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13

High Power Radio Frequency (HPRF) Phase 2 Study

Meeting #5 Minutes (U)

Redacted Copy

17 June 1993

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Captain William A. Lamb

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Chief, Nuclear Weapons Concept Division

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Technical Director,
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High Power Radio Frequency (HPRF) Phase 2 Study

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(U) ACKNOWLEDGMENTS

(U) I would like to take this opportunity to thank Ms. Carolyn Mangeng of Las Alamos National Laboratory, Los Alamos, New Mexico who hosted the fifth meeting of the Joint DOE/DOD Phase 2 Feasibility Study of an HPRF device. Her efforts prior to and during the meeting helped immensely and were appreciated by all in attendance.

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(U) INTRODUCTION

(U) The Nuclear Weapons Concept Division of the Office of Aerospace Studies (OAS/XRN) conducted meeting #5 of the Joint DOD/DOE Feasibility Study of a High Power Radio Frequency (HPRF) Device on 16-17 June, 1993. The meeting was held at Los Alamos National Laboratory in Los Alamos, New Mexico. The purpose of the meeting was to convene working groups, review working group progress, and update the program status. The individual working groups met during the first day of the meeting. A general session was held in the morning of the final day. The agenda for the general session is contained in appendix A.

(U) These meeting minutes document meeting #5 and include copies of presentations from the working group meetings as well as the general meeting. Additionally, a list of attendees is provided in appendix B. The meeting highlights are presented in the following sections.

(U) The topics of discussion during the meeting dealt with the progress of the working groups, funding aspects of phase 2 work, information requirements and interchanges needed for the working groups. The study director requested that each working group chair provide an interim report of progress that will be included in the annual report to the Nuclear Weapons Council Standing Committee (NWCSC).

(U) CLASSIFICATION AND SECURITY

[redacted] The study director, Capt Lamb, presented an overview of the classifications involved in the HPRF Phase 2 Study. Specifically, each individual involved in this study needs to be aware of the proper classification of the materials generated or produced. The classification guides for this study are listed inside the front cover of this report.

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Information provided on the employment of such a device can also carry other caveats such as Not Releasable to Foreign Nationals (NOFORN) and Warning Notice - Intelligence Sources and Methods Involved (WNINTEL). Additionally, information concerning the nuclear design of the HPRF device most likely contains Critical Nuclear Weapon Design Information (CNWDI). It is imperative that all information that is classified be afforded the proper classification security protection. If there is any doubt as to the classification of any information, please take the time to investigate the classification guides or ask the proper knowledgeable individual. A request for information about classified material requires a need-to-know before access to the information can be provided. Make sure you have properly identified an individual's need to know. In regards to unclassified material associated with this program, please handle the information with care. Proper operation security (OPSEC) requires that the unclassified material not be released that can give

uncleared individuals enough information to piece together classified information. [redacted] b(3) DTRA, DOE, USAF

(U) SURETY WORKING GROUP

[redacted] The presentation slides are included in appendix D. The QFD process is being used to address Operational Safety, Dispersal, Use Control, and Nuclear Detonation Safety [redacted] USAF b(1) b(3) DOE, USAF

(U) SYSTEM ENGINEERING WORKING GROUP DTRA

[redacted] These inputs are provided as appendix E. The SEWG reviewed the New Mexico design concepts and the California design concepts. A review of the baseline designs and the variables for the designs were discussed. Additionally, rough estimates for flight calculations were presented. More in-depth analysis of the flight calculations are required to provide the confidence levels desired. The need for hardware for the HPRF program was discussed. The working group sent a request to SAF/AQQS(N) and identified RV requirements over the projected lifetime of a HPRF weapon. Further information will be provided when it becomes available. USAF b(1)

(U) REQUIREMENTS WORKING GROUP

[redacted] The Requirements Working Group (RWG) met during the first day of the working group meetings. [redacted] The working group reviewed the action items from their previous meeting and discusses the requirements for inputs from other working groups. The second iteration of the Military Characteristics (MCs) will be available by October 1993. USAF b(1)

(U) WARHEAD DESIGN WORKING GROUP

[redacted] Action items external to the working group are provided in the action item section this report. USAF b(1)

(U) MISSION ANALYSIS WORKING GROUP

(U) The Mission Analysis Working Group (MAWG) met during the working group sessions. [redacted]. The areas discussed included activities since the last meeting, reorganization of the ICBM to Headquarters, Space Command, status of the mission need statement (MNS), and modeling work completed. The slides are included as appendix H.

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[redacted] Work on mission modeling is continuing in the areas defined for the study. [redacted] Vulnerability information requirements have been re-identified to the VWG and any new information requests will be provided by the MAWG. [redacted]

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(U) VULNERABILITY WORKING GROUP

[redacted] His slides are provided in appendix H. The results of work completed since the previous meeting were presented. Problem areas within testing of foreign assets have been identified and possible remedies discussed. [redacted]

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(U) ACTION ITEMS

(U) Table 1 provides the list of action items assigned during meeting #5. The action items assigned during previous meetings are listed in table 2. Figure 1 shows a timeline for the study.

Table 1. (U) ACTION ITEMS FROM MEETING #5.

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Table 2. (U) PREVIOUS ACTION ITEMS.

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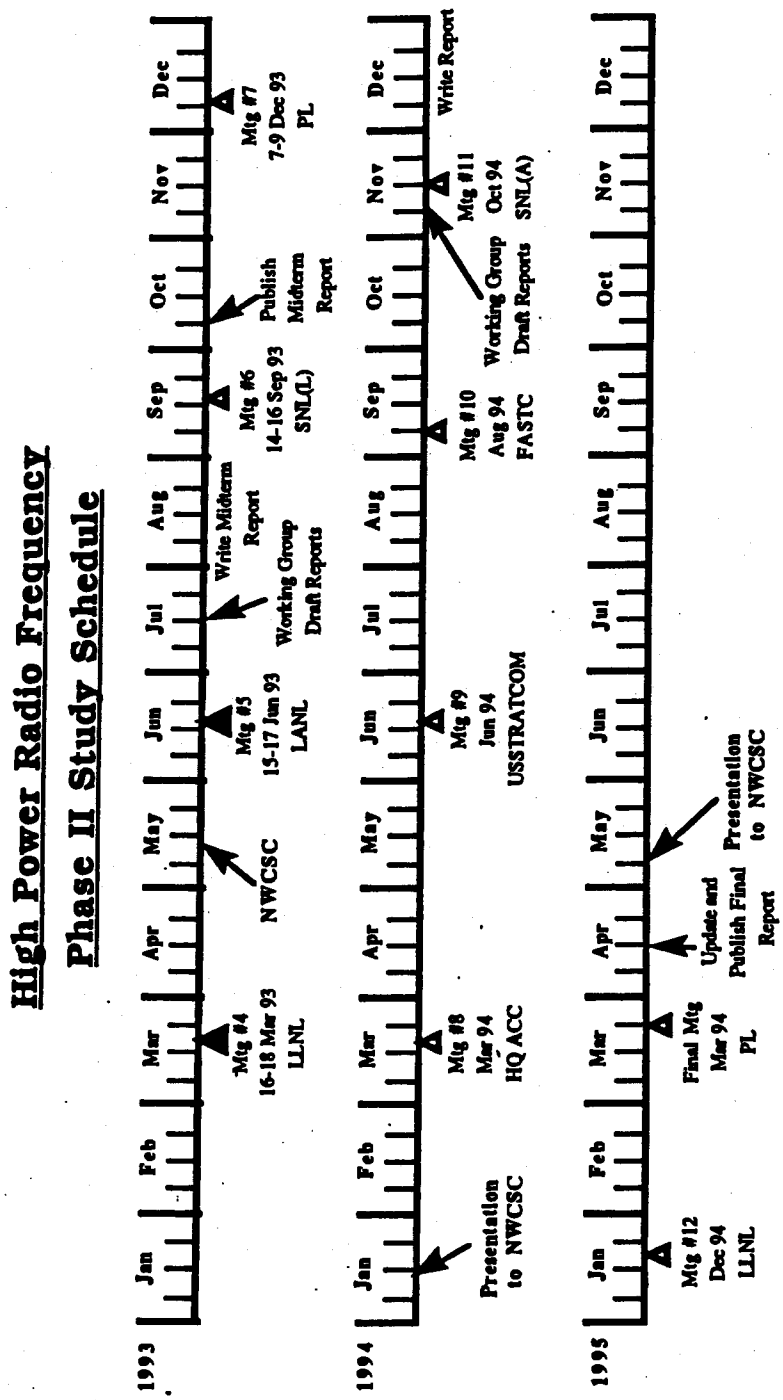

Figure 1. (U) HPRF Phase 2 schedule.

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APPENDIX A

(U) MEETING AGENDA

Agenda - June 17, 1993

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APPENDIX B

(U) MEETING ATTENDANCE LIST

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Meeting #5, 17 June 1993
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APPENDIX D

(U) SURETY WORKING GROUP

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Surety Working Group Summary

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Agenda
Surety Working Group Meeting on June 16, 1993 at LANL

Time	Speaker	Subject
10:00 AM	Jerry Cuderman	Introduction and Action Items
10:15	Jeanne Evans	QFD Update
10:45	Paul Rexroth	Safety Subgroup Report
11:15	Larry Moore	Use Control Subgroup Report
11:45	All	Discussion and Planning for next Meeting
12:00	Adjourn	

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NUCLEAR SAFETY SUB-GROUP ACTIVITIES

- Members
  - Paul Rexroth,SNL (Chairman); Todd Fattor, OL-NS-ENG; Ron Peterson, SNL
- Identified 8 Criteria for Evaluating Candidates
  - Resistance to Direct Multipoint Initiation
  - Insensitivity or Incompatibility of Detonators
  - Exclusion Region Thermal Robustness
  - Exclusion Region Mechanical Robustness
  - Discrimination Ability of Stronglinks
  - Stronglink Resistance to Bypass
  - Stronglink Location
  - Weaklinks
- Made a First Cut at Evaluating Candidates

Resistance to Direct Multipoint Initiation

- Insensitive High Explosive
- Robust exclusion region
- Minimal Exclusion Region Penetration

Insensitivity or Incompatibility of Detonators

- Electric Slappers are better than EBWs
- DOI Slappers are better than Electric Slappers

Exclusion Region Thermal Robustness

- High Temperature Materials Throughout
- No "Softspots" at Joints or Penetrations
- No Pressure Sources

Exclusion Region Mechanical Robustness

- High-Strength Materials Throughout
- Adequate Thickness
- Design Strength
- No "Softspots" at Joints or Penetrations

Discrimination Ability of Stronglinks

- Non-Resettable, 24 Event, Mechanical Discriminator is Baseline
- Any Single Wrong Event Should Lock SL
- Trajectory Sensing Should See 24 Unique Events
- UQS Aquisition and Communication Requires Special Attention

Stronglink Location

- The Closer to the Physics Package the Better

Stronglink Resistance to Bypass

- Non-Conductive Transfer Reduces High Voltage Concerns
- Stronglink and Mounting Must Be Strong Enough To Survive Accident
- Avoid Penetrations into Exclusion Region

Weaklinks

- Necessary to Achieve Nuclear Detonation
- Rendered Irreversibly Inoperable Prior to Threat to Exclusion Region
- Mylar Capacitor Often Good
- PETN in Initiation Train Often Good

HPRF
Safety Themes

Kazuo Oishi-5161
6/16/93

NM Candidates #	Safety Theme	Description
1&2	A	CDU + DSA + TUSG
1&2	B	CDU + SSA + DSSL & TUSG
1&2	C	CDU + SSA + Inertial Switch
1&2	D	DOI + TUSG

SYSTEM CONSTRAINTS

Only one Human Intent unique signal.
No ESSG.

Desired Features

Maintain reversibility until armed. Only way to maintain reversibility is to store the USG information in temporary storage to delay its delivery to the SL at some appropriate time in flight, such as after trajectory UQS is generated. It may provide no safety credit, but it does provide enhanced protection and reversibility up to a point in time in the arming sequence.

Minimize Bypass. Other things equal, keep protection layer as close to the IHE as possible to minimize abnormal environment bypass of that protection layer. This may be called an enhancement. In this respect, DSSL is better than SALAD because, while both isolates the pellet from the detonator, the DSSL displaces the pellet from the normal explosive chain rather than the barrel with the pellet still in-line. Both are still better than SLs at the arming circuits. However, DSSL or SALAD may require additional certification tests on proposed NEPs.

Improve SLs. DSA SL could have been replaced by DOI type SLs (pin and maze which is less subject to tornado vortex, and leaf spring), but it was not chosen because of the development time and cost. It would potentially have provided better performance.

DSA and SSA eliminates the need for a LAC. SSL requires a LAC.

Maximize independence of safety subsystems. However, HPRF is limited to only one Human Intent signal source (which has yet to be proven implementable) and the ESSG has been removed. The TUSG provides more inherent safety than the Inertial Switch because it theoretically can provide a more unique signal that nature can't provide. However, that may not be practical, so a gating or anding function with the Human Intent could help deny the application of this signal to the SL until the last minute in case of anbormal environments. This obviously compromises the independence desired, but is felt to be an improvement over not doing it.

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TRAJECTORY UNIQUE SIGNAL GENERATOR (TUSG)

The proposed TUSG is approximately 2x3x6 inches and weighs approximately the same as the existing TSSGs.

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Doug Weiss is the design contact in 2337. We will submit a short one page description in the next 2 weeks (he is not available next week).

The TUSG will sense the 3 stages of missile boost plus the spin of the reentry vehicle. We will attempt to use as many independent sources of information to generate the UQS as the flight progresses.

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The rolomite technology is fairly mature.

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SAFETY THEME #A

NM HPRF Candidates #1&2

(Conventional CDU + DSA + TUSG)

FLECTRICAL EXCLUSION REGION (Primary and CDU) protected by:

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SL INPUTS:

1. Human Intent is stored temporarily in programmer to delay actual enablement of SL as long as reasonably possible.
2. WH Trajectory Unique Signal Generator (TUSG) generates a UQS based on 3 stages and RB spin.

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PERSONNEL SAFETY:

1. LDIA optical actuation of GES prevents inadvertant actuation by ESD.
2. NG and NG det is TBD. The NG must be electrical prior to 2000, and may be explosive afterwards. The det may be SCB or SP.

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SAFETY THEME #B

NM HPRF Candidates #1&2

(Conventional CDU + SSA + DSSL & TUSG)

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SL INPUTS:

1. Human Intent is stored temporarily in programmer to delay actual enablement of SL as long as reasonably possible.
2. WH Trajectory Unique Signal Generator generates a UQS based on 3 stages and RB spin.

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PERSONNEL SAFETY:

1. LDIA optical actuation of GES prevents inadvertant actuation by ESD.
2. NG and NG det is TBD. The NG must be electrical prior to 2000, and may be explosive afterwards. The det may be SCB or SD.

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SAFETY THEME #C

NM HPRF Candidates #1&2

(Conventional CDU + SSA + Inertial Switch)

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SL INPUTS:

1. Human Intent enables SL without delay.
2. The Inertial Switch should enable the arming circuits upon fact of third stage burn, not first stage burn. However, if the MC3160 is used, it will be the latter.

PERSONNEL SAFETY:

1. LDIA optical actuation of GES prevents inadvertant actuation by ESD.
2. NG and NG det is TBD. The NG must be electrical prior to 2000, and may be explosive afterwards. The det may be SCB or SD.

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SAFETY THEME #D

NM HPRF Candidates #1&2

(DOI + TUSG)

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DOI OPA INPUTS:

1. Human Intent is stored temporarily in programmer to delay actual enablement of SL as long as reasonably possible.
2. WH Trajectory Unique Signal Generator (TUSG) generates a UQS based on 3 stages and RB spin.

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PERSONNEL SAFETY:

1. LDIA optical actuation of GES prevents inadvertant actuation by ESD.
2. NG and NG det is TBD. The NG must be electrical prior to 2000, and may be explosive afterwards. The det may be SCB or SD.

Preliminary Study on Pu and Gas Dispersal

(Roger Breeding, SNL)

- Plutonium Dispersal
  - Plutonium dispersal was analyzed in the MM III Replacement Warhead Phase 1 Study for storage, transportation, and silos. The results should be directly applicable to HPRF
- Gas Dispersal
  - Hazard from Gas Combustion Appears Secondary
    - » Energy contained in gasoline in transportation is much greater than energy contained in gas inventory
    - » Energy in Rocket Propellants in silos is even Greater
  - Radiological hazard can be comparable to Pu Scatter
    - » All of the tritium is dispersed; only part of Pu
    - » Toxicity/ci <<< Pu, but Specific Activity >>>

APPENDIX E

(U) SYSTEM ENGINEERING WORKING GROUP

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HPRF Phase 2 Study

Systems Engineering Status Report

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16-17 June 1993
Los Alamos National Lab
Los Alamos, NM

Agenda
System Engineering Working Group
16 June 1993

General Information -- Hogan
NM Design Concepts:
- warhead -- Haertling
- electrical -- Oishi
- mechanical -- Shultze

CA Design Concepts:
- warhead -- Chow
- electrical -- Hogan
- mechanical -- Buck, Faas

Flight Calculations -- Shover
Hardware Procurement -- Buck
Missile Integration -- Ericksen
Action Items -- Hogan
Discussion

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HPRF

SYSTEM ENGINEERING WORKING GROUP

WARHEAD LAYOUTS

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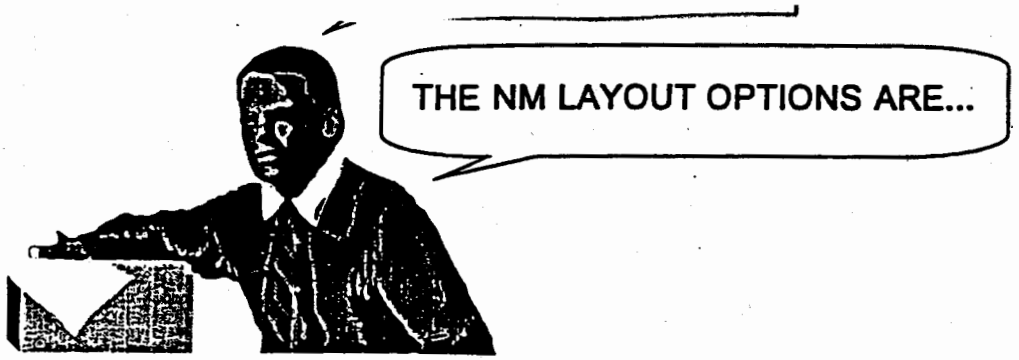

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HPRF
PHASE 2 STUDY
SEWG Meeting #5

16 June, 1993

Richard Keyser
Staff Member
LANL/WX-5

Los Alamos

WX-5

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APPENDIX F

(U) REQUIREMENTS WORKING GROUP

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APPENDIX G

(U) WARHEAD DESIGN WORKING GROUP

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Action Item for both Livermore and Los Alamos members of Warhead Design Working Group:

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Action Item for Vulnerability Working Group:

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Warhead Design Working Group: LLNL Activities Status Report

by
Deborah Wojtowicz, LLNL A-Division

High Power Radio Frequency Phase 2
Meeting # 5

Los Alamos National Laboratory
June 16-17, 1993

Summary of status

- Postshot calculations are continuing (need LANL data)

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- Output calculations to David Mayhall

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APPENDIX H

(U) MISSION ANALYSIS WORKING GROUP

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MISSION ANALYSIS WORKING GROUP

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OVERVIEW

- ACTIONS SINCE LAST MEETING
- REORGANIZATION
- ACTION ITEMS

MAWG ACTIONS

- SNL - DR DAVE FORDHAM
- LLNL - DR AL KAUFMAN
- PL - LT DAVE VANVELDHUIZEN

REORGANIZATION

- ICBMs TRANSFERS FROM ACC TO AFSPACECOM
- EFFECTIVE 1 JUL 93

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ACTIONS ITEMS

- #21 - MISSION NEED STATEMENT
- #35 - TEST OBJECTS ALIGN WITH MODELING EFFORT
- #49 - FUNDING SHORTFALL
- #56 - PROVIDE TIMELINES OF INFORMATION REQUIRED FROM OTHER WORKING GROUPS
- #57 - RESPOND TO SEWG QUESTIONS

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ANALYSIS

PLAN

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APPENDIX I

(U) VULNERABILITY WORKING GROUP

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