6 December 1954

MEMORANDUM FOR GENERAL CARTER:

I would like to have you read this. Beyond reflecting on it, I would not wish you to take any action prior to a complete check of the whole document by Dr. Kullback and such others as he may wish to have consider it.

About the end of next week I plan to take a vacation which will terminate early in January. By that time, we should be ready to consider use of the document outside of NSA.

A. J. CLARK

cc: V/DIR
C/3
Mr. Friedman, S/ASST
Dr. Kullback

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MEMORANDUM FOR GENERAL CANINE:

This is a first draft approach to the general problem of our COMINT effort which I mentioned to you a few days ago.

We are becoming more and more convinced that we are not doing an adequate R/D job with respect to COMINT. This opinion is based principally on the following points:

DESCRIPTION OF TELEPHONE SECURITY SYSTEMS

1. With respect to telephone security, we are now witnessing the beginning of a revolution in communications which will make telephony much more important for military, diplomatic and related activities than it has ever been in the past. Within a few years we will probably see the advent of a secure telephone system based on the vocoder which electrically will be adequate for world-wide telephonic communications. You have already seen the beginnings of similarly secure systems based on pulse modulation for short range tactical communication between airplanes, between airplanes and ground, and between mobile vehicles on land. Pulse modulation will also make possible economical and secure telephone service for moderate distances overland.

2. We have not yet made a start toward the development of methods and techniques for "cracking" telephonic security systems. We do not even know whether or not this will ever become a practicable proposition.

3. The job of cracking telephone security systems would be a formidable one indeed. If we immediately began to apply a major effort to this work, we would be doing very well indeed if within three years we made more than a good beginning. It would be another three years before we could expect to be in a position at all comparable to NSA's present position relative to the cracking of secret telegraph systems. As already mentioned, success in this field cannot be guaranteed; however, it does not seem to me that we should fail to make an heroic effort.

DESCRIPTION OF TELEGRAPH SECURITY SYSTEMS

4. In the telegraph communications field, present day COMINT efforts have not kept pace with developments in COMSEC. Furthermore, in this COMSEC field, we are about to witness a revolutionary change from mechanical encrypting devices to electronic devices. This will surely make the cracking job much more difficult.

At this time I do not consider myself very well informed with respect to the intercept problem; however, I believe that the following things are true.

5. The task of intercepting ordinary long-range telegraphic communications should be susceptible to considerable improvement. Part of this improvement should come about as a result of the steps which you have already taken to improve personnel and methods of operation using presently available gear. Considerable further improvement should, I believe, be capable of realization by employing improved gear and improved methods which R/D should be able to provide. Some indicated possibilities in this connection are:

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EO 3.3(h)(2)

a. Diversity reception.

b. Reception devices which will better indicate the beginning and end of messages.

c. Automatic gear which will better indicate the portions of received messages which are garbled because of adverse receiving conditions.

6. The presently available gear and methods for intercepting VHF and microwave communications should be susceptible of considerable improvement.

7. We should make a start toward intercepting [redacted]

8. We should also make a start toward producing practical methods and gear for intercepting messages [redacted] Experiments have already shown that this is possible.

GENERAL

9. In due course, the results of the study on how NSA could more effectively mechanize its COMINT, which Dr. Bachus is heading up, will become available. We believe that it will indicate much opportunity for more effective mechanization, particularly in the fields of traffic analysis and the winnowing out of promising material for further study from the enormous masses of material which now flow in. At the least it seems a safe bet that this study will indicate the desirability of a larger amount of R/D effort in the COMINT field. We believe also that the study will indicate possibilities of further mechanization which PROD can exploit with very little, if any, R/D effort.

10. Just as a flier, I asked Dr. Campaigne to prepare a brief memorandum setting forth his ideas as to worthwhile projects for improving the effort on COMINT. As a result he prepared a memorandum dated November 22, a copy of which is attached. In this he specifically concluded, at my suggestion, the desirability of undertaking the development of methods and devices for cracking secure telephone systems and also the desirability of transistorising NSA's analytic machines, in view of the fact that I was already convinced of the desirability of these undertakings. Even so, Dr. Campaigne's memorandum serves the useful purpose of adding collaborative evidence in general support of the argument herein set forth.

11. NSA should take the lead in ultimate transistorization of substantially all of its analytic machines. Transistorization now appears to be the only practicable road toward great increases in the pulse rate of NSA's machines, from the present top figure of something like 1 million pulses per second to at least 100 million pulses per second. Some of NSA analytic machines have already about reached the limit of practicability, size and complexity. It would seem to me that the greater reliability to be expected from transistors, coupled with their small size and low power requirements should make it possible to envision practical machines at least 10 times as large and 10 times as complicated as any NSA now possesses.

SOME FIGURES RELATIVE TO R/D EFFORT

12. With respect to R/D effort, some figures have been prepared which are set forth in a memorandum prepared by Mr. A. W. Rose, attached hereto. On Sheet 1, there is set forth for the fiscal years 1947 to 1956 inclusive the total of the R/D effort figured in two ways: (1) in accordance with the present Government Accounting methods, and (2) in accordance with methods which would be used were this a commercial organization. You will note that, figured in this latter way, R/D efforts appear to have increased from 8.0 million dollars in fiscal year 1947 to an estimated 19.3 million dollars for fiscal year 1956. I have used the words "appear to show" above because we cannot be too certain of the accuracy of the figures, particularly for the earlier years.

13. On another sheet is given a breakdown of R/D effort into the COMSEC and COMINT categories for the fiscal years 1951 through 1956. This is of particular interest. It shows that the R/D effort in 1951 amounted to 10.4 million dollars on COMINT and 5.3 million dollars on COMSEC. The projected figures for fiscal year 1955 show a total of 10.1 million dollars for COMINT and 7.5 million dollars for COMSEC. In other words, the R/D effort on COMINT has not kept pace with the corresponding effort on COMSEC. What seems to me particularly significant

has been the apparent tendency for the outside contracts on COMINT to peter out while those on COMSEC have shown a healthy increase.

(NOTE: The present figures in Mr. Rose's memorandum, with respect to the division of effort between COMINT and COMSEC differ considerably from those in an earlier edition. The new edition shows relatively more effort on COMINT than did the earlier edition. We must therefore check these figures further before attaching too much significance to them.)

SOME OTHER COMPARISONS

14. The present total of military expenditure according to the newspapers is something like 35 billions of dollars per year. I estimate very roughly that NSA's total effort plus increased military communications expenditures resulting from the imposition of security requirements amounts to something like 350 million dollars per year. If these figures are correct, it would indicate that NSA's activities amount to about 1% of the present total defense effort.

15. Again very roughly, the above 350 million dollars divides into about 250 millions for COMINT and 100 millions for COMSEC. Comparing these figures with the R/D effort estimated for fiscal year 1955 of 10.1 millions and 7.5 millions for COMINT and COMSEC respectively, we see that if the above assumed figures are true the R/D effort on COMINT amounts to 4% of the corresponding total military effort and the COMSEC amounts to 7.5%.

(NOTE: I have talked to Colonel Jones, the Comptroller, about obtaining better figures with respect to the total effect of NSA on military expenditures in the COMINT and COMSEC fields and I believe that he would be very happy to be assigned the job of obtaining better authenticated figures. It seems to me highly desirable that this be done although high precision is of no importance.)

INDICATED COURSES OF ACTION

16. It seems clear that, in the national interest, NSA's effort in the COMINT field should be expanded; however, in the COMSEC field the present effort seems reasonably adequate.

17. In the R/D area, the most practicable immediate method whereby the over all effort can be expanded is by materially increasing the volume of outside contracts.

18. Because of R/D's present manpower limitations, the increased contracts should be, largely, with strongly organized concerns capable of doing the required work with a minimum of supervision.

19. One such concern is Bell Telephone Laboratories, which has had no COMINT contracts since the last war. NSA has presently under active consideration contracting with Bell Telephone Laboratories for as much work, looking toward the transistorization of NSA's analytic machines, as Bell Telephone Laboratories can be persuaded to undertake. It is hoped that this can be made at least as great as 1 million dollars per year.

20. Another strong concern is the Lincoln Laboratories which to date has done nothing in the COMINT field. It is hoped that Lincoln can be persuaded to undertake a broad contract to study the feasibility of and ultimately produce machinery for the cracking of telephone security systems. This work should start within a year and to be really effective should build up to a rate of expenditure of at least 1 million dollars per year.

21. The possibility of other large concerns entering into other contracts which would require a minimum of supervision should also be explored. It would appear that several other concerns would fall into this category.

22. In addition to this increased contract activity, R/D should immediately plan and take active steps toward increasing its engineering force by a much more intensive recruiting campaign than has as yet been undertaken. In this connection, I have had discussions with the Personnel Department of NSA which has resulted in the preparation of a memorandum from Mr. John L. Sullivan, a copy of which is attached hereto. This memorandum puts forth as a possibility the hiring by NSA of about 40 scientific personnel for each of the next three years, which allowing for attrition would be a net growth of 75 engineers and scientists over this three-year period.

23. Even though I believe that the increased expenditures for R/D should be principally for increasing the COMINT effort, the increased engineering force would be allocated to all segments on a "need for new blood" basis. Proper balance between jobs would then be affected by transfers.

24. Security requirements and in particular the obtaining of full security clearance for new employees offers a major obstacle to the hiring program. The amelioration of this situation should be actively studied.

25. One possibility for ameliorating the security situation would be to set up an auxiliary NSA R/D establishment which would be operated under a security classification no higher than CONFIDENTIAL. It would be even better if it could be operated like the National Bureau of Standards, on an unclassified basis. NSA should actively study the practicability of setting up such an establishment. As a starter, for consideration, we might envisage an establishment with a total personnel of about 50 of which perhaps 25 would be scientific personnel of training at least equivalent of a college graduate.

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26. Even if an outside establishment such as suggested above were established, R/D should immediately recruit some additional personnel who would work under present security regulations. Space provision should therefore be made for increased personnel of 25-50 engineers and 50-100 assistants within the confines of present quarters, prior to the projected move to Fort Meade.

A. B. CLARK