dollars worth of military equipment to the Army and Navy. In some radio fields RCA is the largest producer in the U. S. A.

Prior to Pearl Harbor, government funds released for research were extremely limited. To maintain its position as one of the largest suppliers of military equipment and to investigate technical fields which RCA was convinced were of military importance, RCA financed a large part of its prewar research, and still finances enough to assure initiative and freedom of action.

Most of the developments which RCA sponsored and financed during the several years prior to Pearl Harbor—developments which have proved invaluable in this war—cannot be mentioned for reasons of secrecy. One device developed in 1937 was a type of apparatus believed to have been the first air-borne apparatus of this type in the world—of which millions of dollars worth were ordered before Pearl Harbor. Our leadership in this field is such that even today most of the equipment of this general type procured by the Army and Navy is of RCA design.

IN ANTICIPATION

Early in 1939, in view of the world situation, RCA greatly increased its research and development efforts on war devices. This seemed the only proper thing to do, and subsequent developments have justified this farsighted decision. The research and development program was promptly coordinated throughout all of RCA and, as the war drew nearer, many other steps were taken to prepare for greatly increased activities. Some, such as the calling in of broadcast representatives from the various districts throughout the country, resulted in a temporary loss of business, but subsequent developments throughout the world have proved the importance to our country of these early actions.

ORGANIZATION

RCA's research and development work is conducted in thirteen separate laboratories located in ten different cities. These laboratories are operated by RCA Laboratories, RCA Communications, the National Broadcasting Company, the Radiomarine Corporation, RCA License Laboratory, and the six plants of the RCA Victor Division. The overall research and development program of these thirteen laboratories is closely correlated and coordinated to prevent duplication and assure maximum speed and efficiency. Negotiation of research contracts is centered in Camden. Every

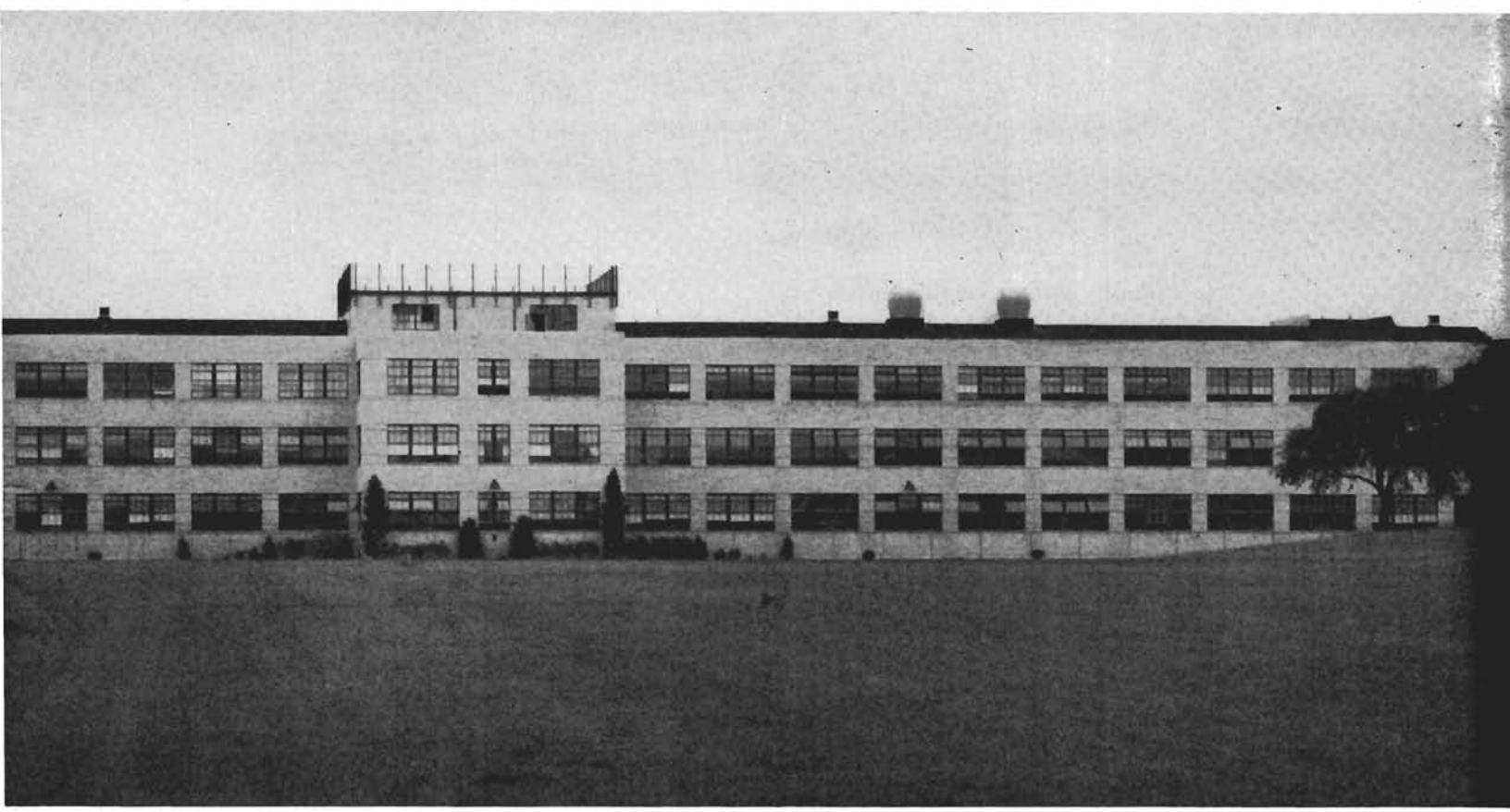


FIG. 1 *Main building of RCA Laboratories at Princeton. Here much of RCA's research is centered.*

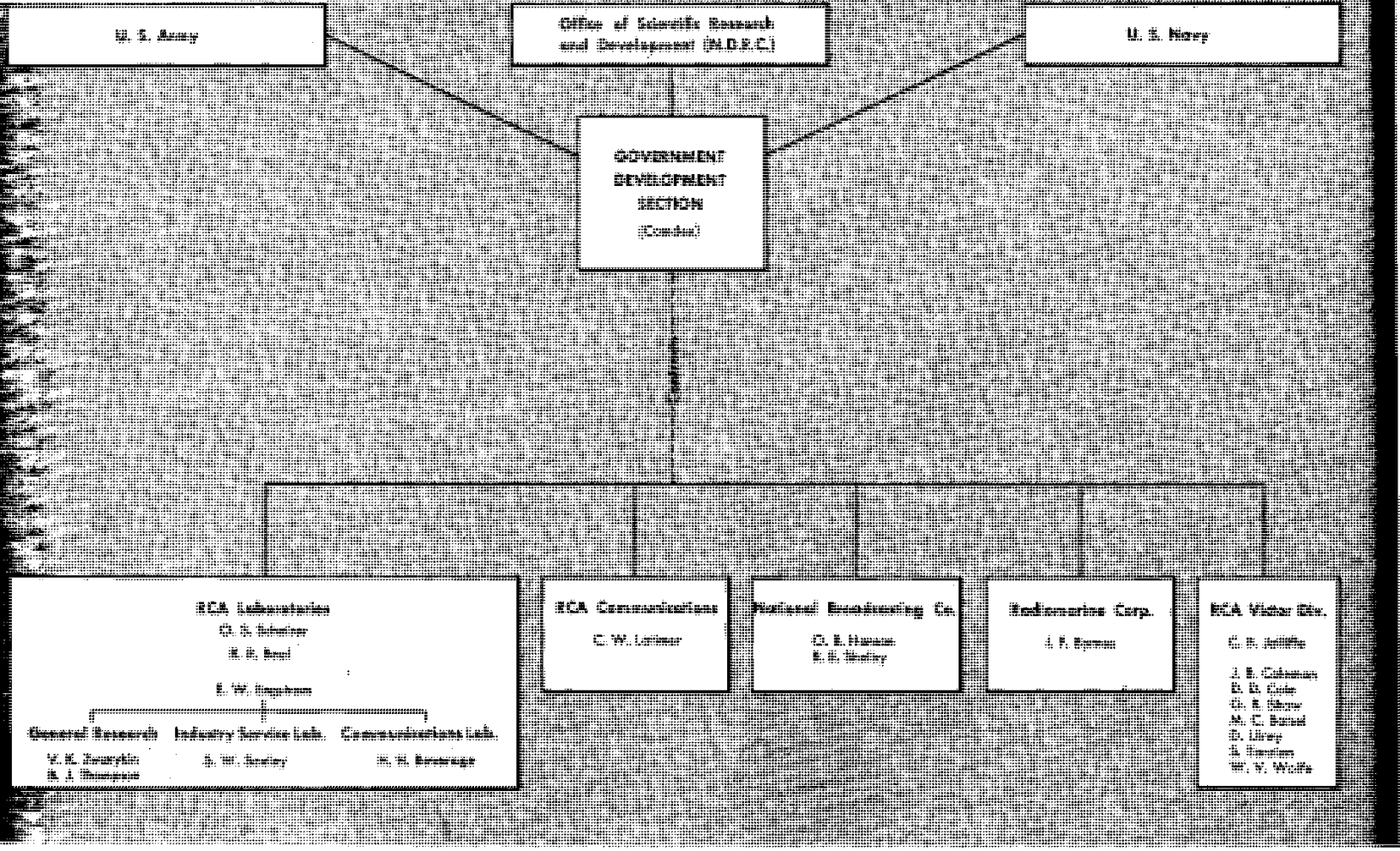


FIG. 2 *Organization of thirteen RCA laboratories in ten cities for war research and development. Through committee membership and technical discussions, direct liaison is maintained between RCA engineers and government laboratories.*

effort is made to see that each laboratory and, in fact, every one of the hundreds of engineers and scientists in RCA is working in the field to which he is best adapted. In addition to carefully preventing duplication within itself, RCA has cooperated fully in supplying information and help to other manufacturers, where specifically requested by the Government, in order to expedite production and prevent duplication of effort in the industry. This kind of cooperation has not only enabled the Government to see to it that the specific information required has been available to those needing it, but also that secret information would not be given out except as required and deemed necessary.

Fig. 2 shows the research and development organization of RCA. Unfortunately, it is not possible to show in a simple chart the various steps which take place from the time a research project is begun until the finished product comes off the production line. Of these steps, research, per se, is but one. Research in general covers only that part of the project in which it is sought to show that the essential idea is practical and can be made to work. Following research comes development, the stage in which the ideas demonstrated by research are put into practice and reduced to forms suitable for application to actual problems. The development engineers work in the laboratories of the various manufacturing plants where they have the necessary daily contact with design engineers and with the production and servicing of specific types of equipment. In these positions they can most readily transform the general results of research into practical apparatus. Following development comes the third step, production design, in which the actual blueprints of the final model are produced. And, finally, there is a fourth step, production, in which the idea which first originated in research months or even years before comes to life and rolls from the plant in tens, hundreds, or thousands, as the case may be. In wartime, research

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and development must be so speeded up that in many cases they overlap and even merge. For this reason the two are usually considered together.

Mr. O. S. Schairer is Vice President in charge of RCA Laboratories; Mr. Ralph R. Beal is Assistant to the Vice President. Research work proper is under the direction of Mr. E. W. Engstrom with Dr. H. H. Beverage, Dr. V. K. Zworykin, and Mr. B. J. Thompson as associate directors. The new laboratories at Princeton constitute the largest single research unit. The work carried on at Princeton covers the whole field of radio and electronics. Included are projects on all types of tubes, AM and FM reception, AM and FM transmission, facsimile, television, sound, RF heating—in fact, on every facet of the radio art.

The group of tube engineers under Mr. Thompson have contributed some outstanding new tubes of great military use. Their earlier developments, such as acorn, beam deflection, and television tubes, are well known. Equally well known is the prewar work of Dr. Zworykin's large electronic research department. Work on microwave devices is directed by Dr. Irving Wolff, well known to broadcasters for his developments of early loudspeakers, later famed for microwave developments.

Dr. George H. Brown, known to all broadcast engineers for his outstanding contributions to broadcast antenna design, is directing work on radio antennas, radio-frequency heating, and other subjects. Dr. Harry Olson, who directs a special group, is well known for his development of the velocity microphone, of speakers handling from milliwatts to kilowatts, and of unidirectional microphones. He has written several books, of which the best known is "Elements of Acoustical Engineering." There are other groups in the Princeton organization, each under the guidance of an experienced scientist.

The research and development work at the RCA License Laboratory is directed by Stuart W. Seeley, who is known by every receiver engineer in the country.

At the several RCA Communications locations Dr. H. H. Beverage, a world-recognized authority on transmission and reception phenomena, directs a variety of projects relating to communications and other subjects.

AFTER THE WAR

RCA, along with other progressive manufacturers, recognizes the problem as well as the obligation to minimize unemployment after the cessation of hostilities and to develop those techniques, equipments, and services which will be most in demand and will contribute the most to employment. Essential to this end will be the carrying on of extensive research in a number of technical fields. Plans are constantly kept up to date for conducting such research and for utilizing its results in the form of specific designs. Personnel are not available at this time for extensive work in non-military fields, but as the end of the war approaches, such research will become more and more possible.

Several of the devices already developed during this war were believed to be impossible only several years ago, even by the most optimistic scientists. Before the end of the war, additional seemingly impossible developments may come out of the RCA research and engineering departments and into the factory. As time goes on the various RCA laboratories will become increasingly recognized as the outstanding source in this country of radio-electronic research and development. Research can never be predicted. Its very essence is the free play of skilled imagination. One certainty is that RCA's extensive research program will constantly contribute importantly to the economy and effectiveness of all forms of radio.

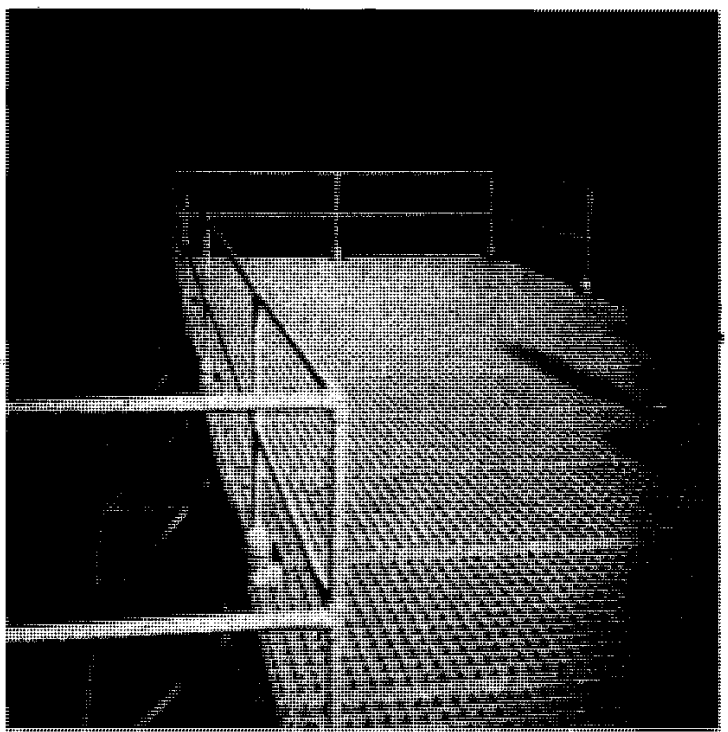

FIG. 3 *The sound room at Princeton. The felt baffles are eight feet deep. Noise level is so low that one hears thermal agitation originating within one's ears. The room is so devoid of reflections (absorption coefficient is 99.7) that microphone and loudspeaker directivity measurements made within it are as accurate as those made in free space.*

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