

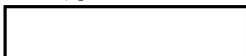
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FINAL REPORT
of the
Defense Science Board Task Force
on
TACTICAL WARNING
February 1972

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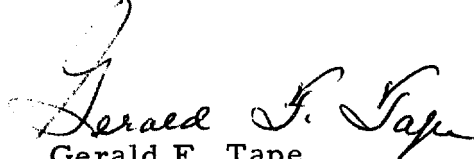
**OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301**

28 April 1972

TO: THE SECRETARY OF DEFENSE

**THROUGH: THE DIRECTOR OF DEFENSE RESEARCH AND
ENGINEERING**

The final report of the Defense Science Board Task Force on Tactical Warning is hereby submitted. I would particularly call your attention to the finding that, despite our large national effort to provide warning of attack by ballistic missiles, we have essentially no capability "today or in the foreseeable future," to detect incoming submarine-launched cruise missiles (see pp. 2 and 15).


Gerald F. Tape
Chairman
Defense Science Board

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

April 25, 1972

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report on Tactical Warning

The attached report is submitted in response to the DDR&E's request of 18 January 1971 to continue the review of the tactical warning area with specific emphasis on the possibility of near term improvements.

The report has been formally reviewed by the DSB and thoroughly discussed with both the DDR&E staff and appropriate service representatives over the last several months. The present document incorporates to a large extent the essence of suggestions made during these reviews. It also incorporates the final thoughts of the Task Force subsequent to the various review actions.

Growing recognition of the importance of tactical warning and needs for attack assessment suggests that a continuing DSB review of this area would be appropriate.

A handwritten signature in cursive script that reads "Carl Haussmann".

Carl Haussmann
Chairman, Tactical
Warning Task Force

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REPORT OF THE TACTICAL WARNING TASK FORCE
OF THE DEFENSE SCIENCE BOARD (U)

I. INTRODUCTION (U)

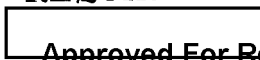
(S) The Tactical Warning Task Force was reactivated by DDR&E on January 18, 1971 to continue its monitoring of tactical warning and associated issues. It was requested by DDR&E to apply itself initially to improvement of tactical warning in the relatively near term; other taskings of the panel -- e. g., review of advanced technologies pertinent to tactical warning -- would follow later. By request the Panel's efforts were concentrated on the ballistic missile threat since it was understood that the bomber delivery threat was being addressed elsewhere.

(S) The five meetings of the Task Force each emphasized a particular subject area as follows:

- (1) Surveillance Sensor System Capabilities --
Lawrence Radiation Laboratory, Livermore, 25-27
January 1971.
- (2) NORAD Perspective on Warning Problems -- Hqs,
NORAD 30-31 March 1971.
- (3) SAC Perspective on Warning Problems, Hqs. SAC
25-26 May 1971.
- (4) Intelligence System Contributions to Warning, NSA,
12-13 July 1971, and the National Military Command
System Interface with the Tactical Warning Function,
National Military Command Center, 14 July 1971.
- (5) System 440L Improvement Potentials and Program
647 Capabilities, Hqs, Electronic Systems
Division, L. G. Hanscom Field, Bedford, Mass.,
16 September 1971.

(S) From the information presented at these meetings, our general conclusion is that today's launch detection sensors -- when presently programmed improvements are completed -- will provide overlapping coverage at least of conventional ICBM launches. However, the questionable survivability of these sensors and their associated communications remains a significant cause for concern.

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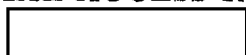
(S) Submarine-launched cruise missiles (SLCMs) are not considered a part of the officially defined threat against CONUS. However, the potential should not be ignored since today we have virtually no capability to provide warning of an SLCM attack.

(S) The impact of more, better, and more diverse Soviet missile systems; the emergence of China as a nuclear power, and developments in national policy requiring more flexible response warrant continuing investigation of warning capabilities and potential improvements. It is believed that the sensor options discussed later can, in combination, offer significant improvement in early warning posture. A diversity of sensors with better correlation of data also has the potential of providing some pre-impact attack assessment capability. The requirement for and utilization of such attack assessment information was not deeply pursued by this Task Force.

(S) System capabilities and requirements are evolving from Tactical Warning toward pre-impact attack assessment. We do not know if this is in fact the route that should be followed. The need to evaluate this trend and, if necessary, develop an alternative, requires a continuing investigation of the following subjects:

- (1) National Command Authority (NCA), and individual command requirements for tactical warning and attack assessment information;

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- (2) Utilization of attack assessment information by ballistic missile defense systems, and the associated nuclear release authority for these systems;
- (3) New systems to meet more extensive tactical warning and/or attack assessment requirements;
- (4) Closer coupling between undersea surveillance systems and warning systems to provide both earlier warning and better assessment of SLBM attacks; and
- (5) New technology to meet future requirements.

(U) In addition, it would seem advisable and useful if a continuing or follow-on committee monitored the fate of this report's recommendations--actions taken or the reasons for not taking action.

(U) A review of these recommendations made by the first Task Force on Tactical Warning is included as an appendix to this report.

(S) Items not considered by the task force or not considered in sufficient depth to produce significant conclusions or recommendations are:

- (1) Third party problems, etc.
- (2) MIRV and MRV
- (3) Launch from under
- (4) SALT implications
- (5) Survivability requirements

Each of these areas will impact on tactical warning systems requirements and could well be the subject of follow-on task force efforts.

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II. DISCUSSION (U)

A. Requirements for Tactical Warning/Attack Assessment

(S) Tactical warning and attack assessment are defined in JCS Publication 1 as follows:

- (a) Tactical Warning -- Notification that hostilities have been initiated including an identification of specific threat events.
- (b) Attack Assessment - Use of information from sensors and any other available source to determine the objectives of an attack and the nature of the targets.

(S) The Task Force elected not to restrict its considerations to tactical warning since the function of attack assessment is inevitably associated with it in that some form of attack assessment will always be required by the NCA before a response to a nuclear attack will be made. Moreover, the same (or similar) surveillance systems provide - to some extent - both types of information. Therefore, it became evident that both functions needed to be considered in our review and evaluation of surveillance-system capabilities and requirements.

(S) It seems worth pointing out that multiple warning and pre- and post-attack assessment systems supported by survivable communications and associated hardware, and (hopefully) dependent upon different phenomenology for warning indications are essential to the deterrent at least in permitting the strategic bomber force to escape weapons aimed at the bomber bases. Portions of our strategic forces can also benefit from warning by being able to reposture themselves into a more survivable mode. ALCC, LOOKING GLASS, NEACP, TACAMO are examples here. The evident existence of a dependable warning system may also enhance deterrence in a more general way. If our warning systems are weak, any response we might make to an attack would either be delayed or be based on limited information and therefore less effective; hence the deterrent value of our "assured destruction" counter-forces is reduced.

(S) The chance of obtaining effective warning is enhanced by use of divergent phenomenology for launch detection. Multiple independent warning systems can make simultaneous attack on all elements of the warning system more difficult.

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(S) A major and controversial question remains in the development of capabilities for improved pre-impact attack assessment:

"Would the U.S. under any circumstance launch a retaliatory strike prior to detonation of nuclear weapons on CONUS?"

The strategic value of a national policy which countenances such a course of action can also be questioned. Therefore, this issue seems worthy of future study from both a technical and political point of view.

(S) Tactical warning is needed for many NORAD, SAC and NCA time-critical decisions. Some key decisions requiring this warning data are:

- (1) Bombers --scramble alert forces.
- (2) National Command Authorities--take steps to improve survival potential and institute other delegation arrangements.
- (3) Defense-- scramble alert force and give nuclear release authority.

(S) While these requirements for data can be met by current or potential surveillance sensor systems, the only concrete guidance for system designers is the JCS Validated Surveillance System Objectives outlined in JSIPS 9-69 and reiterated in JSIPS 1-70. These objectives were not constrained by either technological or budgetary feasibility. We believe that more emphasis is required on realistic goals of prompt and credible warning and assessment of the character of the attack.

(S) In our view, the essential elements of credible warning and attack assessment are: launches have occurred, number (is the attack limited or massive), the country of origin and country being attacked. In addition, it is essential to the NCA decision process to obtain details on the character of the attack as soon as possible, although final retaliatory decisions will probably not be made until nuclear detonations have occurred on CONUS. In any event, whether functioning in support of a retaliatory decision, or as a basis for force reconstitution, a capability for timely post impact nuclear detonation assessment is essential.

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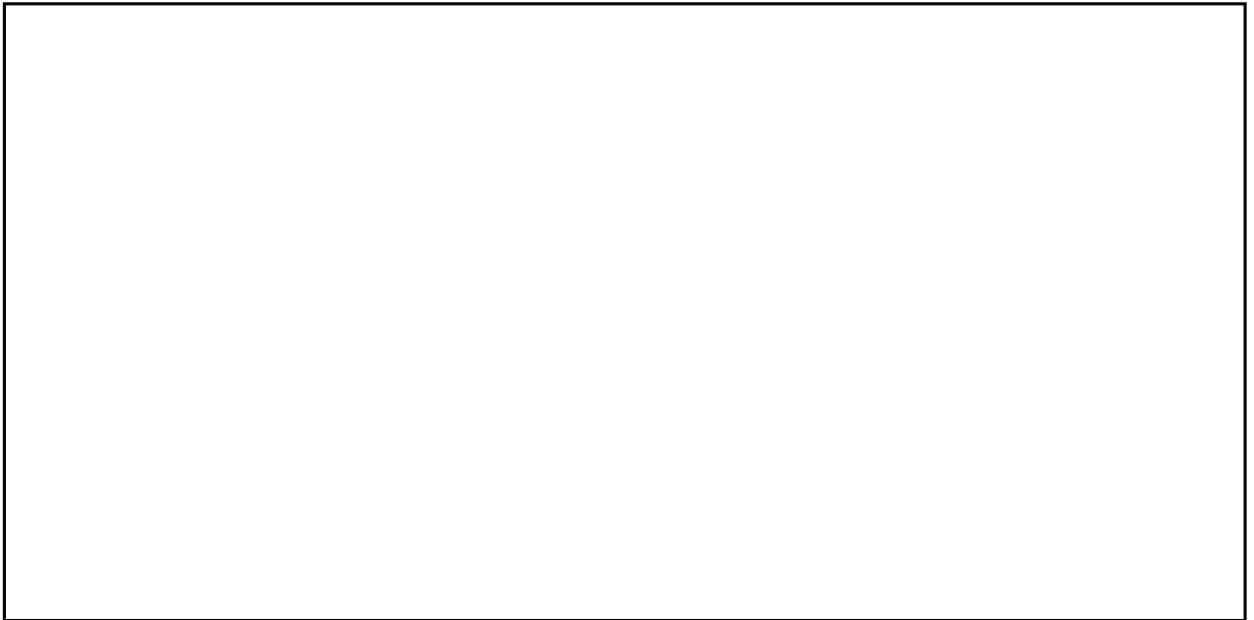
(S) Attack on satellite sensors and simultaneous ECM disruption of redundant surveillance systems would in itself constitute warning. However, sensor vulnerability to countermeasures is also a matter of real concern during an interval of gradually rising international tensions accompanied by successively more provocative acts. The Task Force has been unable to discover what resources could be brought to bear against a slow, insidious, gradually-increasing degradation of our warning sensors which might easily take place in an atmosphere of threats and counter-threats. With current programs there would be relatively few retaliatory measures open to us; perhaps the most logical would be an equivalent attack on their sensors. In such a scenario, it is essential that we be able to unequivocally detect such countermeasures, and to take some protective steps which would at least increase the difficulty of such action. At present, the U.S. has no such capability.

(S) As the number and diversity of warning systems is reduced, the ease with which the enemy can attack and disrupt increases. In this context we note that diversity of detection phenomenology does not necessarily imply diversity of vulnerability to physical attack. Both are needed. If the requirement expands from merely warning of mass attack to warning and assessment of limited and repeated attacks, functional survivability (survival of a warning and attack assessment capability) becomes more critical. The difficulty of adequately hardening any of the current or projected surveillance sensors for tactical warning suggests that functional survivability is best and most economically achieved through a diversity of sensor systems, each survivable to the greatest practical extent. A survivable nationwide post-impact nuclear burst detection system (NUDETS), including its communication, also seems to be a desirable part of this mix.

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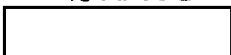
III. DISCUSSION OF SURVEILLANCE-SYSTEM CAPABILITY (U)

(S) From the data presented in various briefings the Task Force has prepared some comments on current and projected surveillance sensor system capabilities in the light of the threats and the needs as we understand them. These comments may provide some feel for the relative cost and adequacy of performance of the various systems.



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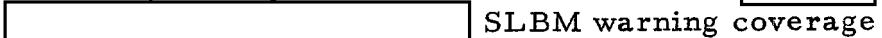
IV. CONCLUSIONS AND RECOMMENDATIONS (U)

A. Conclusions (U)


(S) (1) Although it can be said that when currently approved programs are completed (474N modifications) or become operational (647), we will have a modest capability in terms of coverage and probability of detection for early warning against the officially-defined ICBM and SLBM threat projected through 1976, we do not find any basis for complacency. Until the IOC of the first 

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SLBM warning coverage is at best marginal. Even then coverage of all potential SLBM launch locations will not be complete. Present sensors are extremely vulnerable to electronic or physical attack. Our present ability to warn against cruise missiles is non-existent.

(S) (2) The strong push for dual deployment of  in the eastern hemisphere is premature. The case for additional satellites in the eastern hemisphere should be based on operational experience and confidence in the data processing software, coupled with the realization of the postulated threat (SSNX-8), and has yet to be made.

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(S) (3) In view of BMEWS capability for attack assessment as well as tactical warning, it is desirable to retain this system indefinitely or at least until the attack assessment capability of the northern PARs is fully demonstrated. While BMEWS provides a good impact point prediction capability for attack assessment, it does have coverage gaps against DICBMs, and FOBS. 440L provides only gross attack assessment, but provides good FOBS and DICBM coverage.

(S) (4) Responsibilities for management of the tactical warning mission area are widely distributed and sometimes conflicting. We have found no clear assignment of the

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mission, specific tasks, or responsibilities for providing tactical warning on a world-wide basis. CINCNORAD/CINCONAD has an assigned responsibility for providing tactical warning of an attack against North America and as a result of specific JCS requests is providing data for attack assessment, but does not have the mission of providing a comprehensive national system for tactical warning and attack assessment.

- (S) (5) From the tone and content of briefings to the Task Force, we perceive within the Services and the JCS (NMCC) a growing interest in pre-impact attack assessment to support both SIOP selection and even more detailed control of strategic forces in a nuclear exchange. It seems to be assumed that this information will be forthcoming, but no one seems to know quite how nor precisely what it will be used for.

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The requirements for such data seem not to be clearly established, and the demarcation between attack assessment for NCA decisions and data for battle control is by no means clear. The problem of attack assessment for NCA decision support has received relatively little attention while a large effort has been undertaken to support a sometimes nebulous function of "battle control." The highest priority should be placed on determination and support of NCA decision requirements.

- (S) (6) Post-impact NUDETS are integral and important parts of the overall attack assessment problem. We believe that more attention to this aspect of "attack assessment" is absolutely essential.

- (S) (7) The system specifications, and the demonstrated capability [redacted] considerably exceed the "requirements" for a launch warning system but fall short of providing an attack assessment capability. A simpler (warning-only)

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system will, of course, support launching the bomber force under positive control and a policy of retaliation. It can be said that the trend of warning systems development is toward systems to support at least a limited attack assessment capability.

- (S) (8) The survivability of tactical warning surveillance systems and especially their associated command and control structure is a matter for real concern. Since any system can in the end be put out of action by a sufficiently-determined attack, functional survivability is best assured by redundant systems with different vulnerabilities. It appears neither wise nor feasible to attempt to make one system superhard and then to rely solely on it. The need for improved survivability is, of course, based on the assumption that warning systems may be required to survive to warn of repeated attacks, or that an independent attack on warning sensors might be made.
- (S) (9) Today, and for the foreseeable future, we essentially have no capability to detect incoming cruise missiles flying at low altitude. This is disturbing from two aspects. This has the effect of encouraging these missiles to be stationed close to our shores. In the absence of an adequate defense, this delivery technology presents an all-too-attractive method of delivering payloads. We have found no significant effort to address this particular warning problem.
- (S)(10) A potential way to improve our tactical warning/attack assessment capability is to make operational use in near real time of intelligence data on missile launches. These data could be used both to test the TW/AA surveillance systems and to augment TW/AA in times of crisis. However, there are currently both security and administrative problems in making these data routinely available to personnel responsible for providing tactical warning on a day-to-day basis.
- (S)(11) If the system performance specifications are met (in particular an acceptable false alarm rate for SLBM detection) an automated bomber alerting system will be technically feasible.

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(S)(12) Lack of comprehensive programs to either detect ECM efforts against warning systems or to counter such efforts may well make such attacks attractive to the Soviets in a period of increasing tension.

(S) (13) The performance of 440L as a contributor to the subject at hand, continues to be a matter of controversy. Unless the system can be made to give adequate around the clock performance its value remains questionable.

Note: Another OTH system of interest is COBRA MIST. While the Task Force did not fully investigate aircraft warning intelligence systems, we were briefed on COBRA MIST on two occasions. In these briefings and subsequent discussions we could find no logical basis for establishment or continuation of this system.

B. Recommendations (U)

(S) (1)* An organization should be established within the DOD with the responsibility of staff supervision of the function of tactical warning and attack assessment. With better management focus, technology can be much more efficiently utilized. An integrated tactical warning and attack assessment management organization should in the near term emphasize a clear definition of NCA and CINC requirements, surveillance sensor system data integration, and command and control. New sensor technology can be explored later.

(S) (2)** The possibility of assigning the tactical warning/ attack assessment mission to an organization responsible for satisfying all approved requirements should be explored. The roles of NORAD, SAC, and the NMCS and other key participants should be clearly defined in this mission assignment.

* We hope that DOD Directive 5100.30 will satisfy the intent of this requirement.

** The intent of this recommendation should also be implemented by DOD Directive 5100.30.

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(S) (3) Studies leading to a clear definition of attack assessment requirements and current capabilities should be made as soon as possible. A specific aim of these studies would be to establish the difference between attack assessments required for NCA decision support (including the possibilities of second strike retaliation, and those required for launch-from-under attack) or for battle control.

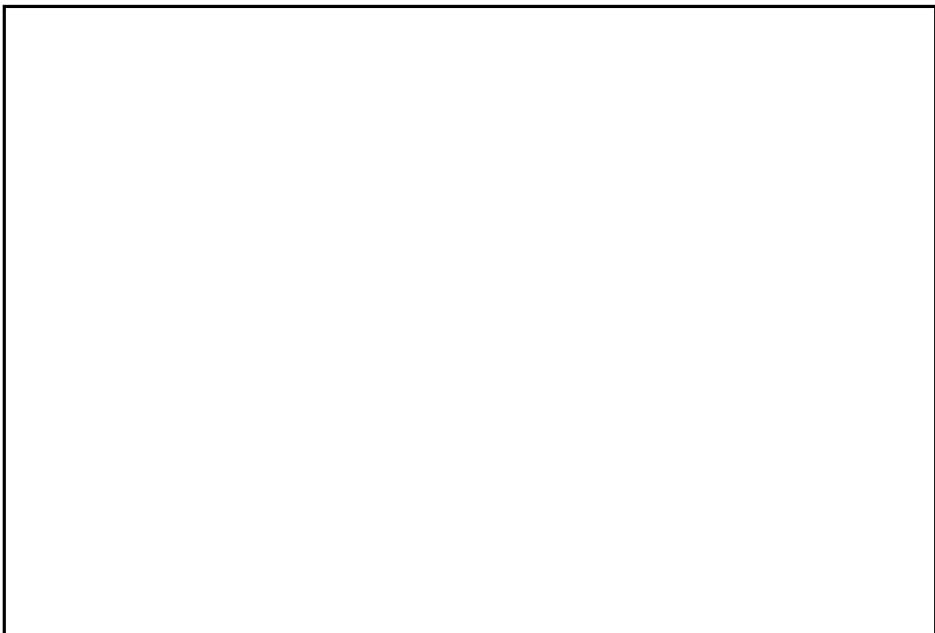
(S) (4) In the design of tactical warning systems and their associated communications, survivability and resistance to countermeasures should be a more important consideration than it is at present. While hardening of radar systems does not appear economically justifiable, greater satellite hardness against nuclear attack should be achievable at moderate cost. The criteria for survivability should be based on analysis of the relationship between the cost of survivability and effectiveness of the system on a case-by-case basis.

(S) (5) The potential, and the need for survivable post-impact NUDETS, and how it might be achieved, should be restudied in the very near future.

(S) (6)

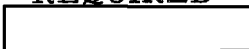
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(S) (9) The testing of sensor-system effectiveness needs additional emphasis. Every opportunity to make real-time, in situ tests of the utmost possible realism should be taken.

(S) (10)



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(S) (11) Present R&D efforts to provide an SLCM warning capability should continue and more active consideration should be given to deployment of an operational system.

(S) (12) A definitive operational evaluation of 440L should be conducted as soon as ADC accepts full system responsibility in order to judge the wisdom of continuing investments in the system.

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Appendix

STATUS OF PRIOR DSB TASK FORCE RECOMMENDATIONS (U)

(U) The first DSB Task Force on Advanced Tactical Warning under the chairmanship of Dr. Albert D. Wheelon submitted their report to OSD on 10 October 1969. It is interesting to note that many of their recommendations for action to improve our tactical warning capability continue to be pertinent and still require action. These prior conclusions and/or recommendations are summarized below in the order of priority which we believe to be currently appropriate.

(S) 1. System Engineering and Evaluation.

"We have observed that warning requirements are ill-defined." This continues to be true and the need for a full-time effort to quantify warning and attack assessment requirements is still apparent. . . "We believe that a useful and reliable early warning (and attack assessment) system can be supported by today's technology, although no single sensor is itself highly reliable under a wide enough range of conditions. Information supplied by several diverse sensors, with their different coverages and failure modes, will do the job if it is properly correlated and distributed." . . .

(S) It is also true of this as well as the previous task force that. . . "we did not dwell heavily on processing, display, and data utilization problems." . . . We did investigate data utilization in somewhat more detail than the previous group and still find that. . . "there is certainly more important progress which can be made in these areas."

(S) With the increasing SLBM threat and the growing National Military Command Center (NMCC) interface with the National Command Authorities (NCA) we find that responsibility for and approaches to use of tactical warning and attack assessment information is becoming more diffuse rather than more cohesive. While SAC and the NMCC may have requirements for information which differ in detail from each other and from those of NORAD, we believe that it is fundamental to a rapid and effective NCA decision process, particularly in times of stress, that all elements have a common basis of information presented in the same or a very similar manner. To achieve this necessary cohesiveness in the NCA decision process, it is still recommended that -

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