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Report of
Defense Science Board Task Force
on

STRATEGIC COMMUNICATIONS, COMMAND AND CONTROL

1 DECEMBER 1972

* Volume I: Summer Study Summary

* Volume III: Appendices

Office of the Director of Defense Research and Engineering
Washington, D.C., 20301

Excluded from the General Declassification Schedule, Classified by Director, C^2 and Space Systems, OASD(T) and various sources.

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09-M-3011
15-M-0026

Office of the Secretary of Defense +5 U.S.C. § 552
Chief, RDD, ESD, WHS
Date: 14 JUN 2016 Authority: EO 13526
Declassify: ______ Deny in Full: ______
Declassify in Part: X
Reason: 3.3(b)(2)(5)(8)
MDR: 15 -M- 0026

DECLASSIFIED IN FULL
Authority: EO 13526
Chief, Records & Declass Div, WHS
Date: JUN 14 2016

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Office of the Director of Defense Research and Engineering
Washington, D.C. 20301

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OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

1 May 1973

TO: THE SECRETARY OF DEFENSE

THROUGH: THE ASSISTANT SECRETARY OF DEFENSE (TELECOMMUNICATIONS)

SUBJECT: Final Report of the Defense Science Board Task Force on Strategic Command, Control and Communication

The Defense Science Board Task Force on Strategic Command, Control and Communications completed its work last year and its findings were briefed to Deputy Secretary of Defense Rush on 1 December 1972. Its final report has now been completed and is hereby submitted. I should like to draw your attention to the two critical deficiencies in our present World Wide Military Command and Control System (WWMCCS) identified by the Task Force and noted by its chairman in his letter of transmittal.

Joseph V. Charyk
Vice Chairman
Defense Science Board

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OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D.C. 20301

20 March 1973

JS 3.3(b)(1)

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report of Strategic Command, Control and Communications Task Force

The Strategic Command, Control and Communications Task Force has reviewed the current U.S. status as well as future plans of our command, control and communications structure with particular emphasis on the World-Wide Military Command and Control System (WWMCCS), and its final report is hereby submitted. Meetings were held on June 14 and 15, July 13 and 14, and for a two week period from July 31 through August 11, 1972. The WWMCCS Council as well as the WWMCCS Working Groups and the Defense Science Board reviewed the conclusions of the Task Force on December 1, September 5, and October 2 respectively. These groups, as well as the JCS, have expressed no serious disagreement with the conclusions and recommendations which may be summarized as follows:

> The DSB Strategic C^3 Task Force identified two principal deficiencies in our present C^3 system (WWMCCS).

[redacted]

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Short term as well as longer R&D programs to remedy these major deficiencies are recommended.

(U) Please note that Volume II, requiring Special Access, is not included; it can be obtained through the office of the Special Assistant for Net Technical Assessment.

(U) The Task Force commends Assistant Secretary of Defense Eberhardt Rechtin and his Deputy, Dr. Howard L. Yudkin for their impressive changes and improvements in the implementation of our recommendations with regard to the WWMCCS System.

Arthur T. Biehl

Arthur T. Biehl, Chairman
Strategic Command, Control
and Communications Task Force

CONTENTS

PREFACE

This report appears in three volumes. The first volume contains the major recommendations of the Summer Study along with a discussion of the reasoning that led to these recommendations. The second volume contains Special Access material that supports some of the arguments made in the body of this report. The third volume (the Appendices) is a compilation of papers written by members of the Task Force and also includes a few administrative sections. The results of this study were presented to the Defense Science Board on October 4, 1972.

[redacted]

VOLUME I

SUMMER STUDY SUMMARY

[redacted]

ABSTRACT

The Defense Science Board Strategic C^3 Task Force identified two principal deficiencies in our present C^3 system (WWMCCS). [redacted] Short term as well as longer term R&D programs are recommended to remedy this deficiency. [redacted]

JS 3.3(b)(1)

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PAGE IS UNCLASSIFIED.

I. INTRODUCTION AND SUMMARY

(U) In May 1972 the Defense Science Board formed a strategic Command, Control and Communications (C^3) Task Force to review the C^3 activities of the Department of Defense. Briefly, the Task Force Charter is to review the World-Wide Military Command and Control System (WWMCCS) and make recommendations to the Assistant Secretary of Defense for Telecommunications as to the adequacy of our current C^3 posture and its possible improvements (see Appendix A).

(U) After two 2-day meetings in June and July (see Appendix B) a Summer Study was held during the first two weeks of August by the newly formed Task Force (members of the Summer Study are listed in Appendix C). The purpose of this report is to present the results of this Summer Study in hopes that the findings and recommendations may be of value to the Department of Defense.

(U) Since different components of the WWMCCS can play critical roles, depending upon the nature of the situation that might arise, we found it convenient to categorize these into seven distinct military situations that could excite the elements of the World-Wide Military Communication System in distinctly different ways. This division is shown in the following list:

1. Normal
2. Crisis
3. Tactical Non-Nuclear War
4. Tactical Nuclear War
5. Selected Nuclear Options
6. SIOP Execution
7. Post SIOP

Each of these situations is discussed briefly in Appendix D. (An alternate view of conditions that may drive WWMCCS is presented in Appendix E.) Clearly, the situations listed drive the C^3 system in different ways. During the time allotted for the Summer Study the Task Force felt that only two of these categories could be tackled in any detail. Hence, we selected the two that we felt needed the most immediate attention: SIOP Execution (Situation 6) and Crisis Management (Situation 2). The recommendations that follow are essentially confined to these two cases.

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(S) The major recommendations of the Summer Study are listed below. The rationale for the order in which they appear and reasoning that led to these recommendations is discussed in the next section. The following list contains ten topics. Recommendations that are pertinent to each topic are presented:

1. <u>Exercises of the Strategic Communications Network</u>

   o Conduct MEECN no-notice exercises to evaluate whether changes in procedures can make the present MEECN more survivable.

   o As a basis for these tests analyze the capability that the Soviets might have in launching a <u>surprise attack</u> against U.S. strategic C^3.

2. <u>Attack Assessment</u>

   o Review the existing attack assessment equipment and procedures to determine what information could be transmitted to the NCA after nuclear detonations and how this information is to be transmitted.

   o Review the need for the development of a new nuclear detonation detection system for the purpose of attack assessment after nuclear detonation.

3. <u>The Advanced Airborne Command Post</u>

   o Establish procedures to ensure AABNCP survivability.

   o Study the feasibility of NCA communications with the AABNCP from a variety of platforms: aircraft, helicopters, ships, staff cars, etc.

   o Consider the development of a special communications package to allow the NCA, wherever he may be, to communicate with the AABNCP.

4. <u>Sanguine</u>

   o Proceed with Stage I Sanguine.

   o Study alternate methods of improving system hardness for Stage II and Stage III.

o Develop equipment that can provide confirmation that Sanguine has received input and has transmitted.

5. Survivable Satellite Experiments

o Analyze potential of locating future systems (based on LES 8/9 scheme) via launch and track data.

6. ERCS Follow-on

o Develop a low-weight missile payload that can be launched and relay the go-code.

o Study concepts for the utilization of this package as a backup to deployed communications systems.

7. The EMP Problem

o Continue vigorously the development of programs to test critical communication systems to the effects of EMP.

o Develop methods for hardening these systems to EMP effects.

8. Threats to "Survivable" Satellites

o Analyze possible threats to communication satellites that technology might allow.

o Review present specifications for satellite hardness in light of this analysis.

9. The Sunnyvale Node

o Determine critical functions that Sunnyvale now provides in controlling important satellites.

o Construct alternate facilities to control critical functions of strategically important satellites.

10. Crisis Communication Links

o Develop interface hardware to provide end-to-end connectivity (automatically) through existing communications nets.

- Accelerate development of secure voice systems.
- Analyze current secure voice requirements in order to institute interim measures.

II. RECOMMENDATIONS AND DISCUSSION

(U) This section is divided into two parts. The first part consists of the major recommendations of the Summer Study, covering ten topics in all. Under each topic specific recommendations are made, along with a brief discussion of the reasoning that led to these recommendations. In the second part of this section, a number of observations are listed. These observations have been phrased as recommendations, but are of a much more tentative nature. It is hoped that this latter list will be subject to further deliberations.

A. Major Recommendations

(U) The deliberations of the Summer Study were concentrated most heavily on the C^3 problems associated with the U.S. response to a major nuclear strike (Situation 6 in the list of Section I). The first eight of the ten recommendations discussed below concern this problem. The logic of the ordering of these first eight recommendations is as follows. Attention is first drawn to the strategic C^3 system as it now exists, and recommendations are made that might lead to, at least, temporary remedies for certain shortcomings of the current system. It is a reasonable assumption that the present system, even with fixes, will be inadequate in the future. Therefore, the next step is to address the major programmed elements that will eventually replace or supplement existing elements of the strategic C^3 system. A discussion of these programmed elements is presented in more detail in Appendix F. Finally, attention is drawn to some of the problems that even these new elements may have in surviving future threats.

[redacted]

1. Exercises of the Strategic Communications Network

(S) JCS and the DCA have both considered Soviet attacks against the U.S. In JCS considerations (RISOP), some communication nodes were intentionally targeted, but not necessarily those that are critical to the survivability of the most important strategic links. The

JS 3.3(b)(2)

Defense Communications Agency went a step further in this regard, but even so, certain elements that presumably are attackable, such as NEACP, the ALCCs, and other PACCS aircraft, were not targeted. The Task Force recommends that a harder look be taken at the potential capability the Soviets might have of decapitating the command, control and communication system of the strategic forces.

(S) Another point was noted by the Task Force. Apparently, in exercises such as POLO HAT, an appreciable degradation of the C^3 system is assumed in part of the exercises. It is not clear, however, that degradation was coupled with a no-notice test mode which would, in fact, accompany such a degradation if it ever occurred. Therefore, it seemed to the Task Force that an appraisal should be made of the advisability of marrying the principle of no-notice tests with a concept of C^3 decapitation, which is almost certainly the result of a no-notice attack. The purpose of such exercises would be to explore whether procedural changes (or ad hoc fixes) could make the present MEECN more survivable.*

2. Attack Assessment

(S) The Task Force understood that information about nuclear explosions in the U.S. would, at present, come mainly from 647 information and from visual observations from military aircraft airborne at the time. Both of these sources have some unique features and should be maintained. The Task Force believes, however, that information required from the 647 should be simple in nature [redacted] so as not to complicate unnecessarily 647 and its data handling system. Specifically, yield, height of burst, etc., do not appear to be required. [redacted]

[redacted]

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Date: JUN 14 2016

[redacted] A simple system that detects nuclear detonations (NUDETS) situated at likely target areas would go far to assure that the NCA receives information about the state of the country, information which may, at the same time, rank equally high as status of forces information. Such a system existed at one time, but we understand that it has been removed. It may not have been optimally designed. The Task Force recommends that the possibilities for a simple NUDET detection system be evaluated and that such a system be deployed at likely civilian and military targets. An alternative to deploying a simple ground-based NUDET detection system might be a low weight, low cost, simple satellite system. Candidate designs for both types of NUDET systems exist and should be evaluated from the overall system point of view.

3. <u>The Advanced Airborne Command Post</u>

[redacted] The key issues of the Advanced Airborne Command Post are the survivability and connectivity of this system. Requirements for data processing should not be dominant in sizing the aircraft. On the other hand, space will necessarily be at a premium in such a command post because of staffing requirements and the fact that improvement in the survivability and connectivity of the communications systems will necessitate placing additional terminals (of all types) aboard. Hence, the Task Force concurs with the choice of a 747 platform. The Task Force believes that the survivability of the airborne command post is heavily procedure-dependent, and therefore, recommends that a considerable continuing effort is warranted to take advantage of the basic survivability of the system. With regard to the connectivity issue, it was observed that the AABNCP could be an extremely valuable asset, whether or not the NCA were aboard. This would be true however, only if the NCA or his successors (wherever they might be) had adequate communication links with the airborne platform. Therefore, a major recommendation of the Task Force is that a special communications package be designed to provide for the NCA a two-way communications link with the airborne command post in the event that the NCA is not aboard. The exact nature of this package has not been defined, but, typically, it might contain a portable satellite terminal, line-of-sight UHF, line-of-sight TV, and an HF backup. This package should be designed so that it could be located on many platforms: aircraft, ships, and ground mobile units. The question of portable satellite terminals would be extremely important since the AABNCP derives its survivability by the ability to operate over an area of about a million square miles and since there is to be a satellite terminal aboard the aircraft. In order to retain this capability for large area operation it might be necessary that possible NCA platforms contain a portable satellite terminal. It is recommended that a study be made of potential platforms which might be exploited for this purpose.

[redacted] In support of these recommendations, some observations seem appropriate. First, with regard to the question of the survivability of the AABNCP, it is pretty clear that destruction of an aircraft, constantly airborne and randomly situated within an area of over a million square miles, would require a very large fraction of present Soviet forces. Several extremely important provisos must be met, however, to make this statement valid. The location of the aircraft must be truly random. In particular, landing and takeoff patterns must not be predictable on the basis of intelligence or other information. The airplane must be airborne at all times and silent (or use covert links only, in particular, covert up-links to satellites). In other words, (1) the aircraft must not be detectable, (2) cautions must be taken such that the communications capability of the aircraft cannot be negated by a barrage attack that is an order of magnitude smaller than that necessary to sterilise the airspace, and (3) the operational area for the aircraft must not be restricted, as it is now, by considerations of communication links or by procedures.

[redacted] The second issue concerns the connectivity between the NCA and the AABNCP. In the event that the NCA is not on-board at the time when warning makes it imperative that the airborne command post survive, the movements of the AABNCP should not be restricted on the grounds of availability of the NCA. Otherwise, its survivability could be greatly lessened. This statement may seem contradictory, since, without participation, the prime function of the AABNCP cannot be fulfilled. On the other hand, if the AABNCP and the NCA are forced by procedures to be co-located in an attackable position, the game may be lost at the beginning. For this reason, it seems logical that an aircraft which has the capability of surviving a reasonably massive attack by virtue of its capability of operation over a large area should be coupled with an NCA that is somewhat equally survivable. The survivability of the NCA can be increased substantially if the NCA and his ten or so successors are not forced, at any time, to rendezvous with a target as important as the airborne command post. Without adequate communications links to the airborne command post, the NCA might feel that a rendezvous was essential. Therefore, a partial solution to the survivability of the NCA is to provide him and his designated successors with a communications package that would, at almost all times, allow him and his successors direct and adequate access to the airborne platform.

4. Sanguine

[redacted] The Task Force subscribes to the deployment of the Stage I Sanguine.* However, it is strongly recommended that the R&D necessary to determine whether or not Sanguine transmitters can be made significantly harder should be vigorously pursued. The current limitation on hardness to about 1000 to 1500 psi is dictated by ventilator design for the diesel engines. The Task Force observed that the battery powered technology which was developed under the DARPA/STO SEESAW Program might provide an alternative power source which could be made much harder. This question should be studied.

[redacted] One important detail was noted. There are, apparently, no specific plans to determine whether or not Sanguine has received the go-code and is transmitting the go-code effectively. Specifically, verification by an airborne command post that input to Sanguine had, indeed, been received and was being transmitted via ELF, could pose some technical problems. These problems should be addressed early.

[redacted] In support of the recommendation for increasing hardness, some observations are in order. First of all, some alternatives to Sanguine were considered by the Task Force. In particular, the possibilities of hardening VLF transmitters, and alternately, of using the present VLF capability in a bell-ringer mode were discussed. However, the uncertainties of VLF propagation in a nuclear environment and submarine vulnerabilities associated with even momentary surfacing in response to the ring of the bell, would seem to continue to make communication the weakest link in the submarine system. On the other hand, ELF is particularly suited to the transmission of short messages under adverse conditions, including jamming. Hence, the concept of Sanguine appears very attractive. However, the presently planned Sanguine configuration, even the full-up system, is somewhat worrisome. Although Stage 3 Sanguine with 121 nodes is clearly much more survivable than any existing communications link to the FBM force, it should be remembered that this system will not be operational until the 1980s. Technology will improve, and today's threat may grow substantially. Even under present SALT agreements, it is unquestionably true that CEPs will become less and that MIRV technology will become more sophisticated. The result of advances in technology of this sort will be that the 121 nodes of the ultimate (present plans) Sanguine system could be destroyed by a few boosters and hence constitute a low price to the Soviets. Recognizing this, the Task Force feels

*Stage I = 16 nodes.

strongly that a concerted effort should be made to define ways in which the physical survivability of Sanguine can be substantially increased. Deep underground, Sanguine has been subject to a fair amount of analysis. This analysis should continue with the assistance of the weapons effects community, in particular, the Defense Nuclear Agency. It is also possible that not-so-deep underground installations may have some potential.

5. Survivable Satellite Experiments

[redacted] The LES 8/9 program is admittedly an R&D effort to determine whether various concepts relating to satellite survivability through covert operation can be achieved. Presuming that this is the program objective, it was somewhat worrisome to learn that the LES 8/9 experiment itself could be monitored in some detail by any competent intelligence collector. In addition, the Task Force learned that history has shown that experimental systems generally find their way into the operational arena, at least on an interim basis. Good examples of this are the present use of LES 6 and the experimental version of 647. For these reasons, the Task Force recommends that, if possible, data transmission from the LES 8/9 experiments be made more secure than is now planned.

[redacted] Although the following comments are not directly applicable to the LES 8/9 program as it now exists (since these are admittedly experiments), they do apply to possible follow-on operational systems of this type. The Lincoln Lab assessment of detection of LES 8/9-type satellites seems to overlook a particularly important point. Presumably they assumed that no launch or track information existed on that satellite booster. The assumption that this type of information would not be available might be correct. On the other hand, since such information might be obtainable and distinguishable from information regarding other launches, the Task Force believes that an assessment as to whether information could be obtained which would serve to localize a deep space satellite from its early track is required.

6. ERCS Follow-On

[redacted] The ERCS program, in its present form, utilizes Minuteman payloads to broadcast the Emergency Action Message. The problem with the current configuration is that in-silo survivability is in serious jeopardy for current Soviet SS-9 yields and CEP. As a consequence, the system is useful only in a launch-on-warning context. Even this is questionable since the message insertion, verification, and launch preparation time (about 15 minutes) exceeds the flight time of an SLBM which could also provide a high probability kill. The Task Force recommends that an assessment be made of the cost and survivability of a follow-on program that could utilize Minuteman or other facilities (for example, bomber or sub-launched missiles), to put a relay into a satellite or other orbit. This asset would parallel and complement planned or existing communication satellite systems.

[redacted] There is a nagging concern that, in the future, too much reliance may be placed on satellite communication, on the assumption that, by some means, the satellite links will remain survivable. Despite pains taken to increase the survivability of satellites, either by placing them in synchronous orbit or beyond (with silent spares as an adjunct), or by proliferating satellites, a determined enemy may find ways of placing satellite communications in jeopardy. For this reason, it seems advisable to consider ground-based systems that could be launched on warning, and at least serve the function of relaying the go-code to the strategic forces. Such a system would not be a replacement for satellite communication, but would serve as an emergency back-up system such as ERCS is now considered to be. The concept that the Task Force recommends is one in which a payload could be launched on warning which would have the capability of receiving and retransmitting critical messages.

7. <u>The EMP Problem</u>

[redacted] The widespread effects of an electromagnetic pulse produced by a high altitude nuclear burst could have catastrophic impact on the strategic communications system. It is important to know whether or not the last ditch assets (Airborne Command Post, ERCS, NEACP) are now subject to degradation because of this effect. It is even more important to know whether planned systems such as the Advanced Airborne Command Post, Sanguine, or the multiplicity of satellite terminals could suffer appreciable damage when subjected to the environment produced by a high altitude nuclear burst. Whereas the landline system is not directly amenable to testing for the effects of EMP, present and planned components of the last ditch strategic communication system (such as aircraft, missiles, and satellite terminals) are small enough so that a certain degree of evaluation of their hardness can be made through simulation techniques. Hence, it is recommended that an examination be made of the possibility of providing facilities to test at least the new systems for the effects of EMP and to continue the development of programs for hardening these systems to these effects.

8. Threats to "Survivable" Satellites

([redacted] The more the U.S. relies on deep space satellites for strategic communications, the more likely it is that an adversary may feel justified in investing resources for negating them. Such investment could take the form of ground-launched anti-satellite missile systems or anti-satellite satellites which follow the communications satellite and attack by jamming or physical measures. It is not clear whether deep space favors the communicator or his opponent. A relative evaluation of the effectiveness of the measures which each might take seems desirable at the outset of a major investment in survivable satellites. This evaluation is recommended. It is fully understood that only a start can be made on this problem, and that much data relevant to this evaluation will come out of the R&D done on developing survivable satellite systems.

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[redacted]

10. Crisis Communication Links

[redacted] Communication in a crisis is a localized intensification of normal communications. Hence, a unique crisis communications net should not be established, but the need met by existing elements. Therefore, it is recommended that normal day-to-day communications networks be provided with the ability to connect to and to talk through often incompatible networks, and to do so automatically. The present system does not adequately meet the needs for a number of reasons, foremost of which are poor NCA to crisis area connectivity and subsystem incompatability. The problems appear to result more from a lack of overall system planning and the need for common standards, rather than from research of technological limitations. In some cases, notably satellite communications, budgetary limitations have also been damaging.

(U) An adequate communication system must provide secure end-to-end, two-way communication including both message traffic and voice. To achieve this, uniform standards are needed throughout the system, together with the necessary automatic switching systems to provide for network reconfiguration and dynamic alternate routing. Initially, much can be accomplished by the provision of flexible interfaces and switches to interconnect existing systems. For example, the automatic switching required to accomplish necessary interoperability is available in commercial hardware with minor modification and is incorporated in the TRI TAC planning. Except for satellites (very inadequate at present), the existing transmission links seem sufficient. At present the technology exists, but interface hardware and operating discipline must be developed.

(U) For normal communication and crisis management, physically soft terminals together with satellites equivalent to standard commercial practice appear adequate. For these services characterized by high volume traffic, partial hardening does not appear to be worth the great cost penalties which result from departures from normal design practice. Necessary survivability and reliability should be achievable by flexible alternate routing and internetting achieved by the new switches and increased availability of satellite links. Fall back reliance on the special hard systems provided for general war C^3 gives additional insurance. Anti-jam transmission waveforms should be provided for critical links, but complicated satellite on-board processors are not recommended.

(U) DoD satellite communications capacity is at present inadequate and must be increased. Particularly important is the limited ground terminal availability which, for example, will limit the use of available satellite capability such as DSCS II. For high capacity communication requirements, use of commercial satellite capability should be explored. It might be possible to use complete transponders of INTELSAT IV variety, together with COMSAT ground stations in the United States and DoD terminals elsewhere.

(U) FLT SATCOM is important for day-to-day communications and will be essential for crisis management, particularly where mobile platforms are involved. Terminal procurement time delay is also a critical problem for this system. Anti-jam and covert transmission modems should be designed for use on critical circuits normally using FLT SATCOM and DSCS II satellite relays. Useful capability for these special transmissions should be possible with these relay satellites not employing costly on-board processing.

(S) Covert transmission capabilities will be required for critical platforms to prevent SIGINT and direction finding by the enemy. End-to-end secure voice must be available, a requirement which cannot be met at present; additional research and development on speech processing is required. Widespread implementation of secure voice on an end-to-end basis in the near future appears to depend on the standard telephone voice channel. A voice bandwidth speech processor which will convert analog voice signals to a 4.8 kilobit digital stream at acceptable quality is required. A 4.8 Kbs processor is required because this is the highest bit rate that generally available analog telephone channels will support with modest additional conditioning. The ability to support a rate greater than 4.8 Kbs world-wide does not appear reasonable without expensive improvement in many transmission sub-systems and/or a continuing high-cost maintenance effort.

B. <u>Other Observations</u>

(S) A number of observations were made by members of the Task Force during the Summer Study. These observations supplement the major recommendations discussed above. In the following, these observations are phrased as recommendations, but it should be understood that these recommendations are tentative and are based upon impressions left by the background data available (briefings, reports, discussions with individuals). The other point to be made concerning the following list is that there was no attempt to order these observations (recommendations). Rather, the following list reflects the results of a poll of the Task Force members on matters other than the major recommendations listed above. The "recommendations" that follow are intentionally provocative. We anticipate that prior to the next meeting of the Task Force more thought will be given to these matters by Task Force members so that the recommendations listed below can be either scrubbed or substantiated.

1. <u>COMSAT should be relied upon much more heavily than now to provide communications links between U.S. forces.</u>

Except for the case of general nuclear war, civilian communication satellite assets that are used by many nations would seem to offer advantages if used by U.S. military to the extent that: a) they are there, b) jamming would be politically difficult, and c) the cost might be less.

2. Real time retargeting of U.S. strategic forces should not drive the plans and configurations of the Advanced Airborne Command Post. Real time retargeting is a very complex issue, depending greatly upon our ability to assess what is happening in CONUS in some detail after we come under attack, and what is probably more difficult, what targets in the attacking country should be attacked by us to limit further aggression. This comment is not intended to oppose selected nuclear options but, rather, to keep them finite in complexity.

3. Since credible options of strategic response to an attack are preplanned, the NCA should have skip echelon capability for communication to appropriate strategic forces, rather than relying solely upon communication through JCS and the CINCs and subsequently to the forces. Since only a *few* choices are currently available to the NCA when responding to a nuclear attack on the United States, these choices (suitably recommended by the military) should be implementable by the NCA himself, without running the risk of lack of connectivity between NCA, JCS, the CINCs and the forces. Of course, JCS and the CINCs should be kept informed of the NCA action, but the NCA itself should have the option of releasing the weapons systems in a preplanned way, particularly if the United States comes under massive nuclear attack.

4. Analyses should be made of possible post-SIOP situations that are relevant to further use of withheld or reconstituted strategic forces. Apparently, one of the hopes for hardware and software aboard the Advanced Airborne Command Post and other future strategic communication components, is that there be some control of the post-SIOP world. The Task Force could not form any opinion as to the realism of these hopes, since it was not clear that sufficient thought had been given to the conditions that might exist after a general nuclear exchange.

5. Communication nodes from early warning systems and to strategic force elements should be replicated. It was noted that there is only one down-link node from each of the two 647 satellites. Additionally, the BEMEWS data passes through only three nodes. [redacted]

6. Alternate airborne relay links should be provided for communication between NEACP and Looking Glass. The PACCS aircraft which now serve this role may be vulnerable to an airbase attack. Should only one of these aircraft go out of commission, the link from NEACP to Looking Glass via line-of-sight UHF could be broken. Hence, parallel means of communication between these essential elements of the strategic communications net should be provided.

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7. [redacted]

8. The use of residual pockets of surviving landline elements should be preplanned, even under a determined communication decapitation attack by the Soviets. It is clear that pockets of landline systems will survive. Which these may be, is clearly open to conjecture. However, provisions should be made (procedures and hardware) that may allow interconnectivity between these pockets after the strike.

9. Studies should be made of the possibility of making HF more survivable, even in a nuclear environment. In the opinion of the Task Force, HF technology has been neglected on the basis that HF transmission will not be a viable means of communication in a nuclear environment. New developments in HF (or any frequency) transmissions, such as spread spectrum techniques, may help. These techniques should be explored.

10. Communication delays to the FBM force during communication exercises, such as POLO HAT, should be analyzed in detail. It was not clear to the Task Force that these communication delays were understood by the community. It seems essential that effort be made to understand the reasons for these delays so that interim measures, [redacted]

11. K-Band submarine transmission should be reexamined. It was understood by the Task Force that plans are already underway to install UHF satellite terminals on the FBM fleet. [redacted]

OSD 3.3(b)(5),(8)

12. All communications systems that are now under design or development should be reviewed in great detail by SIGINT experts. Compromise of important communication links is a profession for some. It is a fact that these professionals are generally very successful.

13. Communication exercises should be run which simulate crisis situations. Although Red Rocket and White Pinnacle message transmissions appear to be highly successful (that is, timely connectivity can be established between the principals), this fact does not imply that other and critical players in a crisis situation can adequately communicate. For this reason, it seems appropriate to explore the possibility of having specific exercises that simulate crises like the Pueblo, the Jordanian crisis, etc., in order to exercise the communications net and to explore for possible deficiencies in the response of this net to a crisis.

14. The SATIN system should not be approved unless additional justification is forthcoming. It was noted by the Task Force that Parkinson's Law is as prevalent, or more so, in the communications field, as elsewhere. It seemed apparent that the more facilities for communication became available, the more traffic was passed. It is not yet clear, but it seems possible that the SATIN system reflects this tendency.

15. ASD/T should review the question as to whether deficiencies in the present communications systems are a reflection of the doctrine that is employed or the hardware that exists. It was noted by the Task Force that the load placed on communications nets (particularly in the day-to-day situation) stems, to a great extent, on the procedures (that is, doctrine) that various subscribers adhere to. In particular, it was noted that status reports or other reports from the various CINCs differ substantially in content, quality and format. Just in this one case, standardization may help the communicator enormously.

16. NATO communications should be reconfigured to depend heavily upon satellite links. Archaic equipment, political overtones, and topological limitations have resulted in serious communication problems in Western Europe. Improvement of landline systems appears to be a very difficult matter. Therefore, the Task Force feels that a proliferation of satellite terminals among the NATO forces (utilizing FLT SATCOM and DSCS II) is the best answer at the present time.

[redacted]ED

VOLUME II

SPECIAL ACCESS

(This volume, not included here, requires Special Access and can be obtained through the office of the Special Assistant for Net Technical Assessment.)

Page determined to be Unclassified
Reviewed Chief, RDD, WHS
IAW EO 13526, Section 3.5
Date: JUN 1 4 2016

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VOLUME III

APPENDICES

INTRODUCTION TO THE APPENDICES

This volume contains ten appendices. The first three are administrative. Following these are a number of papers that were contributed by members of the Task Force. These papers have been reproduced as submitted. The last appendix contains copies of the viewgraphs that were presented on September 6, 1972 to the Assistant Secretary of Defense (Telecommunications) and on December 1, 1972 to the Deputy Secretary of Defense.

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Appendix A

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

TELECOMMUNICATIONS

5 June 1972

MEMORANDUM FOR Dr. G. F. Tape, Chairman, Defense Science Board

SUBJECT: Creation of a New DSB Task Force

I would like the Board to create a Task Force to assist me in the analysis and evaluation of communications for the World Wide Military Command and Control System (WWMCCS) with particular attention to those communications needed to support General War functions including the dissemination of Warning information.

The Task Force should address the following aspects of the problem:

1. It should examine the system concept of communications for WWMCCS, and help me evaluate how clearly and adequately this concept is stated and understood.

2. It should examine the implementation of communications for WWMCCS: (a) how reliable are they, (b) how survivable are they (including the command posts in which they terminate) against attack via jamming, sabotage, or during nuclear and non-nuclear war, (c) how secure are they against unauthorized interception.

3. The Task Force should make recommendations to me on, but not necessarily limited to, the following:

a. Clarification of the purpose of communications for WWMCCS and of the various chief options available.

b. Additions to the system, or possible changes in the mix of different parts of the system.

c. Any possible simplifications of the system.

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d. Adequately defined performance criteria.

e. Adequately specified test procedures.

I wish the Task Force to begin its consideration with study of the system supporting the NCA.

The cognizant person in my office with whom the Task Force will work is Dr. Howard L. Yudkin. I expect that this Task Force will be working through the C^3/I Panel of the Board, with strong interaction with the Strategic Panel.

The Task Force should begin its work as soon as possible. I expect a preliminary report at the end of the DSB Summer Session if this study is one of the "Summer Topics" of the DSB, and by October 1st, if not. Because of the urgency of the subject I strongly endorse the pursuit of this subject as one of the "Summer Topics" of DSB.

Howard L Yudkin for
E. Rechtin

UNCL

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Appendix B

TASK FORCE AGENDA

June 14 and 15

1. Present Strategic C^3
2. War Games (RISOP)
3. C^3 R&D Programs
4. C^3 Crisis Situation
5. General War ACP

July 13 and 14

1. The Defense Communication (DCS)
2. Naval Communications
3. Air Force Tactical/ Crisis Communications
4. Ground Forces Communications
5. CINCSAC C^3
6. CINCLANT C^3
7. CINCPAC C^3
8. CINCEUR C^3
9. Existing Minimum Essential Emergency Communications Network (MEECN)
10. Information Processing and Procedures in the World Wide Military Command and Control System (WWMCCS)

August 1 through 4

1. Tutorial on Satellite Communications
2. Communication Satellite Programs

August 1 through 4 (continued)

3. Spacecraft Vulnerability
4. SURVSAT
5. AABNCP
6. SANGUINE
7. MEECN Vulnerability
8. PAL
9. SIOP
10. Report by Tactical Warning and Attack Assessment Task Force
11. Communications of Sensor Information

Appendix C

MEMBERSHIP
DSB Task Force on Strategic C^3

Dr. Arthur T. Biehl, Chairman
Vice President
R&D Associates

Dr. Charles M. Herzfeld, Vice Chairman
Technical Director, Defense Space Group
International Telephone and Telegraph Corporation

Mr. John Boning
Manager, Government and Commercial Systems
Astro Electronics Division
Radio Corporation of America

Dr. William J. Chalmers
Special Assistant to the Vice President of Systems Engineering and Integration Division and Director of Requirements Analysis
TRW, Inc.

Mr. Walter L. Glomb
Vice President, Director of Advanced Development
Defense Communications Division
International Telephone and Telegraph Corporation

Dr. Kenneth Jordan
Staff Member
Communications Division
Lincoln Laboratory
Massachusetts Institute of Technology

Lt. General Glenn A. Kent, USAF
Director
Weapons Systems Evaluation Group

Dr. Harold A. Knapp
Member, Technical Staff
Institute for Defense Analyses

Dr. Robert E. LeLevier
Staff Member
R&D Associates

Dr. Roland E. Meyerott
Director of Science
Research and Development Division
Lockheed Missiles and Space Company, Inc.

Dr. Allen M. Peterson
Senior Scientific Advisor
Electronics & Radio Science
Stanford Research Institute

Col. Kenneth A. Plant, USAF
Directorate for Operations (J-3), JCS

Mr. Roger Plyer
Government Service Engineer
American Telephone and Telegraph Company

Dr. Robert K. Roney
Assistant Group Executive
Space & Communications Group
Hughes Aircraft Company

Dr. Harold P. Smith, Jr.
Professor and Chairman,
Department of Applied Science
University of California, Davis

Mr. William B. Wright
Staff Member
R&D Associates

OASD(T) Staff Members

Dr. Howard L. Yudkin
Deputy Assistant Secretary for
Systems, OASD(T)

Col. Harry Jaffers, USAF,
Executive Secretary
Executive Assistant to the Assistant
Secretary of Defense (Telecommunications)

DSB Sub-Task Forces on Strategic C^3

A. Strategic

Mr. John Boning, Chairman
Dr. William J. Chalmers
Dr. Peter H. Haas
Dr. Harold A. Knapp
Col. Kenneth A. Plant, USAF
Dr. Harold P. Smith, Jr.
Lt. Col. George R. Underhill, USA

B. Tactical

Dr. Allen M. Peterson, Chairman
Mr. Walter L. Glomb
Mr. Rober Plyer
Dr. Robert K. Roney

C. R & D

Dr. Robert E. LeLevier, Chairman
Dr. Kenneth Jordan
Dr. Robert M. Langelier
Mr. Frank W. Lehan
Dr. Roland E. Meyerott
Mr. William B. Wright

D. Intelligence

Dr. Charles M. Herzfeld
Dr. Harold A. Knapp
Dr. Robert E. LeLevier
Dr. Allen M. Peterson
Mr. William B. Wright

Appendix D

SITUATIONS THAT DRIVE WWMCCS
A. T. Biehl

(U) The Task Force found it convenient in order to organize its thoughts on WWMCCS to think of the following groups of scenarios:

(S) 1. Normal - By normal C^3 functions, it is meant the day-to-day posture requiring routine message traffic for housekeeping purposes, as well as for force status. The Task Force was led to the opinion that the current WWMCCS system serves this function reasonably well, with the principal fault being the lack of widespread use of secure voice. It is well known that the Soviets use a large amount of secure voice (perhaps 80%), in contrast to only a few percent for ourselves.

(U) 2. Crisis - By a crisis situation, it is meant a situation affecting, in a limited way, U.S. national interest in some part of the world. For example, the Jordanian crisis, loss of the EC-121, and the Pueblo. In many crisis situations, we have found that we have experienced difficulties, as well as humanistic problems, with people communicating who do not normally do so on a day-to-day basis. It should be noted that there is an increasing tendency during such crisis situations for the NCA to handle matters directly, and having little experience in communicating in such situations, difficulties are to be expected. Secure voice is, again, a dominant need, and in many cases, difficulties have been experienced in the use of existing equipment.

(U) 3. Tactical Non-nuclear War - A tactical non-nuclear war, for example, is a war between NATO and Warsaw Pact nations, a Korean War, and even, to a certain extent, the current conflict in Southeast Asia. During such a conflict, major forces confront each other with conventional weapons and place special burdens upon C^3. Such items as social customs, language barriers, policies and politics, all enter into the difficulty to be expected in such major conflicts. In particular, in the NATO environment, great C^3 difficulties have been and may continue to be expected. The Task Force did not address this problem, although it did hear from CINCLANT, CINCEUR, and CINCPAC relative to their C^3 problems. The reason for not exploring it further was simply a lack of time and the extreme difficulty and complexity of the problem. However, it should be noted that a contribution to a reasonable solution can perhaps be made in the communications field by means of satellite technology.

(S) 4. Tactical Nuclear War - An example of a tactical nuclear war would be if Warsaw Pact nations and NATO utilized tactical nuclear weapons on NATO/Warsaw Pact territory. Again, the Task Force did not investigate the C^3 requirements under such conditions in any detail, [redacted] In this regard, it will be noted that the Task Force is making no recommendations concerning this item (or item 3).

(S) 5. Selected Nuclear Options - A selected nuclear option, perhaps commonly called "Nixon option," is used in response to limited Soviet nuclear attack against the U.S. and/or its allies. Under such conditions, the NCA may elect to execute one of many options utilizing forces committed to the SIOP. Considerable discussion was held on the reality of this new concept and on the degree of flexibility demanded by the selective use of SIOP-committed forces. The Task Force believes there will be a continuing need for such options, which will grow in requirements for greater flexibility for the NCA to have the capability to execute parts of the SIOP forces, depending upon responses from the other side. Particularly, it is expected the NCA will demand communications with friendly states, as well as the Soviets or other potential enemy states; require an assessment based upon strategic as well as tactical warnings; and finally, will desire the ability to respond, depending upon the attack assessment, extent of negotiations, and damage inflicted upon the U.S. or its friendly neighbors. Quite obviously, this "Nixon option," which will place an extreme burden upon C^3 needs, is the driving force for improving our C^3 capability. It should be noted that the Task Force did not believe this newly-desired capability should be carried to the extreme, wherein the SIOP-committed forces could be retargeted instantaneously and perhaps even in the airborne survivable command post. Rather, the Task Force believes that almost, if not all, of the SIOP forces used under this option plan could be preplanned, and that detailed force status, targeting, and assessments were not necessary in order to implement a restrained response policy.

(S) 6. SIOP Execution - By SIOP execution, it is meant the execution of the SIOP-committed forces in preempt and retaliatory modes. In this regard, it should be noted that the Task Force did not believe it credible to consider executing the SIOP by firing on-warning (or firing out from under). The reason for this conclusion is the difficulty in assessing the validity of the unambiguousness of the tactical and strategic warning afforded by our tactical warning systems and intelligence. Also, quite obviously, the present MEECN is able to

OSD 3.3(b)(5), (8)

execute the SIOP in a preempt mode. [redacted]

(U) 7. Post SIOP - The post-SIOP situation involves operations after both sides execute their SIOP forces against each other. Quite obviously, after such an exchange, considerable C^3 difficulties may be expected. These would involve the survivability of the NCA and the various commands, as well as communication links, even though post-SIOP battle management should be capable of performing the management of surviving forces and terminating conflicts at this time.

(U) From the above discussions, one can surmise that the Task Force found it mandatory that when one said there was a need (or a requirement) for a certain C^3 capability, to be sure and discuss under which context one was talking. For example, if one talks about the need for hardening satellites to ensure their survivability, is one talking about this requirement under a preempt execution of the SIOP, under a retaliatory situation, or even under a post-SIOP situation? Quite obviously, requirements depend upon the scenarios and the intensity of the situation.

Appendix E

C³ PERSPECTIVES

D. B. Bobrow

(C) The points below pertain to the charge to the DSB Task Force to clarify the implications of the WWMCCS concept. Some of them may seem marginal to the customary sphere of action of the Department of Defense. In my view they are central to the primary function stated in the WWMCCS directive. That is, to be "capable of providing information so that appropriate and timely responses may be selected and directed by the NCA and implemented." This charge and the very name of WWMCCS emphasize a C^3 mission rather than one restricted to message transmission.

Looking Ahead

(C) The merit of technology through its life cycle depends significantly on the military and political environment during that life cycle. Given R&D procurement, and deployment lead times and the need to use expensive systems for many years, technology assessment requires some estimate of the environment of at least 1980 and perhaps up to 1990. Such estimates are, of course, plagued by uncertainty. Nevertheless, some gross features of the future are sufficiently clear to set the context for C^3 technology assessment.

(C) First, the latitude of the NCA unilaterally to position and use military forces for non-nuclear situations of a normal or crisis character will decline still further. Relevant implications include:

- Increased priority for communication between the NCA and relevant allied and third party national executives;

- Increased priority for communication between commanders of national military units at the theatre and task force level. Especially in crisis situations, reliance on several independent national C^3 "systems" linked solely at the national executive level will induce severe performance losses through distortion and delay;

- The interdependence of U.S. actions and local conditions requires substantially improved communications with the U.S. officials in principle best informed about local conditions, i.e., the Country Team. This recommendation calls for information as distinct from command links. There must be two-way information flow in real-time between the Country Team and the NCA and between the Country Team and the relevant U.S. military C^3 headquarters;

- The increased autonomy of other nations lessens the extent to which we should assume that third parties will facilitate U.S. military communications. Overseas land-based communications facilities are likely to become the focus for issues analagous to those raised by similarly located U.S. nuclear bases.

Second, with regard to strategic nuclear problems, we see little prospect for change in several vital respects. The U.S. will not have a substantial ability to insure the survival of our "civil" society. The U.S.S.R. will retain an "assured destruction" capability vis-a-vis the United States. American elites and the population at large will not believe that a post-nuclear war society is viable. [redacted] This concern to create additional limited response options in turn will create demand by the NCA for the capability to: a) reprogram fractions of the SIOP force; b) communicate with the national leadership of nuclear adversaries; and c) terminate nuclear hostilities at a number of points in their escalation.

<u>Decision-Making Tendencies</u>

(U) NCA officials will tend to share a number of general propensities as political men. C^3 systems design must accomodate itself to these tendencies as given.

[redacted]

JS 3.3(b)(2)

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Authority: EO 13526
Chief, Records & Declass Div, WHS
Date: JUN 1 4 2016

[redacted]

[redacted] Third, the NCA will be particularly concerned with the current status and the consequences of his decision for U.S. civil society. Damage assessment information of both a predictive and after-the-fact character should have high priority.

[redacted] Fourth, the NCA will find information about the status and behavior of U.S. forces as important for decision-making as information about hostile forces. That information may not now be as reliably, quickly, and securely available to the NCA as information about hostile forces. For crisis management, the implications are extremely disturbing. Crises are most likely to escalate in an unwanted fashion when the respective NCAs are working with different information about military behavior and apparently are being deceptive with regard to the behavior of their own forces. Relevant implications include:

- The NCA requires the option for two-way communications with U.S. military platforms down to and including individual air and naval platforms;

- These query and response links should provide information "copies" to intervening points in the military chain of command and allow comment and clarification from those points. However, forwarding decisions by intermediate levels should not be required.

- Given NCA communication styles, the communications should be of a two-way secure voice type.

- The principle of honest and prompt feedback must be established through exercises and salutary examples.

[redacted] Fifth, at both NCA and subordinate levels of authority iterative communication before decisions seems critical. Unfortunately, the importance of such communications laterally and vertically has been underemphasized in system design, if not in field practice, relative to one-way directive command. Relevant implications include:

- Communications should facilitate two-way dialogue within and across U.S. command channels both within

[redacted]

and between military services. Secure voice links will be especially helpful.

- Efforts to reduce reaction time should pay much greater attention to the time required for decision, clarification, and interpretation in contrast to the current overriding emphasis on message transmission.

Needed Information

(C) Some specific steps seem likely to improve the formulation of C^3 requirements and the efficiency with which C^3 resources are used.

(C) Current C^3 requirements seem to be in large part the product of scenario creation and technological possibility. They do not always seem to be grounded in realistic, detailed knowledge of what the actors in military situations in fact do. Accordingly, priority should be given to systematic, periodic observation of the practice of C^3 down to the platform level but beginning at least at the JCS level. At least in part, requirements should be generated from observed adaptations by operating personnel to present systems. Such an observation regime will be most feasible and informative if it is separate from the normal command chain concerned with evaluating personnel and enforcing doctrine.

(C) Current communications expenditures are largely consumed by O&M accounts. These are in large measure composed of personnel costs. Costs per man may be expected to rise in the future. Reductions in personnel costs may increase the funds available for C^3 improvements without requiring the same magnitude of increase in total C^3 costs. In general, ADP will not provide the solution to the problem posed by personnel costs. It is not known at this point to what extent military personnel relevant to the C^3 mission are over-qualified for their jobs, irrelevantly trained, or over-supervised. Priority should go to a task analysis on a tri-Service basis of what C^3 personnel really do, who they really are, and the skill, training, and grade implications of these findings. ASD(T) may wish to use DARPA to secure such a study. It would be an appropriate use of 6.2 or 6.3 RDT&E funds.

Realizing a WWMCCS System

(C) Without the steps taken to establish WWMCCS it is obvious that there was little prospect of a C^3 system appropriate to NCA needs.

However, in and of itself, the creation of the WWMCCS Council does not suffice to insure the creation of such a system with sufficient speed. Some major and difficult to achieve steps seem necessary to cope with current organizational arrangements, commitments, and incentives. Serious analysis should be made of the possible gains from movement toward the following management policies:

- Greater use of private sector organizations to design, construct, operate and maintain the C^3 system. Obviously, certain positions, e.g., NCA staff and battle jobs, should not be contracted out. However, a large part of the system may not require military personnel and may allow for substantial economies through personnel stability. If this management option becomes used more heavily, it is important that there be a clear locus of responsibility and guidance. ASD(T) is the appropriate locus.

- Greater centralization of C^3 responsibilities and personnel in a single part of DoD with appropriate reductions in the character and resources of the individual military services. The prime candidates for centralized management are ASD(T) and DCA.

Appendix F

COMMENTS ON PROGRAMMED SYSTEMS AND EQUIPMENT

R.E. LeLevier

(U) The Task Force has had only a brief but intensive exposure to the problems facing WWMCCS. Therefore, it is difficult for us to comment on the various program objective memoranda (POM) with any depth. This is particularly difficult, since we do not know, perhaps it is even unknown, the actual data flow requirements in the various scenarios. There must be a trade-off between computer power and transmission capability, and these are probably not the same in all situations. Nonetheless, we will make a few observations without, at this time, pretending to know which investment strategy is the soundest or is required.

Satellite Program

(U) The FLTSATCOM Program seems sound and well conceived. In particular, it will relieve the Navy of the heavy reliance on HF communications. (However, as noted elsewhere in this report, the only survivable element of MEECN could be HF from Looking Glass to the worldwide SIOP forces.) We tend to lean to the POM, plus two DSCS Phase II satellites with at least global UHF terminals. We would like to raise the question of whether the country is exploiting the rather large, widespread existing UHF technology which could provide, even on an interim basis, effective and relatively low cost, long haul communications capability. This capability could be realized way ahead of the more advanced SHF and EHF options which are under consideration.

General War

(U) The general war POM consists of:

[redacted]
SATIN IV
HYDRUS
SANGUINE Phase I
PIGGYBACK Satellites
Satellite Terminals on B-52s
AABNCP

OSD 3.3(b)(5)

[redacted]

(TS) We do not regard the SATIN IV data net as being survivable, and feel that if the net improves SAC's housekeeping capability, then the Air Force may as well go ahead with it.

[redacted]

(S) Preliminary results from the SANGUINE experiment are most encouraging. Elsewhere in this report, we recommend that research and development be conducted on increasing the hardness of the capsules with continued study on deep underground systems.

(TS) PIGGYBACK satellites and terminals on B-52s are very sound programs. The Task Force favors growth potential for the AABNCP, including, if possible, a 647 direct read-out capability and a NUDETS read-out capability as well.

(U) A final comment on secure voice technology: we observe that in communication via synchronous satellites there is a time delay of several tenths of a second automatically built-in. It is our understanding that, even at the narrow band bit rates of current secure voice systems, this time delay could be exploited to give the equivalent of wide band voice quality. We believe this should be examined carefully, even to the possible elimination of the military requirement for instant non-delayed transmissions. We won't have instant communication when using satellites, anyway. If we learn to use the satellites efficiently, why not build this small time delay into other systems, thereby achieving secure voice at a much reduced cost over the so-called wide band systems?

Appendix G

SATELLITE SYSTEMS PROCUREMENT

R.K. Roney

(U) In reviewing the planning and status of satellite communications for the Military Services, one is struck by one compelling observation. After a decade of practiced space technology, after hundreds of millions of dollars of DoD expenditure for communication satellites, and at a time when virtually the entire free world enjoys high quality, rapid access voice or television interconnectability in a commercial manner through satellite communications, vital defense communications (especially tactical and naval) appear to hang by the thin thread of two experimental satellites. These satellites, the LES-6 and TACSAT-1, have no back-up in reserve, and are surpassing their expected life.

(U) This situation seems to epitomize the defense communications program, to date. Some attention needs to be focused on the question: Why is it that the most useful (some say the only successful) systems have been those which have bypassed the normal DoD procurement routine?

(U) Two factors have contributed to this situation, both of which need to be attacked. One is technological policy: the Services have the ultimate rather than settling for the possible. The second is organizational: there has been no effective authority to plan and implement programs of joint Service requirements, except on an experimental basis.

(U) The capability for effective tactical satellite communications has not been technologically limited for half a decade. It has suffered from disastrous planning, policy, and management. Procurements have been delayed by the tedius cycle of definition, redefinition, and over-specification. Exhibit: Advent, IDCSP vs. Syncom, Intelsat I. Note that while Syncom was rejected by the Army in 1960 as not meeting their requirements (vice Advent), Syncom (through experimental terminals) ultimately became a key link in Army communications to Southeast Asia for two years before IDCSP was deployed in 1966, and actually relayed telecasts of the Japanese Olympics in 1964 through a terminal left over from the Advent program.

(U) Lack of coordinated authority for joint Service developments, aside from the obvious consequences of interface compatibility, has apparently contributed to a budget starvation in satellite system development. Exhibit: the TACSAT program. TACSAT I was sponsored by a tri-Service committee for experimental purposes. However, it was terminated with a single assembled spacecraft, with the development qualification model being launched for experimental service, with the total spacecraft segment limited to $30 M expenditure. A second flight article was terminated for a procurement saving of less than $4 M.

(U) The lack of coordinated authority and budget starvation is further reflected in the implementation of terminal procurements throughout the Services to exploit the satellite capability. Again, terminal capability has not been a technology limitation at any time, in the sense of a research requirement. It has been simply a matter of cost and commitment. Terminals do not exist only because the development has not been procured.

Appendix H

C³ COMMUNICATIONS: DAY-TO-DAY CRISIS, NETWORK INTEROPERATION, VOICE

R. Plyer

(U) The WWMCCS concept in the crisis situation requires that the NCA be able to communicate with secure voice directly and quickly to force elements below the CINC. In turn, the ability for elements below the CINC to rapidly access the NCA is also required. Many of these force elements are reachable only over communications which are a part of a local tactical net or other specialized network dedicated to a command or control function.

(U) The tactical and specialized networks, in the main, have not been designed for interoperability, but many of them do use the standard 4 Kc voice channel as their basic communication resource. The tactical nets often involve a mix of wire and HF radio communications. The Navy uses HF radio, to a large extent, for its tactical needs, but this resource will be supplemented with UHF Fleet Sat Comm under current programming.

(U) The circumstance where the NCA may wish to initiate a call to a force element below the CINC level involves a directory question. Since the unit may be reachable only over a tactical network, the user address in that network may not be known to the NCA. A call directed to the force element must therefore involve the CINC, if only to get the address. Two operational alternatives are available at this point. The CINC location can extend the call downward, or the CINC location can give the address information to the NCA, who can then initiate a second call to the force element. In the first case, the CINC can remain on the communication and can add other elements to the connection as may be required. In the second case, the CINC can still add on laterally, but the connection of the CINC and all CINC-initiated lateral additions to the communication will be at NCA's discretion. When calls flow in the opposite direction, that is, from the force element upward to the NCA, the directory problem is not as severe, since there is only one NCA. However, it may be desirable to have such calls directed to the CINC, who can extend the call toward NCA and make whatever lateral additions he feels are necessary. This routing should be an operating discipline, and not be incorporated into the communications system design because the force element may need to go upward at a time when the CINC may not be available.

(U) Several distance interface situations exist when considering the interoperability of networks.

(U) Crypto Interface - Since the crisis management requires that secure voice be employed, the question of crypto compatibility must be addressed. There appears to be no way available in the foreseeable future to achieve crypto compatibility without going through a red analog interconnection. This red analog interconnection must always be made at a point of U.S. forces control. This does not appear to increase the red area problem significantly.

(U) Transmission Interface - Transmission interface is complicated by existing secure voice arrangements which may be in use on tactical and special use dedicated systems. If the quality of speech on these systems is low, then the overall speech quality of any inter-operation connection will be correspondingly low. For this reason, any currently programmed secure voice arrangements for application in the tactical or special purpose network should be examined for their suitability for interoperation with this 4.8 Kbs secure voice plan.

(U) Signaling Interface - Interoperability must recognize that the tactical and special purpose networks use a variety of supervisory signals and that supervisory signals must flow across the interface, permitting the interoperating networks to recognize and act on seizure, disconnect and call progress indications, in accordance with their designs and in a manner permitting each to discharge its functions independently of the other.

(U) Address Interface - Network interoperability must recognize that the dedicated special purpose and tactical networks employ a variety of addressing schemes. Interoperability requires that the address be forwarded from one network to the other with conversion at the interface. Under this plan, a user in a tactical network may have more than one address designation. The user will have his regular network address, known to the other users on that network, and may also have a second address, known only to users on a different network. The required address conversion will be done at the network interface point on a simple look-up, table-type translation. There may be instances where the signaling and addressing are so unique that the cost for automatic translation is not warranted. In these cases, a human translation can be substituted. In this case, however the supervisory interface should still be "thru" electrically, and not dependent on human intervention after initial call set up.

(U) Signaling Interface - Interoperability recognizes that, in addition to differences in address formats, the tactical and dedicated special purpose networks also involve various methods to forward address information over lines and/or trunks. A look-up table and conversion equipment must be available to effect this translation.

(U) Network interface points should be selected with regard to the red analog patch requirement and should be located at points where several tactical and dedicated special purpose networks normally converge. The CINC locations seem likely candidates, as well as their alternate locations. Other locations may also be appropriate.

(U) Crypto transmission, signaling and address compatibility require a device at the point of network interconnection which will accept lines with different signaling; suspension and address formats will convert these to a common cross office format for interconnection.

(U) A review of existing commercial hardware and the proposed TRI TAC switch plan suggests that switching to accomplish the interoperability is both available in the commercial version with minor work and incorporated in the TRI TAC planning.

(U) Essentially, what is required is a 4-wire switching matrix, either analog or digital, a central processor and a variety of line terminating units. Portions of the TRI TAC planning can provide this capability if the TRI TAC is modularly constructed to permit application of only the voice matrix processor and line terminating units in a conventional bay mounted manner. Several commercially developed switches may also be useful in this regard.

Appendix I

C³ COMMUNICATIONS: DAY-TO-DAY AND CRISIS MANAGEMENT, SECURE VOICE

R. Plyer

(U) Wider secure voice application for the next five to ten years appears to depend on the widespread availability of the standard 4 Kc analog voice channel. However, during this period, most of the circuit growth and replacement will be digital facilities.

(U) A secure voice plan which fits the near-term environment and which can phase gracefully into the all-digital world of tomorrow is indicated.

(U) A voice bandwidth processor which will convert voice to a 4.8 Kbs stream at acceptable quality is required. This 4.8 Kbs stream will be encrypted and use a modem on analog voice channels. It will directly use available digital resources without the modem, where such facilities exist and where the costs are attractive.

(U) 4.8 Kbs per second appears to be the preferred rate for this system because the generally available analog voice resources will support 4.8 Kbs at an error rate suitable for secure voice, with modest additional conditioning. The ability to support a rate greater than 4.8 Kbs world-wide does not appear reasonable without expensive improvement in many transmission subsystems and/or a continuing high cost maintenance effort well above the current level.

(U) There are three cases where the 4.8 Kbs stream will enter the major digital transmission facilities.

A. The voice processor is located close enough to the major digital transmission facility that the 4.8 Kbs stream can use a simple cable driver on copper distribution cable pairs, (up to about 3 miles, see Case a on Figure I-1, page 48.)

B. The voice processor is located close enough to the major transmission facility that the local copper distribution cable can be treated with intermediate digital regeneration and the processor can be communicated through a simple cable driver (up to 15 miles, see Case b on Figure I-1, page 48.)

C. The voice processor is located beyond the copper cable pair range. In this case, the voice processor will employ a modem on a conventional 4 Kc analog channel. The signal will be demodulated at the junction with the major digital transmission facility and interconnected with that facility digitally (see case Case c on Figure I-1, page 48.)

(U) In the case where a major digital transmission facility is not available, the 4 Kc voice channel employed may not be demodulated until it reaches the desired terminating station, if that station also does not employ digital facilities. In the more likely situation, the 4 Kc line would be demodulated at whatever point a digital facility is encountered, (see Case d on Figure I-1, page 48).

(U) Local, on base switching can be any of a family of <u>4 wire</u> space or time division switches, arranged to accept network signaling and supervision. There has been some work done to employ a <u>2 wire</u> switch for full duplex data at 4.8 Kbs. This work may be applicable to secure voice. These switches can be located in a black area, since all of the message is encrypted. The signaling, however, is done in the clear.

(U) Network switching can also be any of a family of 4-wire switches. For example, the existing Autovon switch can be employed. It is not mandatory that this traffic employ <u>any</u> network switching. The local, on-base switching arrangement can be directly connected to other on-base switches, where traffic density warrants, and network switching employed only for economy, which may result from consolidating final route traffic for several on-base units.

(U) The on-base switches for secure voice can share the direct trunks or final group with any clear voice traffic for possible additional economic advantages.

(U) Interoperability of this proposed system with existing tactical systems and other high quality secure voice systems drives the bit rate to the highest sustainable on voice channels (4.8 Kbs), of the necessity to provide the high quality secure speech per link since conference may place links in tandem. It is also necessary to consider a build-up connection consisting of a tactical network link and one or more 4.8 Kbs links in tandem with a second tactical network link. This interoperability affects the selection of the voice processor. A careful choice of voice quality for a multi-link system versus processing cost is necessary. There exists a volume of work in the voice processing area, and other work has recently been initiated. This current work should be directed to the voice quality for multi-link use versus cost consideration.

(U) There exists a body of work which directs itself to key distribution considerations. This work can be directly applied to this proposed system. No attempt will be made in this paper to describe the key distribution plan.

(U) In summary, a 4.8 Kbs secure voice system interfacing with both analog and digital facilities is proposed. This system will signal in the clear and provide end-to-end voice security at an acceptable quality level with multi-link connections. Many trunk links can be encrypted to secure the signaling. For example, satellite links can be so treated. Existing switching and transmission systems are utilized to eliminate R&D expense. A graceful transition to an environment of increasing digital facilities is also incorporated. Voice conferencing will be available, but the conference bridge connection will have to be done in the clear in a red area.

(U) Work in the key distribution area needs to be focused and programmed, and funded to match the program. Work in the voice band voice processing area needs to be focused in the 4.8 Kbs range, and needs to be funded and programmed to match this program. The large multiplying factor involved in the voice processor and key generator suggests that MSI or LSI techniques may offer some economies. Also, it may be possible to employ commercial design and manufacture rather than the MilSpec concept for many installations, to further reduce per station costs.

FIGURE I-1.

PBX AND LOCAL LOOP

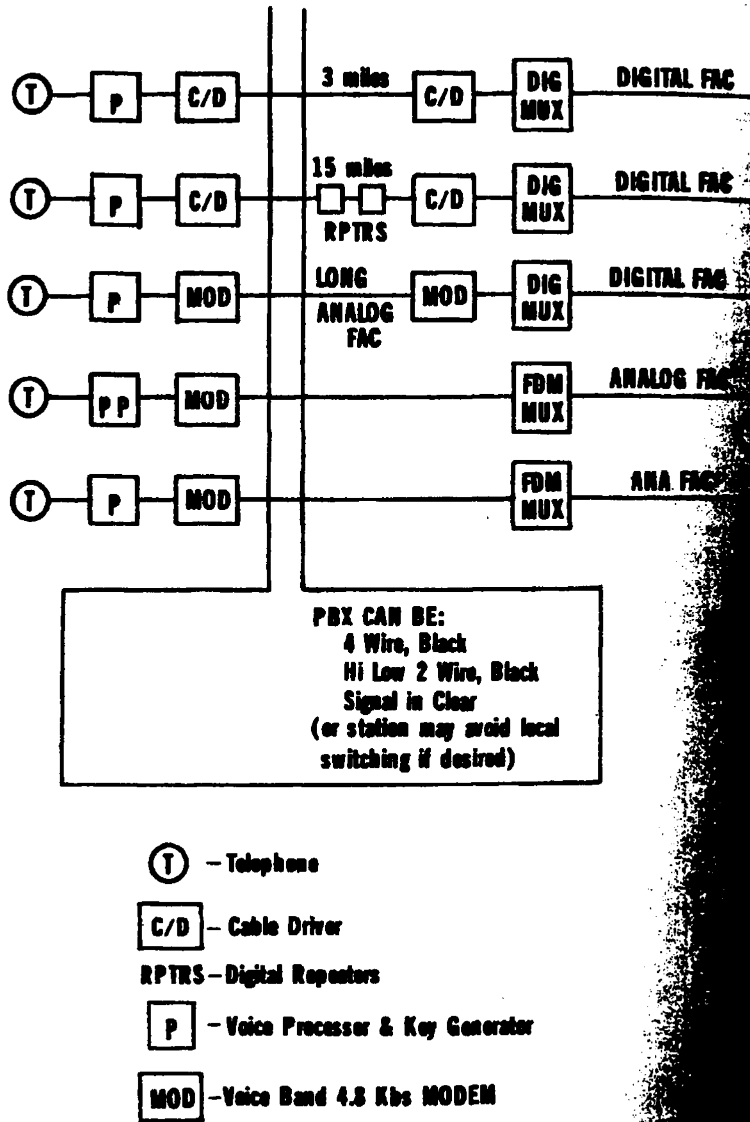

FIGURE I-2.

TRUNK SWITCHING

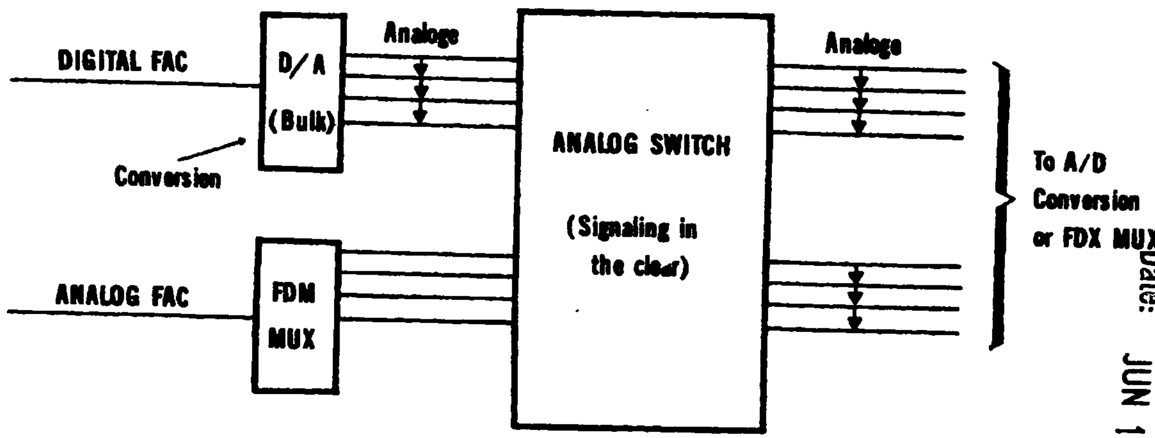

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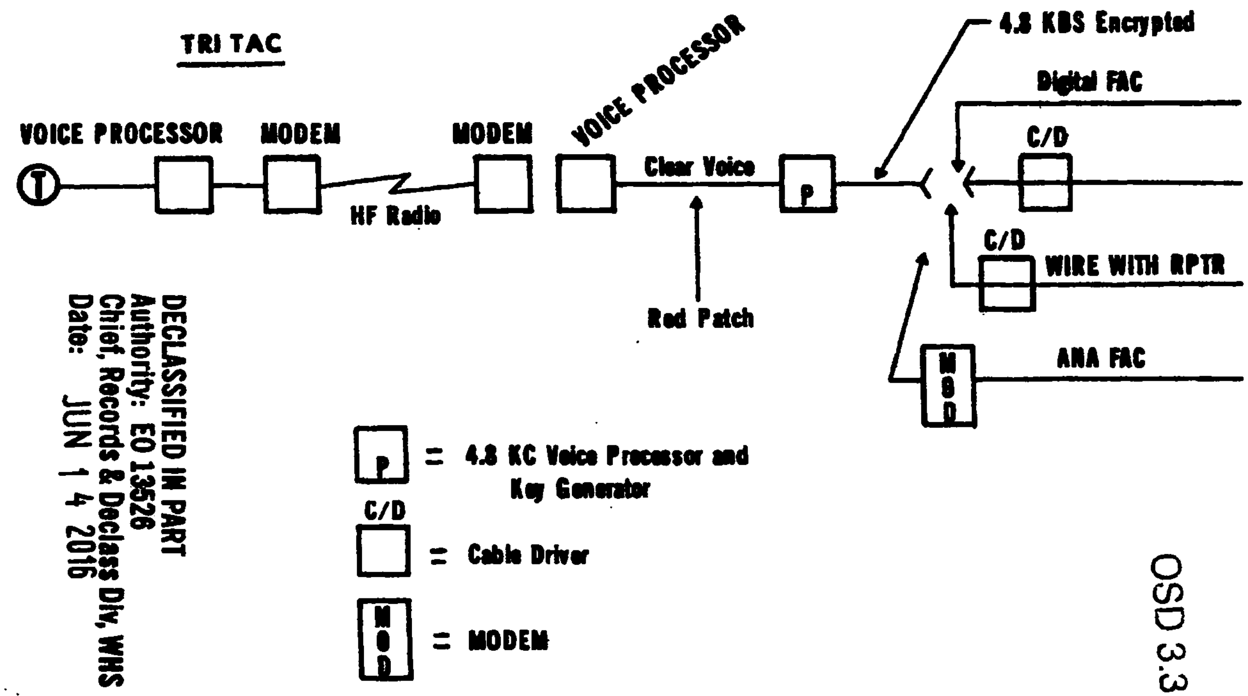
FIGURE I-3.

TACTICAL NET INTEROPERATION



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Appendix J

EMP VULNERABILITY OF C[3] SYSTEMS
A STATUS REPORT

Peter H. Haas

(U) 1. Surface/Near Surface Burst Induced Problems

We can state with considerable confidence that of the presently existing or planned systems only SANGUINE has a highly probable and critical vulnerability to the EMP produced by a surface or near-surface nuclear detonation. The obvious reason for this statement is, of course, that only SANGUINE is designed to be blast overpressure resistant and that the range of high-level EMP fields from surface bursts is quite limited. [redacted] On SANGUINE the presently biggest problem is our inability to calculate the expected currents or electromagnetic fields in 500 to 1,000 psi overpressure regions. The resultant current injections come from a combination of electromagnetic field coupling and direct radiation induced charge replacement. Because of our inability to predict these currents, which are expected to be of the order of 10^4 - 10^5 amperes, we have a resultant difficulty to design protection methods and testing techniques to confirm their adequacy. It is expected that these problems will not be solved for at least one to two years until the results of some planned underground nuclear experiments become available. The successful design and confirmation of protection techniques for the generator stations appear to be feasible and should be achieved within the next three to four years. One should be prepared to accept temporary, short-term interruption of transmission capability as a price for this protection.

(U) 2. EMP from Exoatmospheric Bursts

EMP susceptibility to exoatmospheric nuclear detonations is a considerably more speculative matter of considerably greater impact because of the widespread coverage of larger fields by single bursts of moderate yield. [redacted]

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[redacted] This precisely the experience from the weapon systems and appears to be the preliminary result of the last two years of testing of elements of the proposed C^3 system for SAFEGUARD. It is for these reasons a thorough test and analysis program of all existing and planned C^3 systems is long overdue and at last beginning to be pursued. Our present predictions on the performance of C^3 systems before the duct of this program are, of course, made with relatively low co as to their accuracy; however, our confidence in predicting the of an eventual hardening program is considerably higher.

(S) 3. Survivability of Various C^3 Systems HAEMP

a. Land Based Communications. Because of the wides dependence on digital techniques in the switching, encrypting a some systems even transmission media it is expected that circ resulting in transmission errors, message and call misdirect temporary outages and interruptions and even occasional dam be experienced. The result will be a general delay and conf during critical times could be catastrophic. Very few system relatively unaffected, principally they should be those which specifically dedicated (JCSAN, SACPAS, etc.,) and which d quire the undisturbed operation of switching centers. The land based systems which depend on switching centers may of fact be quite difficult because the identification of a parti mission path may be impossible. Thus the very techniqu

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assure connectivity in spite of physical plant damage, namely, the provision for multi-alternate routes, could end up as making the problem of EMP hardening impossible unless one accepts a principle of hardening everything. The latter technique is probably incompatible with the otherwise recommended and widely accepted practice of using commercial systems wherever possible. Thus one needs to conclude that for the most urgently required transmissions by land-based media, unswitched, blast protected and well identified circuits will be required. In this context, one can expect the least susceptibility problems for non-secure voice transmission systems, such as Autovon and much greater problems for digital transmissions such as Autodin, Secure Voice, etc.

b. Airborne Systems. At this stage there exists virtually no credible experimental data on the effects of EMP on aircraft of any type. Thus it is difficult to predict with high credibility what problems will be encountered in the identification, analysis and removal of undesirable and potentially damaging signals in aircraft electronics. Sufficient tests and predictions have been performed to allow order of magnitude estimates of skin and cable currents. These predictions show that the problems will be widespread and probably quite serious for even existing aircraft. For the planned AABNCP with its large ADP facility, one can expect very serious shielding and hardening difficulties. In the past we have encountered serious problems in the design of inherently hard computer systems and it has nearly always been necessary to resort to some type of circumvention scheme. Great care needs to be taken in the choice of ADP equipment and its associated software so that with circumvention only graceful, tolerable and temporary degradation is possible rather than a complete sudden breakdown which would make rapid reconstitution impossible. There is considerable doubt whether the test of the aircraft with its supporting flight equipment and avionics in an EMP environment will yield sufficient information to permit only relatively quick subsequent tests of the entire Airborne Command Post. It should be recalled that the initial tests, hardening program and final confirmatory proof tests for the MINUTEMAN G missile took several years. It is doubtful that less time will be required for the complex AABNCP aircraft in a yet to be designed--much less built--simulator. Since an AABNCP with full ADP complement and no credible assurance of hardness is worth little more than the present system, one should carefully re-examine the hardness test plans. Perhaps a less pure, less stringent test sequence accompanied by very generous degrees of overhardening, overshielding, excessive precautions, inflated safety margins and much skepticism would lead to earlier results with greater credibility.

c. RF Communication System. The very first and fundamental thing one needs to say about RF systems is that nearly all of them have inherently similar susceptibilities as the land lines because they use land lines as interconnections between transmitter/receiver and the source/commander. This fact appeared quite clearly to greatly enhance the vulnerability of the RF systems from the ANMCC where an apparently quite resistant and readily hardenable VLF transmitter, capable of communicating by dependable ground wave with many relay facilities, was judged too vulnerable because of its distance and soft cable connections to the Command Post proper. A simple disconnect can cure this problem. Thus, altogether aside from blackout problems, one should consider RF stations and systems vulnerable to the same degree as land lines. Their hardening, however, should be a fairly simple undertaking which should be commenced as part of the present C^3 vulnerability test series.

(U) 4. Relation of EMP to Other Weapon Effects. There is no question that each of the above systems have serious vulnerabilities quite apart from EMP due to normal overpressure, gust loading and thermal radiation effects. The single most major difference is, however, that individual targeting is required. [redacted]

(U) 5. EMP Vulnerability of Satellite Communication Systems.

a. The Ground Based Facility.

All the statements made earlier on ground based systems apply equally well to the ground terminals of satellite systems. Their EMP vulnerability to surface bursts need not be seriously considered unless they are blast protected. The vulnerability of the facility itself to high altitude bursts is probably not radically different from that of other C^3 facilities and that of the connecting transmission media should naturally be identical to others of the same type. Again the same statements made earlier also apply here--no tests have been conducted,

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some preliminary analyses have been made with low confidence; hardening is probably not too difficult.

b. The Different EMPs Peculiar to Spacecraft.

We need to consider other EMP-like phenomena in addition to the electromagnetic radiations which result from interaction of ionizing radiation with the atmosphere at a distant place. The first is called Internal EMP (IEMP) and is also important to exoatmospheric weapon systems. It results from gamma and more importantly higher energy (hot) X-rays impinging on metallic enclosures, creates electrons by either the Compton or photoelectric process on the interior and thus gives rise to very high electric and magnetic fields inside. Fields of 10^5 volt per meter and tens of gauss are common and can induce currents in cables in the 10-100 ampere range. The other is called System Generated EMP (SGEMP) and results from, again, the interaction of X-rays with the metallic surface. Electrons are ejected and some will escape to infinity until external fields predominate. Since the process is asymetrical, both by virtue of projected surface area differences and by the direction of the impinging radiation, charge differences will result on the surface and redistribution currents will flow. For very low X-ray fluences, commensurate with distances of the order 10^4 Km from megaton bursts, one predicts surface currents of the order of 100 amperes.

c. "EMP" Response of Spacecraft.

(1) EMP. In the few tests and analyses which have been conducted we have found that the communication portion of the satellite is either generally quite hard to EMP or that the transient upsets are of little consequence. Transient upsets can influence the station-keeping portion, however, hardening is well within the state of the art and has been done on at least one satellite. The situation with reconnaissance satellites is somewhat more complex, largely because of a more prevalent use of both digital and ultra-high sensitivity circuitry, however, even here one can be optimistic regarding hardening. The existing EMP simulators are somewhat deficient insofar as they do not replicate the EMP signal as dispersed by transmission through the ionosphere, however, their modification is well within the state of the art and will be accomplished.

(2) IEMP. We have a reasonably good understanding of the phenomenology and a rapidly improving understanding of the response of circuitry because of the importance to weapon systems. Much work

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has been accomplished in nuclear tests and laboratory work is proceeding. In general, one can state that IEMP is probably not a very serious problem at distances of 10^4 Km from detonations, at much smaller distances the problem becomes more difficult. There have been no tests and only a few analyses but we believe if they are properly conducted one can be quite optimistic about hardness of future satellites to IEMP at distances of the order of 1000 Km from megaton detonations. The hardness of present satellites is unknown--one would be prudent to be pessimistic at the shorter distances.

(3) SGEMP. We have no method to adequately experimentally examine the susceptibility of a spacecraft to SGEMP. The cost of a simulator to accomplish this is likely to be prohibitive (of the order of $25-50 million) and its capability highly restricted, even at very low radiation exposures. The cost of a single underground test would be similarly very large and its accomplishment open to question. We are thus faced with an unknown susceptibility which is likely to remain with us for some time to come. The most probable susceptibility of spacecraft to SGEMP arises from the customary external cabling with little or no shielding. We feel that if significant attention were given to this problem--which may be prohibitive due to excessive weight penalties--SGEMP would be a much less serious susceptibility. Some laboratory methods are presently under consideration which may be illuminating and it is possible that satisfactory hardening solutions can be found during the next one or two years. In the absence of a good system verification test technique, we will, however, continue to be faced with doubts as to their adequacy. There is one additional matter which requires resolution in the near future. Little hardening will be accomplished without the availability of realistic prototype spacecraft for this purpose--for extended time periods. Moreover, to properly evaluate the results of tests, supporting ground facility equipment is frequently required. Neither schedules nor cost considerations have permitted this type of availability in the past to any great extent and difficulty of co-locating special test facilities with the development facility in some of the above instances creates a further problem.

d. In summary, we believe that satellite systems which can survive and satisfactorily operate through EMP environments can be built and while we are not aware of catastrophic vulnerabilities of systems presently under development we will continue to have some doubts about their "completely undisturbed" performance. The EMP survivability of older, presently deployed systems is very doubtful. We must of course continue to recognize that EMP is only one nuclear weapon effect and really only of concern with detonations not specifically intended to destroy any one particular spacecraft--for deliberate one-on-one attacks other vulnerabilities dominate.

Appendix K

VU-GRAPHS FOR

6 SEPTEMBER AND 1 DECEMBER 1972

PRESENTATIONS

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V

DEFENSE SCIENCE BOARD

STRATEGIC C^3 TASK FORCE

INTERIM REPORT ON WWMCCS

1 December 1972

SECRET

CONTENTS

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ABSTRACT

- THE DSB STRATEGIC C^3 TASK FORCE IDENTIFIES TWO PRINCIPAL DEFICIENCIES IN OUR PRESENT C^3 SYSTEM (WWMCCS).

[redacted]

- SHORT TERM AS WELL AS LONGER TERM R&D PROGRAMS TO REMEDY THESE MAJOR DEFICIENCIES ARE RECOMMENDED.

SECRET

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SITUATIONS

1. NORMAL - DAY-TO-DAY POSTURE REQUIRING ONLY ROUTINE MESSAGE TRAFFIC

2. CRISIS - A SITUATION AFFECTING IN A SOMEWHAT LIMITED WAY U.S. NATIONAL INTEREST IN SOME PART OF THE WORLD, e.g., JORDANIAN CRISIS, LOSS OF THE EC-121, THE PUEBLO.

3. NON-NUCLEAR WAR - FOR EXAMPLE THE WARSAW PACT TAKES HOSTILE ACTION AGAINST NATO USING CONVENTIONAL WEAPONS ONLY.

4. NUCLEAR WAR - FOR EXAMPLE THE WARSAW PACT EMPLOYS TACTICAL NUCLEAR WEAPONS AGAINST NATO COUNTRIES AND VICE VERSA.

5. SELECTED OPTIONS - IN RESPONSE TO LIMITED SOVIET NUCLEAR ATTACK AGAINST THE U.S. AND/OR ITS ALLIES THE NCA ELECTS TO EXECUTE ONE OF MANY OPTIONS UTILIZING FORCES COMMITTED TO THE SIOP.

6. FULL SIOP - IN RESPONSE TO AN ALL-OUT NUCLEAR ATTACK ON THE UNITED STATES THE NCA AUTHORIZES THE EXECUTION OF MOST OF THE SIOP FORCES.

7. POST SIOP - THE SITUATION AFTER A LIMITED 5 OR MAJOR 6 NUCLEAR ATTACK EXCHANGE.

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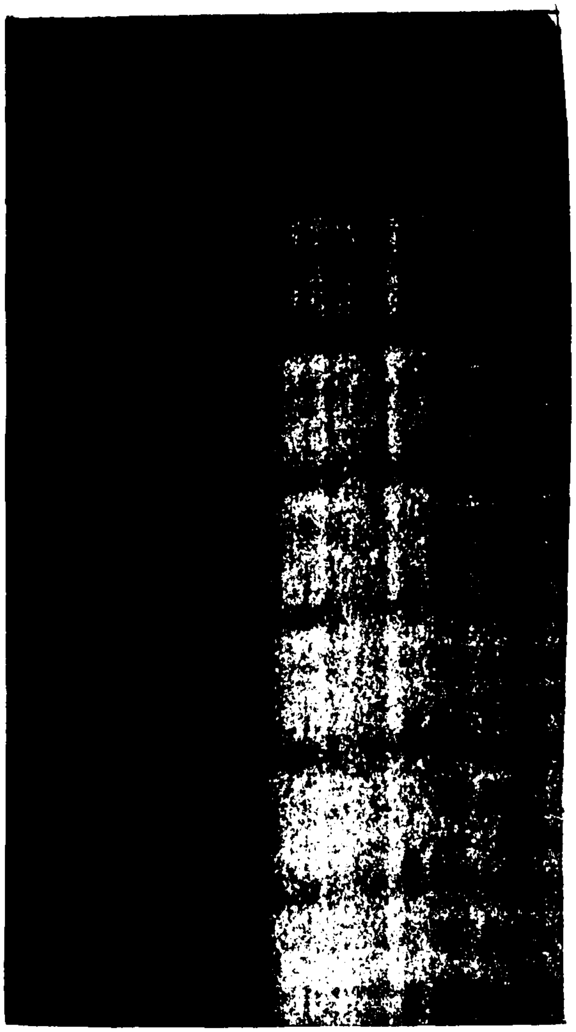

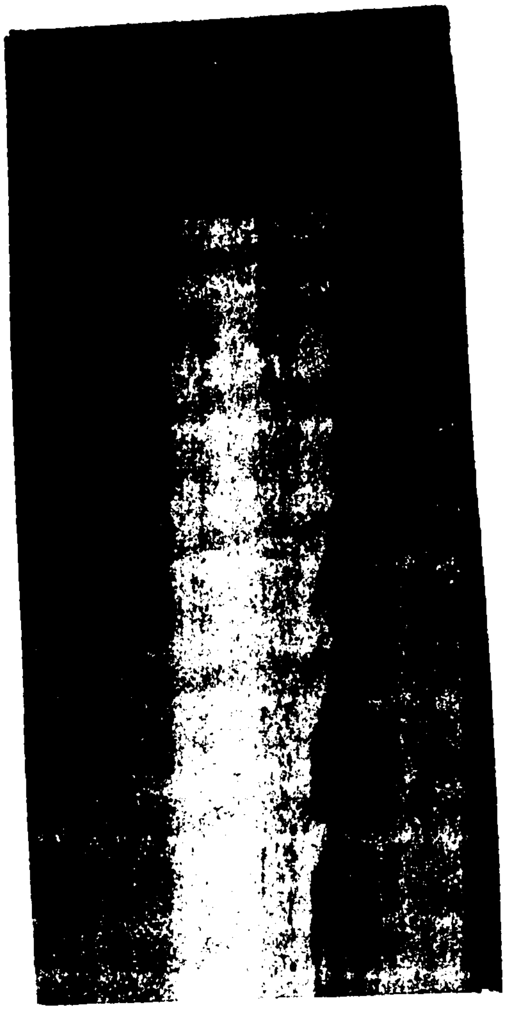

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RECOMMENDATIONS (STRATEGIC)

COMM EXERCISES

ATTACK ASSESSMENT

AABNCP

SANGUINE

SURV SAT EXPERIMENTS

ERCS FOLLOW-ON

EMP

SATELLITE SPECS

SUNNYVALE

SECRET

EXERCISES OF THE STRATEGIC COMMUNICATIONS NETWORK

RECOMMENDATIONS

1) ANALYZE THE CAPABILITY THAT THE SOVIETS MIGHT HAVE IN LAUNCHING A SURPRISE ATTACK AGAINST U.S. STRATEGIC C^3.

2) CONDUCT MEECN NO-NOTICE EXERCISES BASED UPON ABOVE TO EVALUATE WHETHER CHANGES IN PROCEDURES CAN MAKE THE PRESENT MEECN MORE SURVIVABLE.

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ATTACK ASSESSMENT

RECOMMENDATIONS

1) REVIEW THE EXISTING ATTACK ASSESSMENT EQUIPMENT AND PROCEDURES TO DETERMINE WHAT INFORMATION COULD BE TRANSMITTED TO THE NCA AFTER NUDETS AND HOW THIS INFORMATION IS TO BE TRANSMITTED.

2) DEVELOP A NEW BOMB ALARM SYSTEM FOR THE PURPOSE OF ATTACK ASSESSMENT AFTER NUDETS.

THE ADVANCED AIRBORNE COMMAND POST

RECOMMENDATIONS

1) ESTABLISH PROCEDURES TO ENSURE SURVIVABILITY.

   - o Randomize
   - o Covert Comm (DF)
   - o NCA Rendezvous

2) STUDY THE FEASIBILITY OF NCA COMMUNICATION WITH THE AABNCP FROM A VARIETY OF PLATFORMS: AIRCRAFT, HELICOPTERS, SHIPS, SUBMARINES, STAFF CARS.

3) DEVELOP A SPECIAL COMMUNICATIONS PACKAGE TO ALLOW THE NCA, WHEREVER HE MAY BE, TO COMMUNICATE WITH THE AABNCP.

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SANGUINE

RECOMMENDATIONS

1) PROCEED WITH PHASE I SANGUINE.
   (MORE SURVIVAL, A/J CAPABILITY, SUB ANTENNA)

2) STUDY ALTERNATE METHODS OF IMPROVING SYSTEM HARDNESS FOR PHASE II AND PHASE III.

3) DEVELOP EQUIPMENT THAT CAN PROVIDE CONFIRMATION THAT SANGUINE HAS RECEIVED INPUT AND HAS TRANSMITTED.

ERCS FOLLOW-ON

RECOMMENDATIONS

1) DEVELOP A LOW WEIGHT MISSILE PAYLOAD THAT CAN BE LAUNCHED AND CAN RELAY THE GO-CODE.

2) STUDY CONCEPTS FOR THE UTILIZATION OF THIS PACKAGE AS A BACKUP FOR DEPLOYED COMMUNICATIONS SYSTEMS.

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THE EMP PROBLEM

RECOMMENDATIONS

1) DEVELOP A PROGRAM TO TEST CRITICAL COMMUNICATIONS SYSTEMS TO THE EFFECTS OF EMP.

2) DEVELOP METHODS FOR HARDENING THESE SYSTEMS TO EMP EFFECTS

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THREATS TO "SURVIVABLE" SATELLITES

RECOMMENDATIONS

1) ANALYZE POSSIBLE THREATS TO COMMUNICATION SATELLITES THAT TECHNOLOGY MIGHT ALLOW.

2) REVIEW PRESENT SPECIFICATIONS FOR SATELLITE HARDNESS IN LIGHT OF THIS ANALYSIS.

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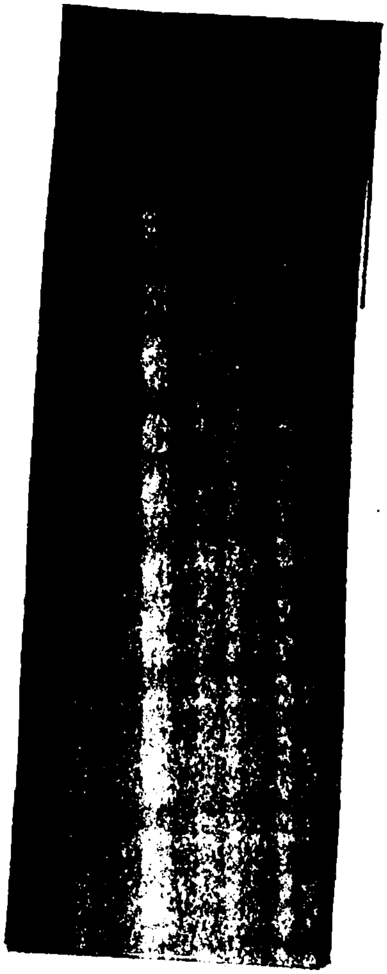

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OBSERVATION

C^3 AREA UNDERFUNDED RELATIVE TO OTHER DOD ELEMENTS--SHOULD CONSIDER INCREASE IN R&D $ EVEN AT THE EXPENSE OF SOME WEAPON SYSTEM COMPONENTS.

CRISIS COMMUNICATION LINKS

RECOMMENDATIONS

1) DEVELOP INTERFACE HARDWARE TO PROVIDE END-TO-END CONNECTIVITY (AUTOMATICALLY) BETWEEN EXISTING COMMUNICATIONS NETS.

2) ACCELERATE DEVELOPMENT OF ADEQUATE SECURE VOICE SYSTEMS.

3) ANALYZE CURRENT SECURE VOICE REQUIREMENTS IN ORDER TO INSTITUTE INTERIM MEASURES.

OBSERVATION

C^3 FUNCTIONS NEED CENTRALIZATION--SHOULD PROVIDE CENTRALIZED DIRECTION WITHIN SINGLE DOD ELEMENT EVEN IF SERVICES MUST SACRIFICE.

OTHER COMMENTS

1) USE OF COMSAT IN NON-NUCLEAR ENVIRONMENT.

2) REAL TIME RETARGETING SHOULD NOT DRIVE AABNCP.

3) MORE COMM ASSETS, MORE TRAFFIC: SATIN

4) POST SIOP PLANNING NEEDS ANALYSIS.

5) REDUCE LINKS NEEDED FOR SIOP RELEASE BY NCA.

OTHER COMMENTS (continued)

6) PROLIFERATE NODES: 647, BMEWS, ETC.

7) ALTERNATE RELAY AIRCRAFT FOR PACCS.

8) LINKS VIA AIRCRAFT TO B-52s.

9) EXERCISES THAT SIMULATE CRISES.

10) SATELLITES FOR NATO.

OTHER COMMENTS (continued)

11) TIME DELAY TO FBM--UNDERSTANDING

12) ASDT REVIEW OF DOCTRINE VS. HARDWARE

13) SIGINT CONSIDERATIONS IN DESIGN

14) HYDRUS VS. UHF: TWO-WAY COMM?

15) PREPLAN TO USE COMM RESIDUE

16) IMPROVEMENTS IN HF