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May 1, 1959

Noted by D/DCI
14 May 59

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MEMORANDUM FOR DR. J. R. KILLIAN, JR.

FROM: W. O. Baker NSA review completed

SUBJECT: Coordination of Military Communications Development with Particular Reference to the CRITICOMM System

A letter from Dr. J. R. Killian, Jr. to the Honorable Neil H. McElroy, September 19, 1958, pointed out the opportunity for coordination of communication systems, in the forthcoming extension and improvement of national military and intelligence networks. As noted therein, certain studies in the President's Science Advisory Committee have been concerned with this subject. In the ensuing months the studies have been continued and intensified. (However, there is not yet a completed review of all the relevant scientific and technological factors which enter into the exceedingly complex problem of providing adequate communications for national security.)

Since the letter of September 19, 1958, the Office of Director of Defense Research and Engineering has been activated. It has certain responsibilities concerning the acquisition of new communications systems. Likewise, in this period the organization of the Directorate for Communications-Electronics (J6) in the Office of the Joint Chiefs of Staff has resulted from the reorganization plan for the Department of Defense and a Director and a Deputy Director have been appointed. The chief communicators of the three services are represented in the J6 activity by a Military Communications Electronics Board, of which the Director of J6 is chairman.

Also in this period, various large military programs have been started.

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the 480 Global Air Force Communication System, the UNICOM Global Army Communication System (sponsored by the Signal Corps), and particularly the CRITICOMM system for timely transmission of critical intelligence. The CRITICOMM system is the implementation of National Security Council Intelligence Directive No. 7, and for this the Department of Defense Directive S-5100.19 was approved on March 19, 1959. The Secretary of Defense, in accord with the NSCID No. 7, has acted as executive officer and has designated the Signal Corps to carry out this project.

All this organizational and project activity is superficially impressive. However, on examination it does not seem to be leading very fast to the desired objective of a single, integrated system adequate to the country's needs. On

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the contrary, it appears that the effectiveness of some of the new projects may be limited by some essentially arbitrary consequences of the present fragmentation. Moreover, the proposed project plans, in their efforts to provide advanced physical hardware, do not always seem to take adequate account of the possibilities of making better use of what we already have. (Indeed, the picture conjured up seems close to that of some day turning off all our working communications and switching to an untried system.) The following comments are directed primarily at the CRITICOMM project, but somewhat more general remarks along the same lines are given at the end of this report.

- (1) There is already a serious limitation on the physical facilities available for the CRITICOMM system because of the wording of Section IIA of the DOD Directive S-5100.19. Here it is stated that the CRITICOMM system will consist essentially of existing COMINT facilities plus whatever modification of those facilities were proposed in a JCS CRITICOMM plan dated August 22, 1958.

Critical intelligence, as material of overriding priority, should have accessible for its handling all of the capabilities of military communications.

- (2) The limitation of CRITICOMM facilities mentioned in (1) may, of course, be attributed to the special encryption and consequent switching center requirements of intelligence messages, but this just emphasizes another difficulty of the present approach. That is, that the CRITICOMM system as presently interpreted is completely separated from transmission requirements and facilities. A communication system of highest importance is being discussed while ignoring the central position of transmission. Vague assumptions of the separability of elaborate switching centers such as are proposed, and will be mentioned below, from the qualities of transmission systems of the several services are made.

This situation should be reorganized in a way that provides a realistic engineering relation of switching centers to optimum utilization of available and planned transmission links. This is particularly important because most transmission for some time to come must be by the notoriously erratic H. F. links, and we need flexibility of signaling rate to cope with adverse conditions of propagation and maximum flexibility of routing to provide as much reliability as possible in the complete system.

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- (3) These preceding basic difficulties only highlight a still more pressing problem. This is that existing facilities should be first and fully exploited for CRITICOMM purposes. (If this is properly done, the proposed new system will probably not appear as the drastic improvement that it purports to be.) For example, if the present switching centers were modified and reorganized so that urgent messages could be retrieved from reels when there is an over-all transmission delay, immediate improvements would result. This can be done, for instance, through "stunt-boxes" which teletype circuits can signify the presence of certain message types. By suitable combination of such alarms which would reveal the receipt of critical messages in existing centers, and a reasonable modification of circuits and procedures, there could be acquired within six months a valuable improvement in present intelligence handling. We would also obtain some very constructive experience on the real requirements of an ultimate system, and would develop a basis for deciding when we could make use of existing facilities in such a system, and when we should ask for something new.
- (4) The preceding proposal is also appropriate for the testing of the critical urgent-intelligence processing system being planned in General Goodpaster's office at the direction of the President. For instance, this testing as presently proposed could yield significant information on the reflex time for a suitable CRITICOMM system. This reflex time, which is a pre-eminent quality of the system, is not controlled by switching center behavior alone, so that present CRITICOMM plans cannot tell us all we would like to know about the basic needs of the system.
- (5) There are many specific deficiencies in the projected systems development which it is believed would be corrected by a firm coordination of the development engineering and operations through J6 and the Director of Defense Research and Engineering. For instance, the alternate routing implied in the characteristics of the proposed system is largely illusory. Most of the messages will go out on a very few radio links, even though it may look, in the switching center, as though a selection from a large number of choices is being made. Actually, as remarked earlier, many important transmission links are denied to the system through formal restrictions, such as that they are not

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COMINT assigned, etc. (Under pressure of emergencies the patching of communications linkages may be done manually without regard to such restriction, although some future global network might have a truly automatic system. If this is achieved, provision should be made for truly automatic selection of CRITICOMM routes from all those available.)

- (6) Realistic evaluation of what a practical improvement in switching centers would consist of should be brought prominently into over-all planning. As assumed in the grander plans, forthcoming growth in the use of multiple addresses may mean that present mechanical switching centers will be overloaded. However, NSA engineers among others have detailed experience with system capacities up to now and also with the facts to be faced in getting any marked improvement. Concrete analysis of what is needed and attainable for something like a maximum of 530 addresses should be presented. (Under present plans, so many more trunks are being required than the 20 or so necessary for this number at any particular center that attainment of effective changes by the end of 1961 is questionable.)
- (7) Several principles apparent in present CRITICOMM scheduling are of doubtful validity. For instance, the "circuits switching era," which is not postulated to arrive until 1965 or later, is cited as the first appropriate time for common user basis of operations. There is inadequate and inconclusive evidence on which to postpone common user practices to that time. In fact, they are likely to provide an immediate advantage.
- (8) Similarly, assumptions about the "off-duty" traffic loads for CRITICOMM should be carefully scrutinized. Some experts have the impression that a very large fraction of the volume now swamping mechanical and manual switching centers should be carried by mail. This will become increasingly convenient and effective with the speed of jet transport systems. It appears unwise to plan any major communications project on the basis of anything like the existing traffic, which is far too lavishly staffed with secondary matter.
- (9) Further emphasis of the inseparability of transmission and switching engineering, as noted in Section 2 above, shows up in the excellent performance of the synchronous data technique being introduced in special areas by NSA. This shows how the requirements of transmission may alter transmission format.

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This marked improvement over the 5-unit stop-start teleprinters of the present teletype network was designed to take advantage of existing systems. It is reliable and fast, and without the need for start and stop pulses, it can send at the maximum rate allowed by the transmission medium being employed. As a flexible digital system, it is convenient for the Cyrillic alphabet. In contrast to some much more elaborate proposals, this scheme might even work into present switching centers by using a torn-tape procedure. In any case the opportunity for prompt improvement of present facilities should be exploited.

- (10) As implied above, major technical problems of the CRITICOMM system and related communications planning seem to be connected to at least six parallel authorities partaking in management. A system whose (1) development and engineering were managed by the Director of Defense Research and Engineering (who might designate a service as Development Agent), and whose (2) operation was assured by J6-JCS, in accord with (3) the requirements of the Assistant to the Secretary of Defense (Special Operations) and DIRNSA, might yield more effective progress. Such needed progress is not assured by the present arrangements for military communications planning.

In summary, the present plans for communications development appear still to exhibit the fragmentation, duplication, and overlapping of authority among the various agencies which have been noted and deplored by many observers earlier. While it may be possible to achieve a gradual integration of the new projects with each other and with existing systems, the road to this result is by no means plain.

It should be emphasized that this scattered and fragmented attack on our global communications problem is not only uneconomic, it is also dangerous. Nothing is more likely to fail in a crisis than a collection of individually minimal non-reinforcing, non-exchangeable global communications networks. Moreover, the grandiose planning to which competition among the interested agencies naturally leads tends to diminish interest in what may be done in improved global communications in the next few years, which may be among our most critical times.

APPROVED BY THE PANEL, PRESIDENT'S SCIENCE ADVISORY COMMITTEE:

H. W. Bode
D. Huffman
J. R. Pierce
W. O. Baker

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Noted by D/DCI
14 May 59

May 2, 1959

Dear Mr. Quarles:

Since Dr. Baker, Dr. McMillan and I discussed with you and Dr. York some of the technological aspects of our future communications development in the Government, and in particular in the Department of Defense, a panel of the President's Science Advisory Committee which concerns itself with communications has given to me the attached memorandum. The panel was originally formed by me to undertake studies requested by the President's Board of Consultants on Foreign Intelligence Activities and at my request, has more recently broadened its studies in the field of communications.

Since the techniques of communications concern many diverse areas of Government, the advantages of co-operation across departmental lines are especially strong in communications research and development. Particularly in the critical matters of military and intelligence communications, combinations of systems objectives, technologies, and operations can yield facilities both better and less costly than separate systems provide.

Hence, the importance has been noted of unified planning and development in large new communications projects now being proposed. Attached herewith is a preliminary report by part of a panel of the President's Science Advisory Committee which discusses the integration of existing and forthcoming programs. It also suggests some measures which would help in advancing especially the most urgent communications capabilities of the Government.

Your comments on the issues raised in the memorandum and any other reflections you may have will be welcome.

Yours sincerely,

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J. R. Killian, Jr.

The Honorable Donald A. Quarles
Deputy Secretary of Defense
Washington 25, D. C.

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