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DEPARTMENT OF THE AIR FORCE
AIR FORCE MATERIEL COMMAND (AFMC)
NUCLEAR WEAPONS INTEGRATION DIVISION

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MEMORANDUM FOR DISTRIBUTION

15 July 1994

FROM: SA-ALC/NWIC (AFMC)
1651 First Street S.E.
Kirtland AFB, NM 87117-5617

SUBJECT: HPRF Phase 2 Study General Meeting 94-2 (#9) Minutes

Attached is a copy of the Minutes from the High Power Radio Frequency Phase 2 Study General Meeting 94-2 (#9) held 16 June 1994 at the Los Alamos National Laboratory, Los Alamos, New Mexico. If you have any questions or comments please call me at (505) 846-9575 or my direct number of 846-4001 ext. 208, DSN is 246-9575 or 246-4001 ext. 208.

Keith M. Baird

KEITH M. BAIRD
HPRF Study Director
Nuclear Advanced Concepts Branch

Attachment:
HPRF Phase 2 Study General Meeting 94-2 (#9) Minutes including Distribution List

Redacted Copy

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW
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2ND REVIEW-DATE: 11/8/99 | 3. CONTAINS NO DOE CLASSIFIED INFO
AUTHORITY: DD | 4. COORDINATE WITH: DoD was
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NWIC-MM-94-2

MINUTES

HIGH POWER RADIO FREQUENCY (HPRF)
PHASE 2 STUDY GENERAL MEETING 94-2 (# 9)
16 JUNE 1994

Keith M. Baird
HPRF Study Director

NUCLEAR ADVANCED CONCEPTS BRANCH
NUCLEAR WEAPONS INTEGRATION DIVISION
SA-ALC NWIC (AFMC)
1651 FIRST STREET SE
KIRTLAND AIR FORCE BASE NEW MEXICO 87117-5617

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MINUTES

HIGH POWER RADIO FREQUENCY

PHASE 2 STUDY GENERAL MEETING 94-2 (# 9)

16 JUNE 1994

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DISTRIBUTION 191

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MINUTES

HIGH POWER RADIO FREQUENCY

PHASE 2 STUDY GENERAL MEETING 94-2 (#9)

16 JUNE 1994

I. (U) INTRODUCTION. The High Power Radio Frequency (HPRF) Phase 2 Study General Meeting 94-2 (# 9) was hosted by the Los Alamos National Laboratory (LANL), Los Alamos, New Mexico, on 16 June 1994. Mr Keith Baird, HPRF Study Director, Nuclear Advanced Concepts Branch (NWIC), Nuclear Weapons Integration Division (NWI), chaired the meeting.

A. (U) Administration. Mr Baird welcomed the attendees and Dr Michael Bernardin, LANL, provided administrative information. A special thanks to Dr Bernardin and LANL for hosting the meeting. The meeting agenda and list of attendees are attached as Appendices A and B, respectively.

B. (U) Executive Working Group Membership. All members and observers or their representatives, except for the Det 10 SMC, and Ogden Air Logistics Center and SAF/AQQS (N), were present. Current members and observers, and their organizations are identified in Appendix C.

C. (U) Schedule/Milestones. The Working Group Chairmen were reminded of the importance to work towards meeting the schedule and milestones in Appendix D. The Study Director requested that each working group chairmen provide changes/additions to the Schedule/Milestones for their respected sections as they occur.

II. (U) DISCUSSION TOPICS.

A. (U) Program Update. Mr Baird, HPRF Study Director, addressed administrative program issues (Appendix E).

1. (U) Mid-Term Briefings. The HPRF Mid-Term Briefings in May/June 1994 were well received.

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A question from Admiral Henry Chiles, CINC STRATCOM resulted in an action item to determine the magnitude of the HPRF Phase 2 Study in man/years expended.

2. (U) Final Report Outline. The outline for the final HPRF Phase 2 Study Report was presented and agreed to in general, however, the Working Group Chairmen may provide suggested changes to their respective chapter breakdown.

3. (U) Army TECOM Vulnerability Data. The Army TECOM at White Sands, New Mexico has a large vulnerability database as a result of their extensive systems hardness test program. Dr Bernardin, LANL, and Captain Warzinski, FCPRA will visit White Sands in July 1994 to determine what system vulnerability data is applicable to the HPRF program.

4. (U) Vulnerability Community Data Consensus Meeting. The vulnerability community will be asked to review the HPRF vulnerability database to ensure it is complete without any major gaps.

5. (U) Strategic Command (STRATCOM) Meeting. A meeting will be scheduled in August 1994 with interested HPRF Phase 2 Study members and STRATCOM targeteers to discuss HPRF system applications.

6. (U) Study Tasking Review. The study tasking was reviewed by the HPRF Study Director to remind members what was required by the original study tasking. One of the concerns that the Phase I Study tasking letter identified was post-strike analysis

assessment methods. This has not been addressed in the Phase 2 Study. Also four months prior to the end of the Phase 2 Study, the preferred warhead candidate is required to be submitted as input for the Department of Energy's (DOE's) Major Impact Report (MIR). The MIR addresses the DOE's product capability assessment. Related issues also planned for inclusion in the final HPRF Phase 2 Study Report are maintaining the nuclear technological base and exercising the DOE production facilities. An action item was assigned on exercising the new DOE production complex to support the HPRF program.

7. (U) Support Through End of Study. Future agency funding support for the Phase 2 Study has been mentioned by some participants as uncertain. The Study Director requested that Agency representatives need to work with their management to obtain adequate funding through the end of the study to ensure complete documentation of the study effort.

B. (U) Requirements Working Group Report. [redacted] USAF b(1) presented a status of the topics addressed at the Requirements Working Group (RWG) meeting held 13-14 June 1994 (Appendix F). The purpose of the meeting was to discuss the comments received on Draft 3 of the Military Characteristics (MCs) and on Draft 2 of the Stockpile to Target Sequence (STS) document. The MCs and Section 1 (Introduction), Section 2 (Logistics), and a portion of Section 3 (Environments) of the STS were reviewed in detail. Changes will be reflected in the MCs Draft 4 and STS Draft 3 documents scheduled to be submitted to RWG and HPRF Executive Working Group (EWG) members during the week of 4 July 1994. Use Control requirements will be updated in the MCs Draft 4 to include requirements provided in the draft Department of Defense (DoD) Directive C-3150.aa. Nuclear environments continue to be a topic for discussion; however, it appears the W78 nuclear environments will satisfy the HPRF nuclear environments for Phase 2 Study

4. (U) Schedule and Final Report. The methodology for evaluation of surety features of the warhead candidate designs is complete and includes operational safety, nuclear detonation safety, dispersal safety and use control. Preliminary evaluations have been completed. Final candidate design definitions are required to complete SWG tasks. Due to funding uncertainties, it is essential to complete as much of the surety evaluations during FY94. Accordingly, an SWG schedule is shown in Appendix G.

D. (U) Warhead Design Working Group Report. presented a status of the topics addressed at the 15 June 1994 Warhead Design Working Group (WDWG) meeting.

The information presented on the New Mexico candidates is the same as that presented at the joint SWG/SEWG and is included in Appendix G.

1. (U) New Mexico Candidate Designs. LANL presented engineering layouts for the current candidates. The Phase 2 engineering for Candidates 1 and 2 is essentially complete. Candidate 3 is nearing final definition. The subject of weight and volume constraints was discussed with the conclusion that further information is required.

2. **Stockpile Improvement Programs and Modifications.** LANL related a request from Admiral H.G. Chiles, STRATCOM Commander, during an interim HPRF briefing at Offutt Air Force Base, Nebraska.

E. (U) Systems Engineering Working Group Report.

presented a status of the topics addressed at the 15 June 1994 Systems Engineering Working Group meeting which was held jointly with the SWG. Topics discussed at the meeting included TRW flight calculations and New Mexico design updates (Appendix G).

1. (U) Gas Transfer System Design.

One

USAF b(1)

2. (U) Flight Calculations. [redacted] QF-16 HPRF-1

DOE, USAF b(3)

TRW suggested any new payload would require a new support deck and flight testing. The payload weight constraint the study is designing against was questioned. The TRW position contradicted the Ogden Air Logistics Center opinion limiting the excursions from the current payload specifications (e.g. weight, c.g.) to facilitate system integration without flight testing and platform redesign, i.e. the concept of transparency.

[redacted] b(1) b(3)

DOE, USAF DTRA

F. (U) Vulnerability Working Group Report. [redacted] USAF

presented a status of the activities associated with the VWG (Appendix I), addressed at the 25-26 May 1994 joint Mission Analysis Working Group (MAWG)/Vulnerability Working Group (VWG) meeting [redacted] b(1)

DOE, USAF DTRA b(3)

These tests complete the SNL test effort in support of this study. Final test reports will be published during November-December 1994. The PL test programs were reviewed.

This ensures the most recent vulnerability test and analysis results are incorporated into the mission analysis portion of the study. SNL has been assigned to address data transfer gaps between the MAWG and the VWG as shown in Appendix I. The VWG schedule for meeting final report milestones is also shown in Appendix I.

G. (U) Mission Analysis Working Group Report. [redacted] presented a status of topics, associated with the MAWG (Appendix J), addressed at the 25-26 May 1994 joint MAWG/VWG meeting.

1. [redacted] **Penetration Mission Analysis.** This analysis is behind schedule with the baseline scenario not to be completed until the end of July 1994. This slip should not impact delivery of the draft analysis.

b(3)

CG-ITPRF-1

DOE, USAF DTRA

III. (U) ACTION ITEMS. Twenty-two action items were closed from previous meetings and four action items remain open. Four new action items were assigned as a result of this meeting.

A. (U) Old Action Items.

1. (U) *Action items 25-27, 29-32, 44-45, 59-61, 63 and 70 were **closed** with work being performed in accordance with the various working group charters.*

b(3)

DOE, USAF DTRA

3. (U) 7-4. Assigned to the WDWG. The TBDs in the intrinsic radiation paragraph 2.7.7 of the MCs needs to be worked as the warhead design is finalized.

USAF b(1)

This action item is **closed.**

b(1)

DOE, USAF DTRA b(3)

5. (U) 7-6. Assigned to the RWG. What STS radiation environment levels must the HPRF warhead survive during launch, mid-flight and reentry? Provide information to the SEWG. **Suspense: September 1994.**

6. (U) 7-7. Assigned to the RWG. Provide HPRF MCs' Use Control requirements to the SEWG. *Use control is being worked based upon a new draft DoD Directive C-3150.aa..* This action item is **closed.**

7. (U) 7-8. Assigned to Each Working Group Chair. Provide plan of action, along with timelines, to include major activities between December 1993 and end of study. Also, need Working Group schedules with milestones to incorporate into overall study schedule. Provide information to the HPRF Phase 2 Study Director. *This information has been provided.* This action item is **closed.**

8. (U) 94-1-1. Assigned to the VWG and WDWG. Review MC requirements in paragraphs 2.2.1 and 2.6.1 and provide the RWG recommended wording for the warhead's design enhancement for peak field and energy coverage. **Suspense: 15 July 1994.**

9. (U) 94-1-2. Assigned to the WDWG. DoE b(3)

/ This action item is **closed.**

10. (U) 94-1-3. Assigned to the VWG. Provide to NWIC funding requirements for continued test data refinements to FAAT estimates through Kaman Sciences Corporation. *Funding requirements were provided and $33.6K of NWI funds were MIPR'd through PL to KSC to support this effort.* This action item is **closed.**

11. (U) 94-1-4. Assigned to the VWG. USAF b(1

Funding requirements were provided and $50K of NWI funds were MIPR'd to LLNL to support this effort. This action item is **closed.**

[redacted]

DOE, USAF DTRA b(3)

13. (U) 94-1-6. Assigned to NWIC. Investigate the HOQ evaluation process for use on other new warhead programs/concepts/designs. *An organization within NWI is investigating the HOQ evaluation process for future use.* This action item is **closed.**

B. New Action Items.

1. (U) 94-2-1. Assigned to all HPRF Agency Representatives (EWG members): Provide estimate of manyears expended by your agency on the HPRF Phase 2 Study from the beginning in August 1992 through the projected end in March 1995. Provide estimates to HPRF Study Director. **Suspense: 30 June 1994.**

2. (U) 94-2-2. Assigned to TRW. Modify payload weight verses range chart to include lower reentry angles.

Suspense: 30 June 1994.

USAF b(1)

3. (U) 94-2-3. Assigned to AFSPC/DOMN. Provide reason the HPRF Phase 2 Study Group did not pursue the fifth mission in the tasking letter. Provide the reason to the HPRF Study Director. **Suspense: 30 June 1994.**

4. (U) 94-2-4. Assigned to DOE/AL/WPD. Provide proposed draft write-up on "Exercising the new DOE production complex" for the HPRF Final Report. Provide this draft write-up to the HPRF Study Director. **Suspense: Next HPRF Phase 2 Study General Meeting 94-3 (#10) scheduled for the Air Force Space Command (AFSPC) on 22 September 1994.**

IV. (U) NEXT MEETING. The HPRF Phase 2 Study General Meeting 94-3 (# 10) will be held on 22 September 1994 at Kaman Sciences Corporation representing AFSPC, Colorado Springs, Colorado. The Working Groups will hold their meetings independently at the call of the respective chairmen at a time and place agreeable to those involved. Meeting rooms will be reserved at KSC for 20-21 September 1994 for working groups to meet but time and room will be arranged for by the respective working group chairman.

APPENDIX A

AGENDA

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AGENDA

HPRF PHASE 2 STUDY GROUP GENERAL MEETING 94-2(#9)
at Los Alamos National Labs
16 June 1994

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APPENDIX B

LIST OF ATTENDEES

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HPRF General Mtg 94-2 Attendance List 16 Jun 94 @ LANL

Agency	Rank	First Name	Last Name	DS	AC	Phone #	City or Base	ST	ZIP Code
Dept of Defense									
USSTRATCOM/J533	Mr	Stan	Gooch	271	402	294-5254	Offutt AFB	NE	68113-6500
USSTRATCOM/J004	Maj	Kevin	Kirsch	271	402	294-7466	Offutt AFB	NE	68113-6500
USSTRATCOM/J5231	Maj	Steven	Langer	271	402	294-5070	Offutt AFB	NE	68113-6500
FCDNA/FCPRA	Capt	Skip	Langbehn	246	505	846-8575	Kirtland AFB	NM	87117-5616
FCDNA/FCPRA	Capt	John	Warzinski	246	505	846-8575	Kirtland AFB	NM	87117-5616
US AIR FORCE									
HQ AFSPC/DOMN	Capt(E	Mike	Morgan	692	719	554-5428	Peterson AFB	CO	80914-4120
HQ AFSPC/DOMN	Maj	John T.	Valverde	692	719	554-5995	Peterson AFB	CO	80914-4120
SA-ALC/NWIC	Mr	Keith	Baird	246	505	846-9575	Kirtland AFB	NM	87117-5617
SA-ALC/NWIS	Mr	William R.	Barry	246	505	846-9576	Kirtland AFB	NM	87117-5617
SA-ALC/NWIW	Mr	Frank	Carrillo	246	505	846-6767	Kirtland AFB	NM	87117-5617
SA-ALC/NWIM	Mr	Daniel	Granados	246	505	846-4611	Kirtland AFB	NM	87117-5617
SA-ALC/NWIC	LtCol	Roger	Kropf	246	505	846-9575	Kirtland AFB	NM	87117-5617
SA-ALC/NWIC	Mr	Jim	Sweeney	246	505	846-6767	Kirtland AFB	NM	87117-5617
PL/WSM	Mr	Sam	Gutierrez	246	505	846-4823	Kirtland AFB	NM	87117-5776
PL/WSM	Mr	Stephen L.	Langdon	246	505	846-4823	Kirtland AFB	NM	87117-5776
PL/WSR	Mr	Robert	Torres	246	505	846-0296	Kirtland AFB	NM	87117-5776
US ARMY									
US ARMY ARDEC	Mr	Philip	Angelotti	880	201	724-5451	Picatinny Arsnl	NJ	07806-5000
US Army ARDEC	Mr	Donald	Huie	880	201	724-2720	Picatinny Arsnl	NJ	07806-5000
ARL/AMSRL-WT-ND	Dr	Christopher	Kenyon	356	703	490-2311	Adelphi	MD	20283-2800
Dept of Energy									
DOE/HQ, DP-121	Mr	S.	Johnson		301	903-2984	Germantown	MD	20874-5000
DOE/AL-WPD	Mr	Karl	Rueb	245	505	845-5189	Albuquerque	NM	87185-5400
Los Alamos Nat Labs									
LANL/ESA-7	Mr	Lee	Anderson		505	665-2762	Los Alamos	NM	87545-2345
LANL/X-5	Dr	Michael	Bernardin		505	667-1439	Los Alamos	NM	87545-2345
LANL	Mr	Troy	Eddleman		505	667-6811	Los Alamos	NM	87544
LANL	Mr	Mike	Haertling		505	667-0592	Los Alamos	NM	87545-2345
LANL	Mr	John	Hutchinson		505	665-3665	Los Alamos	NM	87545-2345
LANL/ESP-7	Mr	Tom	ILG				Los Alamos	NM	87545-2345
LANL	Dr	Ronald	McFee		505	667-1682	Los Alamos	NM	87545-2345
LANL	Mr	Ed	Whitted		505	665-0038	Los Alamos	NM	87545-5000
LANL/NWT	Mr	Larry	Witt		505	667-6609	Los Alamos	NM	87545-2345

APPENDIX C

EXECUTIVE WORKING GROUP MEMBERSHIP

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HPRF Phase 2 Study
Executive Working Group Membership

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APPENDIX D
SCHEDULE/MILESTONES

	Milestone	Start	End	Remarks
☐	**Meetings**	6/16/94		Los Alamos, NM
☑	Completed Meetings			9 mtgs completed fr 11 Aug 92 Planning Mtg
☐	Future Meetings	6/16/94		Los Alamos, NM
☐	LANL Mtg 94-2 (#9)	6/16/94		Los Alamos, NM
☐	STRATCOM Mtg 94-3 (#10) (Tentative)	9/7/94		Omaha, NE
☐	AFSPC Mtg 94-4 (#11)	11/16/94		Colorado Sprs, CO
☐	LLNL Mtg 95-1 (#12)	1/26/95		Livermore, CA
☐	DOE/AL Mtg 95-2 (#13) Final Mtg	3/23/95		Albuquerque, NM
☐	**Working Groups**			
☐	RWG Milestones		7/4/94	MC & STS Drafts due
☐	MCs		7/4/94	Draft 4 distributed for comments
☑	MC Draft 3	3/14/94		
☐	MC Draft 4		7/4/94	
☐	MC Draft 5		9/1/94	
☐	HPRF WXX Final Draft MC		11/15/94	
☐	STS		7/4/94	Draft 3 distributed for comments
☑	STS Draft 2	4/18/94		
☐	STS Draft 3		7/4/94	
☐	STS Draft 4		9/1/94	
☐	HPRF WXX Final Draft STS		11/15/94	
☐	Issues			
☐	IAF&F			AF has never used, Navy has
☐	SWG Milestones		5/20/94	Develop UC Evaluation Methodology
☑	Nuc Det Op. Safety Methodology		12/8/93	
☐	Dev UC Eval Methodology	3/10/94	5/20/94	
☐	Evaluate Candidates	5/31/94	8/1/94	
☐	Write Draft SWG Report	8/1/94	10/28/94	
☐	Submit Draft SWG Report	11/4/94	11/4/94	
☐	Work on Draft SWG to Finalize	11/4/94	4/15/95	
☐	Issues			
☐	UC interface with ICBM			
☐	WDWG Milestones		9/7/94	Prel Written Report
☐	Prel written report		9/7/94	Inputs from both LLNL & LANL
☐	Final written report	9/7/94	11/16/94	
☐	Peer review of candidates	1/1/95		Input to Major Impact Report
☐	Issues			
☐	Number of candidates			DOE b(3)
☐				
☐	SEWG Milestones		7/30/94	Rough draft Internal SEWG
☐	Author Assignments			
☐	Stabilize UC designs		6/30/94	
☐	Stabilize flight trajectory calcs		6/30/94	

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APPENDIX E
PROGRAM UPDATE

PROGRAM UPDATE

EWG MEMBERSHIP

SCHEDULE/MILESTONES

MID-TERM BRIEFINGS

FINAL REPORT OUTLINE

ARMY TECOM VULNERABILITY DATA

VULNERABILITY COMMUNITY DATA CONSENSUS MEETING

MEETING AT STRATCOM TO BRAINSTORM HPRF APPLICATIONS

STUDY TASKING REVIEW

SUPPORT THROUGH END OF STUDY

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HPRF Phase 2 Study Report Format

Executive Summary

1. Introduction
   - 1.1 Background
   - 1.2 Tasking
   - 1.3 Navy Involvement
   - 1.4 Study Organization
   - 1.5 Scope of Study

2. Related Issues
   - 2.1 START Implications
   - 2.2 Warhead Certification
   - 2.3 Draft DODD C3150 "Controling the Use of Nuclear Weapons"
   - 2.4 Maintaining the Nuclear Technological Base
   - 2.5 Excercising the DOE Production Facilities

3. Mission Effectiveness Analysis & Assessment
   - 3.1 Mission 1
   - 3.2 Mission 2
   - 3.3 Mission 3
   - 3.4 Mission 4
   - 3.5 Mission 5

4. Vulnerability Testing, Analysis & Assessment
   - 4.1 FAAT Analysis
   - 4.2 High Level Tests
   - 4.3 Low Level Tests & Data Extrapolation

5. Warhead Candidates
   - 5.1 California Designs Descriptions
   - 5.2 New Mexico Designs Descriptions
   - 5.3 Joint CA/NM Design Description
   - 5.4 DOE Engineering Trade Studies
   - 5.5 Peer Review

6. System Engineering
   - 6.1 MMIII Delivery System Interface
   - 6.2 RV/Warhead design options
   - 6.3 IAF&F
   - 6.4 Packaging
   - 6.5 Use Control

7. Nuclear Surety
   - 7.1 Requirements
   - 7.2 Special Concerns
   - 7.3 Unique Issues

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APPENDIX F
REQUIREMENTS WORKING GROUP REPORT

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A Requirements Working Group Meeting was held on 13-14 June 1994 at Orion International in Albuquerque NM. The purpose of the Meeting was to discuss the Comments received on Draft 3 of the MCs and on Draft 2 of the STS document. Changes to the MCs will be reflected in Draft 4 scheduled to be submitted to RWG and EWG members during the week of 4 July 1994. Use Control continues to be a topic for the requirements. The Use Control requirements will be updated in the next Draft MCs to include the Use Control requirements provided in DOD Directive C-3150.aa.

The RWG reviewed Sections 1 (Introduction), Section 2 (Logistics), and a portion of Section 3 (Environments) of Draft 2 of the STS document. Comments during the meeting agreed upon at the meeting will be included in Draft 3 of the STS scheduled to be submitted during the week of 4 July 1994. Nuclear Environments continues to be a topic of discussion; however, it appears the W78 nuclear environments will satisy the HPRF nuclear environments. This will be discussed at the next RWG meeting.

In addition, a brainstorming session was conducted to list all the uniqe issues associated with the HPRF. A Draft point paper will be drafted to further amplify this unique issues and will be provided to all members for their review. The goal is to document all these issues in the Final Report.

Development of the requirements continues to be on schedule to meet the 15 November 1994 deadline.

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HPRF PHASE 2
REQUIREMENTS WORKING GROUP
MEETING 94-2
13-14 JUNE 1994

AGENDA

A. INTRODUCTION

B. MEMBERSHIP REVIEW

C. STUDY REPORT

D. MCs

E. STS

F. ACTION ITEMS

G. NEXT MEETING

H. ADJOURN

HPRF Warhead Phase 2 RWG
16 June 1994

Draft Outline for Study Report

- Requirements
  - Draft Statement of Need
  - Military Characteristic (Description)
  - STS (Description)
  - Unique HPRF issues
- Appendices
  - Draft MCs
  - Draft STS

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HPRF Warhead Phase 2 Study Group
General Meeting 94-2
16 June 1994
LANL, Los Alamos NM

STS

- Draft 2 of STSs was reviewed
  - Section 1 (Introduction)
  - Section 2 (Logistic and Employment Concepts)
  - Section 3 (Environmental Requirements)
- Draft 3 of the STS scheduled for week of 4 July 1994

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HPRF Warhead Phase 2
General Meeting 94-2
LANL, Los Alamos NM
16 June 1994

HPRF AI- 7-6 to RWG

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What STS radiation environments levels must the HPRF warhead survive during launch, mid-flight and reentry? Provide information to the SEWG.

Suspense: June 1994

UNCLASSIFIED

HPRF Warhead Phase 2
General Meeting 94-2
LANL, Los Alamos NM
16 June 1994

HPRF AI-7-7 to RWG

UNCLASSIFIED

Provide HPRF MC's Use Control requirements to the SEWG.

Suspense: June 1994

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HPRF UNIQUE ISSUES

DOE, USAF
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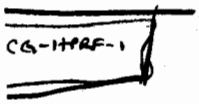
- Stockpile Sampling
- Certification (Testing)



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- Integrated AF&F
- RS Visually Indistinguishable
- FARR Issue (Use Control)
- Pu Dispersal
- Employment Strategy (Mission Need)
- Non-Compatibility with MK21 or MK12A
- Measure of Effectiveness
- Minimum Acceptable Reliability
- Opportunity Cost (W62 vs HPRF)

APPENDIX G
SURETY WORKING GROUP/SYSTEMS ENGINEERING WORKING GROUP REPORTS

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SEWG/SWG MINUTES –HPRF MEETING 9

USAF b(1)

The Surety and Systems Engineering working groups met in joint session on June 15, 1994 at Los Alamos National Laboratory. The following summarizes the presentations made at the joint session.

Summary of SWG Meeting Presentations

USAF b(1)

The objective of the briefing was to educate the SWG and SEWG participants on these components.

Use Control Themes– G. Strandin, K. Oishi
One of the requirements of the HPRF tasking was to consider use control implementation as recommended by the FARR study. Considerable progress was made in addressing use control since HPRF General Meeting #8. As a result of several meetings involving representatives of SNL, LLNL, TRW, and SA-ALC/NWIM, it appears that there are no show stoppers in the implementation of use control for weapons on the Minuteman III system. Preliminary examination of missile system warhead interfaces has revealed nothing that would preclude use control implementation up to and including CAT F if that proves to be the desired or required option. The presentations on use control themes addressed possible DOD requirements based on the FARR study and DoDD 3150.aa and included possible implementations based on the above referenced, recent discussions.

Use Control Theme Evaluation– Moore
Metrics were proposed for assessment of use control themes for the HPRF candidates. A PUGH matrix has been established to provide for collection of the assessment data. Initially, a meeting of each nuclear laboratory, its Sandia counterpart, and use control representatives will evaluate the candidates for that laboratory. This first iteration is intended to provide feed-back for each laboratory. A second iteration will be done if necessary. The second phase will be a joint meeting of both nuclear laboratories, their Sandia counterparts and the use control representatives to establish a consensus evaluation for all candidates. The results of the assessment will be presented at the December HPRF General Meeting #11.

Dispersal Evaluation– Breeding

b(1) DOE, USAF DTRA b(3)

[redacted] All of the candidate designs have a significant number of features in common. Since these are identical, they drop out of the evaluation process. There are, however, a number of features which differ from candidate to candidate.

b(1) DOE, USAF DTRA b(3)

The evaluation process is essentially a PUGH Matrix implementation.

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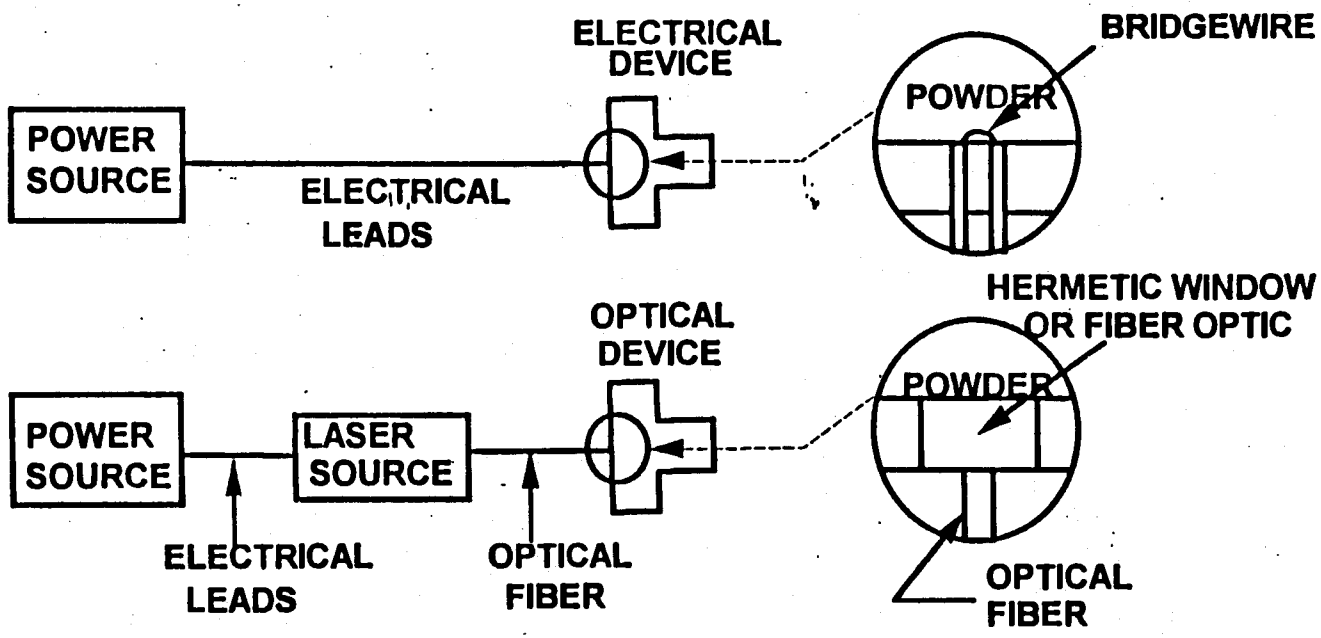
System Motivation and Overview



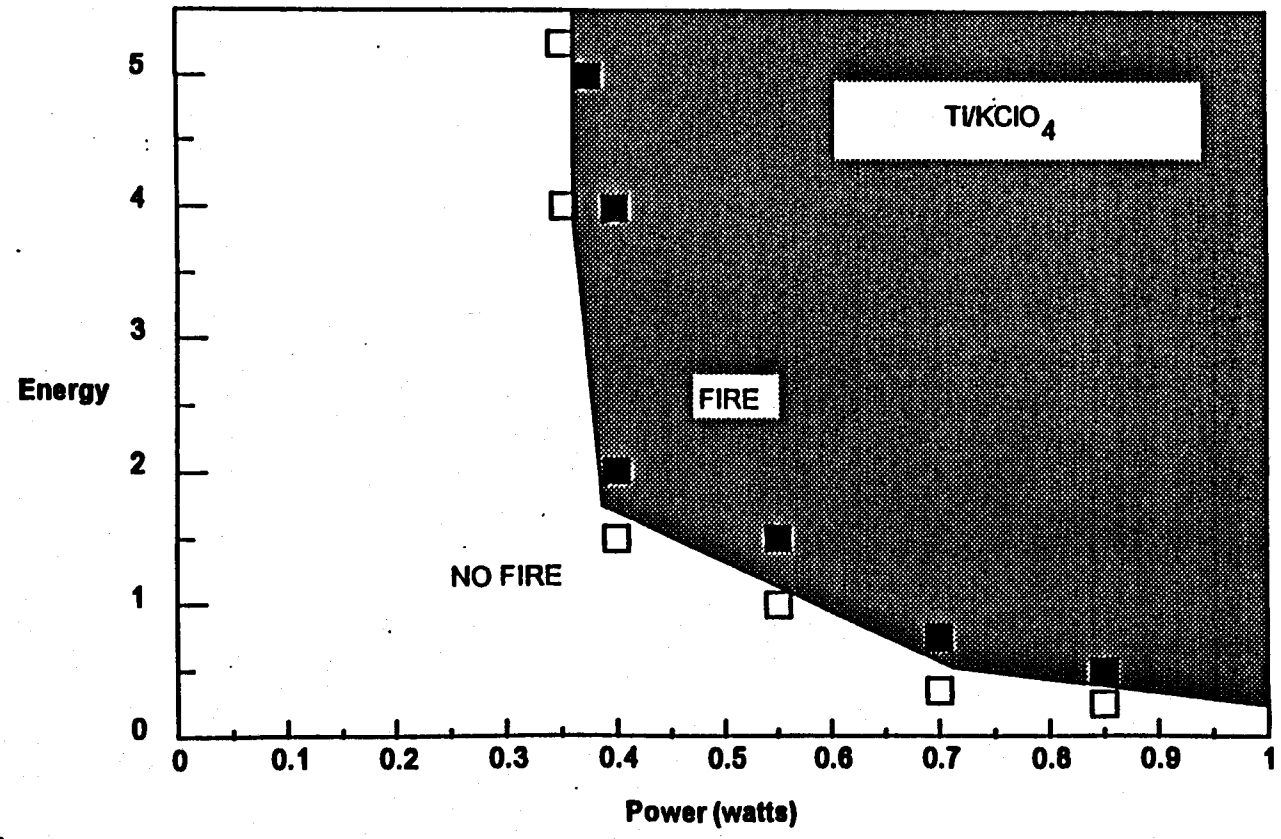
The absence of a bridgewire and electrical leads eliminates ESD, CAF and corrosion concerns. No fire and EMR concerns are also reduced.

Optical energy from the laser is absorbed by the powder to raise it to the autoignition temperature.

2/14/94 FJS 2662 vg3

Ignition Threshold for $Ti/KClO_4$

Thermal properties, such as thermal conductivity and the autoignition temperature, determine minimum requirements.



2/14/94 FJS 2652 vg8

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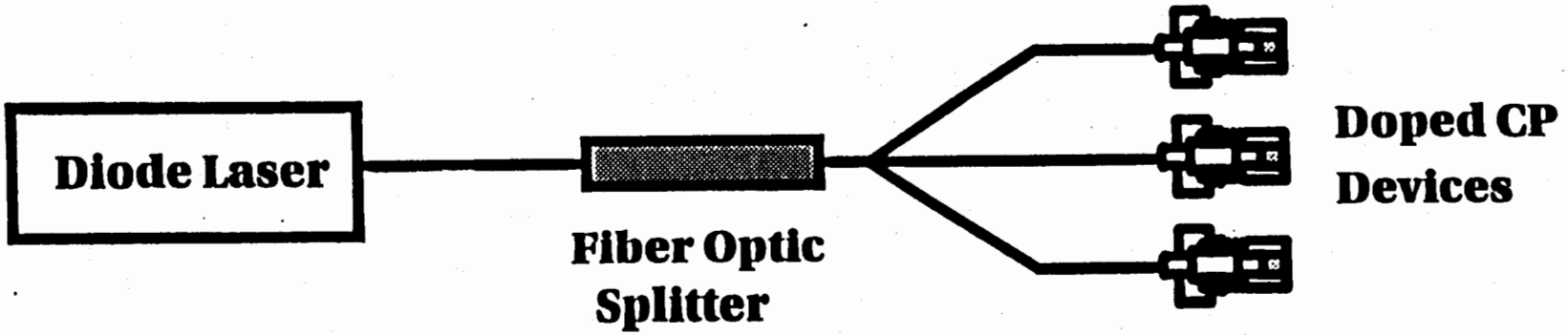
Multiple Ignitions With a Single Laser Diode

1.2 Watt optical power, 2.2 A pulse to laser diode

10 msec duration

100 micron optical splitter



Leg	Energy Level (mj)	Function Time (ms)
1	2.13	1.63
2	2.08	1.80
3	2.03	.892

2/14/94 FJS 2552 vg10

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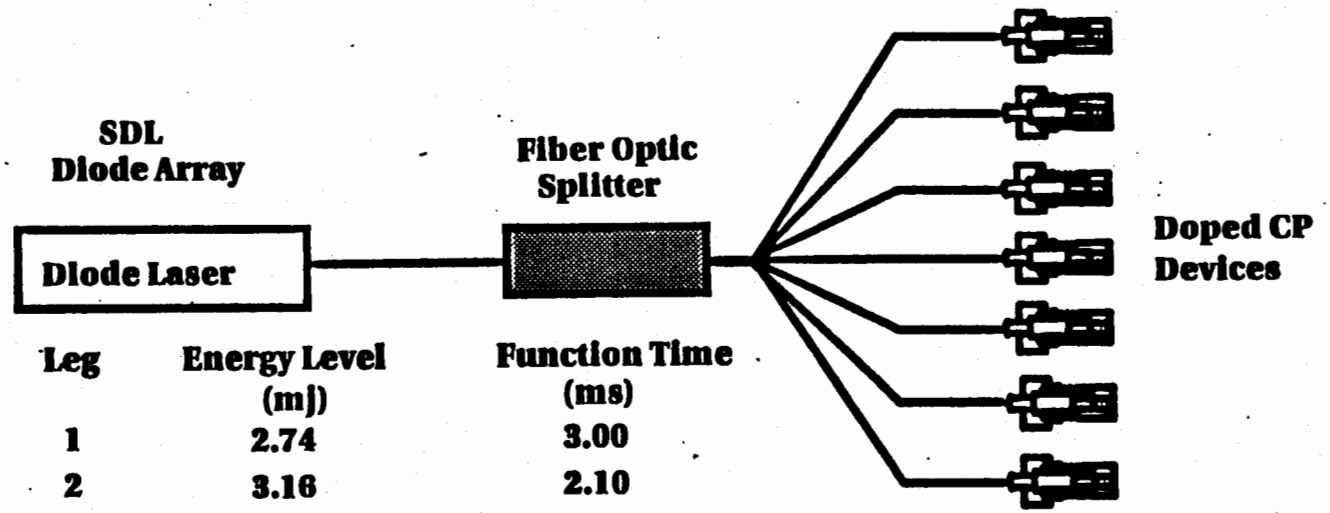
Multiple Ignitions From a 15 Watt Diode Array

8 Watts coupled from a laser diode array into a single 400 micron fiber. (26 A, 10 msec pulse)

Bundle of seven 100 micron fibers connected to CP detonators.



Leg	Energy Level (mJ)	Function Time (ms)
1	2.74	3.00
2	3.16	2.10
3	2.79	2.40
4	2.59	3.26
5	3.10	1.81
6	3.80	1.73
7	2.85	2.11

2/14/94 FJS 2662 vg11

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Thermal Environment Margin

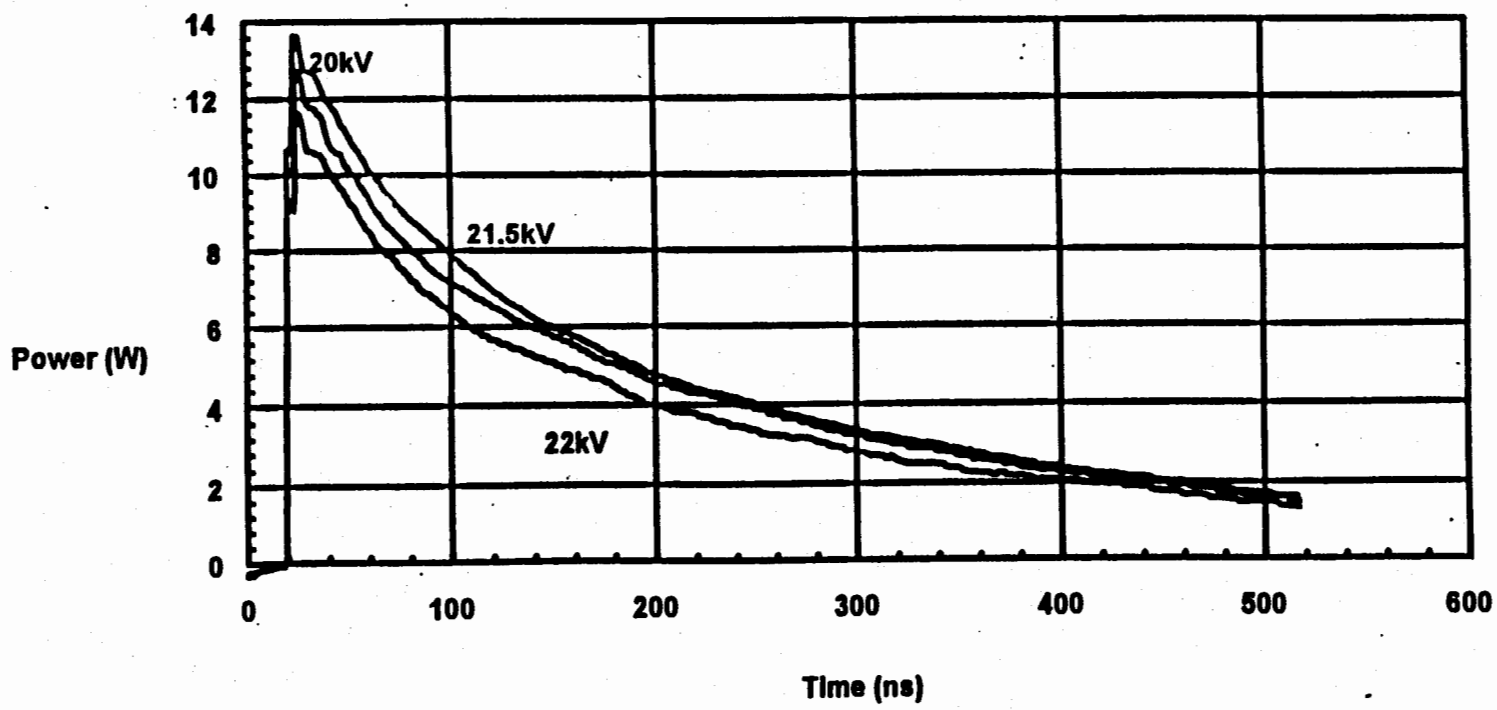
Variation in ignition threshold is small as a function of temperature.

Tests in liquid nitrogen show a small shift in threshold:

	ambient	-196 C
CP (no fire/fire)	(1.25 mJ/1.50 mJ)	(1.8 mJ/3.0 mJ)
$Zr/KClO_4$ (no fire/fire)	(3.0 mJ/3.25 mJ)	(3.0 mJ/5.0 mJ)

Optical Output From Laser Diode Exposed to ESD Pulse

Diode begins to fail and optical output is reduced as charge voltage is further increased.



2/14/94 FJS 2652 vg16

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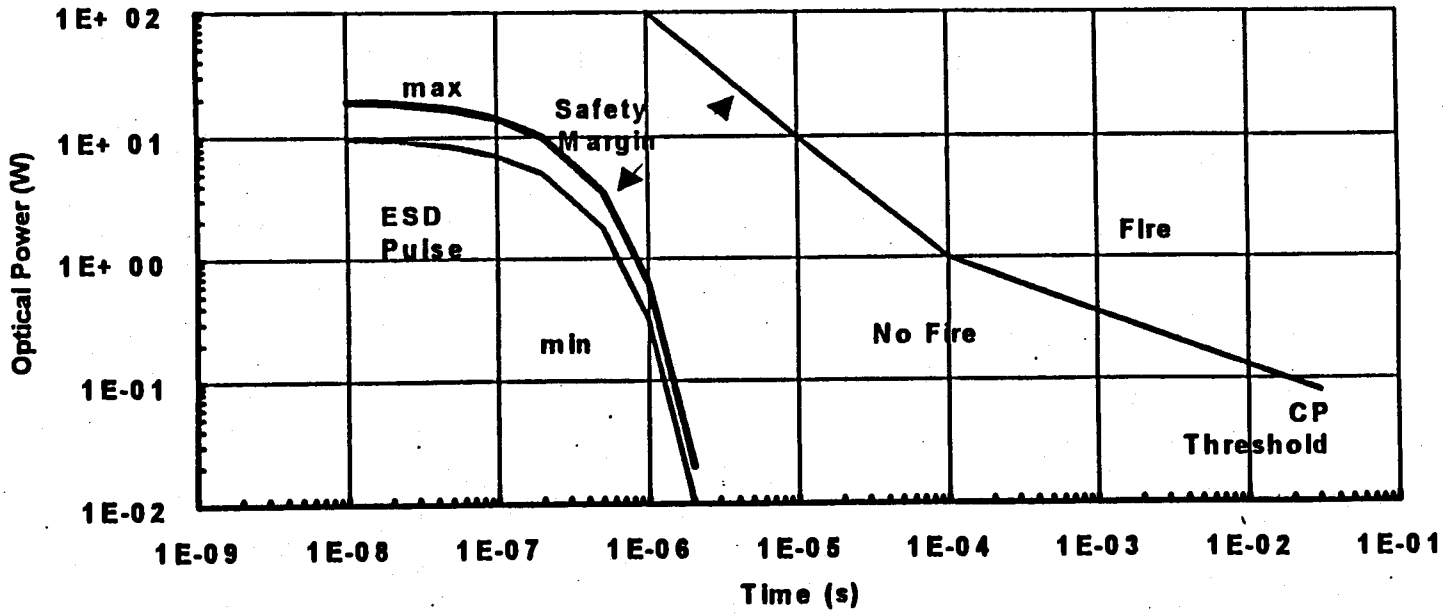
ESD and Ignition Energy vs. Time

Maximum optical energy and power output from the laser diode exposed to ESD is insufficient to ignite either CP or $Ti/KClO_4$



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ESD Sensitivity Summary

Explosive components are immune to ESD due to Faraday cage around the charge cavity.

The threshold for diode damage from an ESD pulse is variable and dependent on each individual diode.

The optical output from a laser diode exposed directly to the ESD pulse is <u>insufficient</u> to ignite explosives.

The time duration of the ESD induced optical pulse is too short and the optical energy is too low for ignition.

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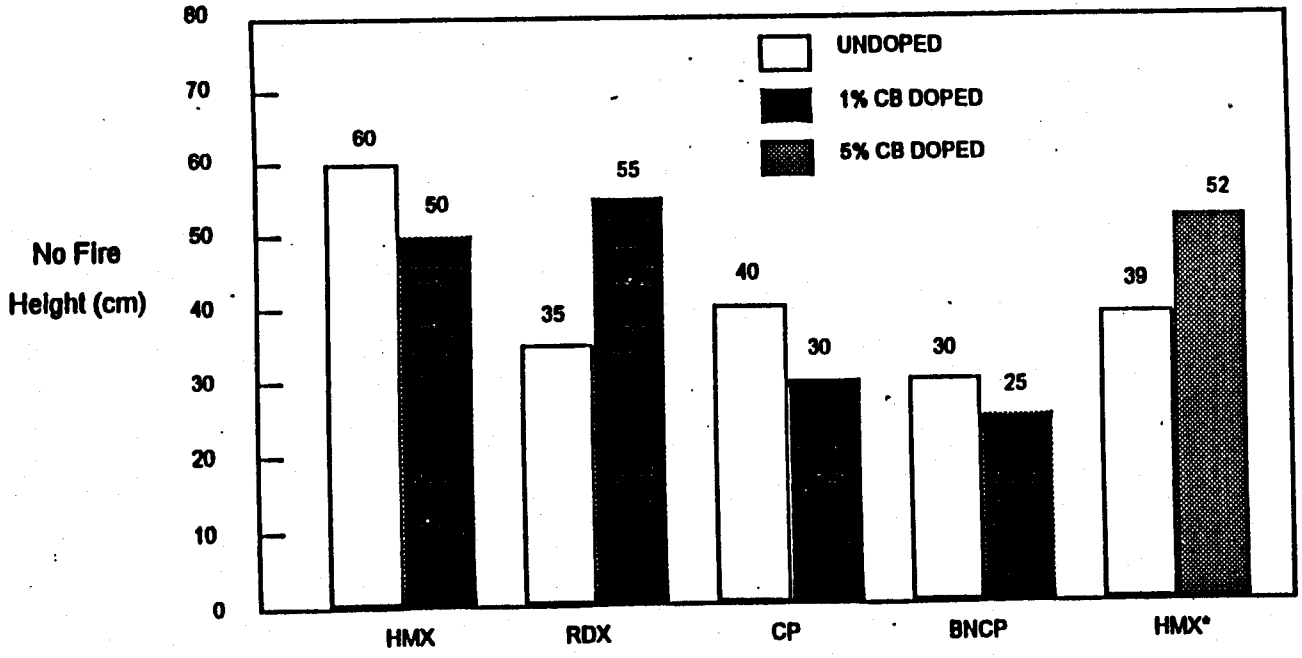
LDI Safety Enhancements

- Explosive components have been successfully tested against multiple ESD pulses.
- Tests at Sandia's lightning facility have shown that lightning flash is insufficient to ignite LDI explosive components.
- ESD tests on diodes show insufficient energy to ignite LDI components.
- No significant change in explosive safety with addition of dopants.



Data from J. Fronabarger UPI report # MTR-336

* 50% Height, J. Stimmel, M-1 LANL

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HPRF JOINT SURETY/SYSTEMS ENGINEERING WORKING GROUP MEETING

JUNE 15, 1994

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GENERAL USE CONTROL THEME (U)

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Gerald E. Strandin, Dept. 5371

Sandia National Laboratories/California

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These comments pertain to the General Use Control Theme Presentation by G. E. Strandin. The vugraphs are referred to by their title and include a brief elaboration of their contents.

Use Control Policy Documents Pertinent to HPRF
These three policy documents define the HPRF use control approach.

Use Control Requirements Determined by Policy
The essence of each policy documents is extracted in this vugraph. In its present draft form the DoD directive is more specific than the DOE memorandum.

Use Control Capabilities Required For HPRF
The use control capabilities required are most specifically called out by DoD Directive C-3150.aa and of course the FARR recommendations. The last "bulleted" item is also required by FARR recommendation #12 in addition to the MC's and the DoD directive.

Operational Assumptions for HPRF in MMIII with GRI
These items were agreed upon in a meeting May 12, 1994 of the appropriate personnel from TRW, SNL/NM, SNL/CA, SA-ALC/NWIM and LLNL.

Additional Assumptions for HPRF Use Control in MMIII
These items were also included in the May 12 meeting.

Figure 1 Use Control Physical Interfaces (U)
This figure depicts the physical layout of the LCC and LF stations where the indicated PAL operations can take place. Some variation on these indicated operations may be possible or desirable based on results of future studies, but this is the most likely operational configuration.

Figure 2 Reentry Vehicle Use Control Connections (U)
This figure depicts the interconnections within the RV for the use control system. Note that both the provision for the PAL controller using the Descrete Line PAL Interface (DLPI) and the serial link to the Missile Guidance Set, Digital Computer Unit MGS/DCU is shown.

Figure 3 Proposed HPRF System UC Configuration
Finally, the overall system block diagram is shown. Refer to the write up by Kazuo Oishi for comments on this Figure.

June 10, 1994

Use Control Policy Documents Pertinent to HPRF

- DOE Memorandum -- Protection of Nuclear Weapons and Nuclear Explosive Devices Against Deliberate Unauthorized Use, by Victor Stello, Jr. Principal Deputy Assistant Secretary for Defense Programs dated April 16, 1990.

- DoD Draft Directive C-3150.aa -- Controlling the Use of Nuclear Weapons, CNSI, dated July 9, 1993.

- Report recommendations of the Federal Advisory Committee on Nuclear Failsafe and Risk Reduction (FAAR), SFRD, dated October 30, 1992.

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Use Control Requirements Determined by Policy

- DOE Policy -- "An integrated system of positive measures shall be developed, implemented, and maintained to protect all nuclear weapons and NEDs in the custody of the DOE against deliberate unauthorized use."

- DoD Policy -- "Positive measures shall be taken to maintain control of all U. S. nuclear weapons and nuclear weapons systems during all phases of their life cycle. These measures shall consist of appropriate devices and procedural safeguards."

- FARR Recommendations #11, #12, and #29

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[redacted] b(3)

Use Control Capabilities Required for HPRF (U)

[redacted]

[redacted]

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[redacted]

Operational Assumptions for HPRF in MM III with GRP*

- Derive PAL unlock from existing EAM at LCC

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- Recoding of PAL to be in sync with weapon system code change
- Use tape loader (RCM/CTU)** position for recode to be conducted at the LF
- Requires no change to operational LCC and LF
- May require changes to the Wing Code Processing System

* Guidance Replacement Program
** Replacement Control Monitor/Cartridge Tape Unit

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Additional Assumptions for HPRF Use Control In MM III

- Communication with warhead from LCC and LF will be through Missile Guidance Set (MGS)
- Power required for W/H PAL operations supplied by MGS
- Serial link to PAL will be supplied by MGS -- this implies a hardware add and a software change to MGS
- Cabling changes required in Reentry System (RS)
- Warhead programmer (WHP) will be designed to commumicate with MGS and translate for W/H PAL

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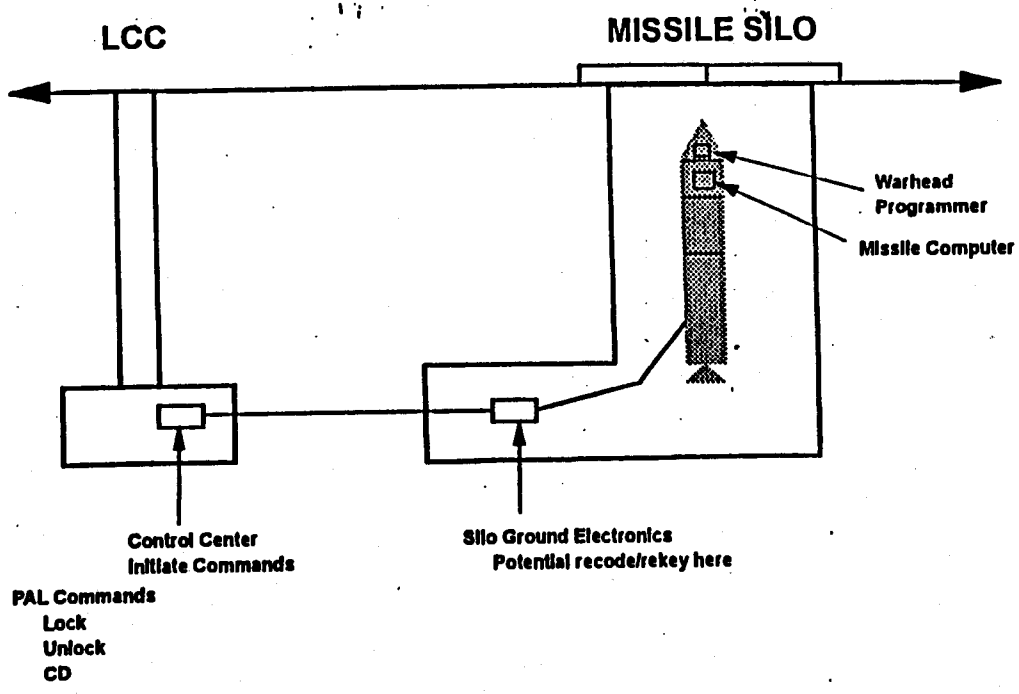
FIGURE 1. Use Control Physical Interfaces (U)



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Proposed HPRF UC Configuration
K. Oishi - SNL/5161
6/17/94

The UC system block diagram was generated on the basis that "CAT F Equivalent" was considered only as "CAT F" to expedite our study to present a somewhat "worst case" equivalency. It is a worst case situation to DOE since the implementation is applied at the WH itself and no credit was given to the protection provided by the total launch and missile complex. The "less than worst case" situations may then be presented based on this study and subsets of the traditional WH PAL and CD systems . It may also be a worst case for DoD since it requires extensive interfaces.

USAF b(1)

They may be incorporated as software and procedures within the LCC gear that already exists, as mentioned at the meeting, or they may be hardware boxes whose designers and builders are to be determined later beyond this study. In the absence of more detailed studies, we can not at this time down select the large list of options. At this time, it appears that the integrated software approach may be more likely. It appears that the PAL functions will be limited to lock and unlock and not status reporting. [redacted]

USAF b(1)

The PAL Controller at the LF is functionally depicted the same way as that at the LCC. It is assumed that the necessary communications, bus formatting and protocol will exist or be developed to make the remote operation possible. The operations would include the recode/verify, status, and rekey function.

USAF b(1)

The only link assumed between the remote controllers and the WH is the digital computer unit (DCU) within the missile guidance set (MGS) via the existing launch facility/MGS communications and power system. TRW indicated the feasibility of this link, in that it will be done according to requirement directives given in a future phase. TRW stated early in the program that any suggested hardwire changes in the launch complex would be too costly. They also indicated (with caveats), that all necessary software//hardware to allow the remote WH operations are feasible and are viable options.

Given the feasibility of the communications link, minimal knowledge of the MGS/AFA communications and power interfaces are still required to size the missile interface unit within the WH. This is an issue since we are very volume limited within the WH and it may limit viable candidates.

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NMC

6/15/94

C	cat	DSL	DOI	DSSL
1	D	X	X	X
1A	F	X	X	
2	D	X	X	X
2A	F	X		
3A	F	X	X	X

-2 Reliability

+40 Weight

\+ Complexity

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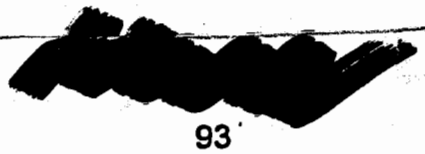

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MECHANICAL INTEGRATION

- HPRF will utilize either MK12A or MK21 aero shell.
- For MMIII the differences between MK12A or MK21 and HPRF designs will be the mass properties.
- It is reasonable to assume levied for the MK12A and MK21 in the Single Reentry Vehicle (SRV) program will apply to HPRF RVs.
- Solutions to integration of MK12A or MK21 into SRV configurations for MMIII should transfer to HPRF vehicles, provided HPRF requirements are not very different from MK12A or MK21 requirements.

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MECHANICAL INTEGRATION

- A study was conducted which concluded that the MK21 could be integrated into the MMIII system without significant difficulty.

Areas of concern for this study included system integration, adapter development, and other technical considerations.

SYSTEM INTEGRATION

- Requirements for the MMIII system are being developed in the SRV program include worst case environments.
- Controllability of stage III which uses LITVC is a major concern when mass properties are changed. The SRV program determined that a MK12A or MK21 payload would not overextend the LITVC system.
- A heavier payload, such as HPRF vehicles, should help the controllability by pulling the cg forward.
- Ballast may be used to offset radial shifts in cg. However, this may require modification of the deployment module.

SYSTEM INTEGRATION

- Controllability is affected by the bending frequencies, which are affected by repositioning and changes in mass properties of the payload.

Bulkhead stiffness requirements are also affected by repositioning and changes in mass properties of the payload.

More analysis will be required to ensure HPRF RVs do not create bending frequencies outside of tolerance and that bulkhead stiffness is adequate.

ADAPTER DEVELOPMENT

- **For a MK21 aero shell an adapter will be required for integration into the MMIII bulkhead.**

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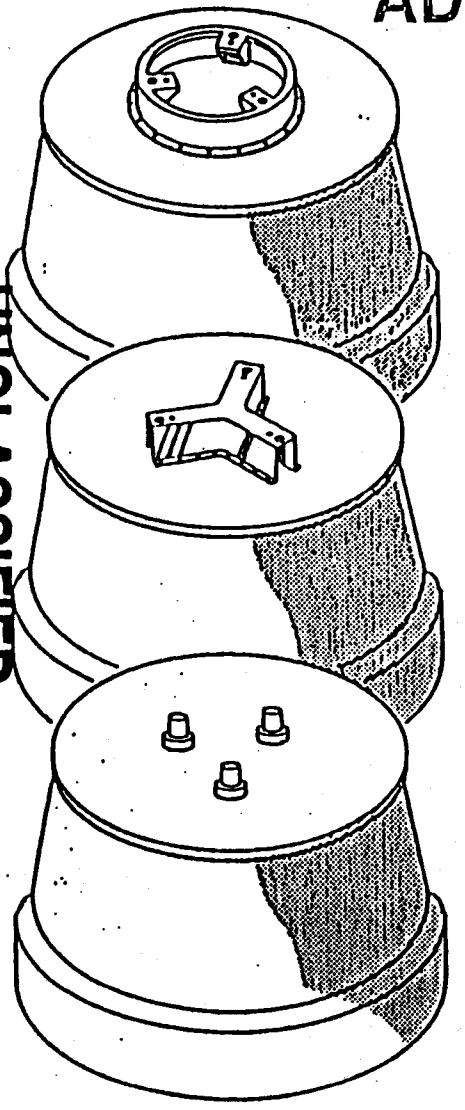
MK-21 RV IN MINUTEMAN III MECHANICAL INTEGRATION ADAPTER DEVELOPMENT



CIRCULAR STAND

TRIANGULAR FOOT

TRI-PEDESTAL

- PERFORMANCE TRADES
- COST TRADES
- DETAIL DESIGN
  - MK-21 RELEASE MECHANISM
- TEST
  - STRENGTH
  - STIFFNESS
  - ENVIRONMENTS

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TECHNICAL CONSIDERATIONS

- Many technical challenges need to be addressed to ensure the MK21 will be compatible with the MMIII system.
- Issues common to both the MK12A and MK21, such as changes to control gain and filters, will be addressed in the SRV program.
- The MK21 has several unique considerations and so will HPRF designs.
- For the MK21 these include shock from the separation nuts, vibration from stage III resonant burn and spin-up rate.

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MK-21 RV ON MINUTEMAN III MECHANICAL INTEGRATION TECHNICAL CONSIDERATION

ITEM	MINUTEMAN III SRV PROGRAM	
• HIGHER LOADS	MK-12/12A	MK-21
• ACCELERATION	▒	▒
• STAGING	▒	▒
• SEPARATION SHOCK		▒
• RESONANT BURN		▒
• NWE LOADS	▒	▒
• BENDING MODES		
• CONTROL GAINS AND FILTERS	▒	▒
• DEPLOYMENT DYNAMICS		
• RV RELEASE DYNAMICS		▒
• POINTING ERROR AND LATERAL RATES AT RV SEPARATION		▒

▒ APPLICABLE TO RV CONFIGURATION

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MK-21 RV IN MINUTEMAN III MECHANICAL INTEGRATION SEPARATION SHOCK

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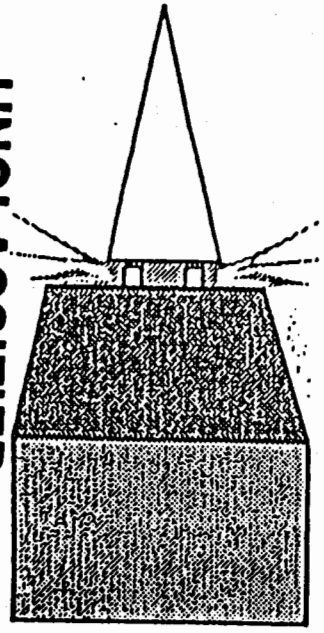

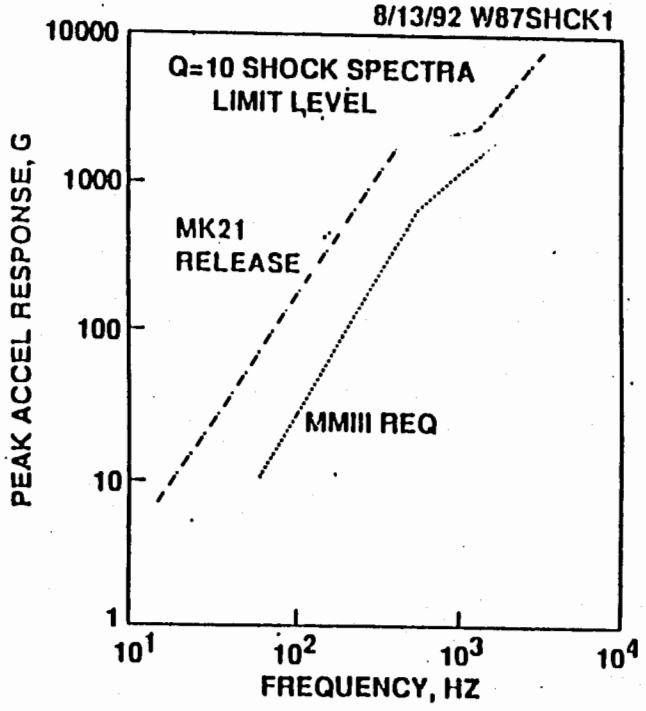

- DESCRIPTION
  - HIGH G-HIGH FREQUENCY SHOCK AT SEPARATION
  - SEPARATION NUTS HIGHER THAN BALL LOCKS
  - SOME PBV EQUIPMENT MUST OPERATE AFTER SEPARATION
  - MMIII COMPONENTS NOT QUALIFIED TO SEPARATION NUT LEVELS
- MITIGATION
  - ADAPTER/BULKHEAD DESIGN
  - CRITICAL COMPONENT MOUNTING
  - TEST VALIDATION

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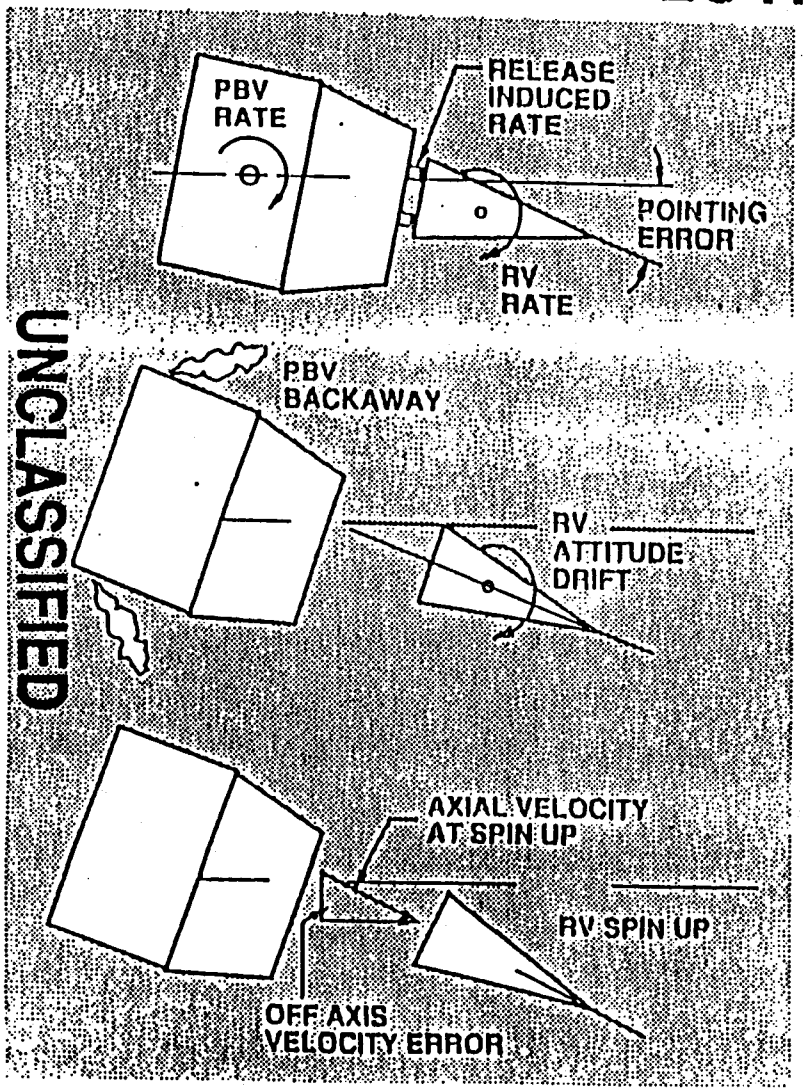
MK-21 RV IN MINUTEMAN III MECHANICAL INTEGRATION RV DEPLOYMENT DYNAMICS



- DESCRIPTION
  - PBV CONDITIONS AT SEPARATION
    - POINTING ERROR
    - ANGULAR RATE
  - SEPARATION
    - INDUCED ANGULAR RATE
  - RV/FLIGHT PROGRAM
    - TIMING FROM SEPARATION TO SPIN
- MITIGATION
  - VVC SOFTWARE UTILIZATION
    - NULL ATTITUDE ERROR AND RATE
  - SEPARATION NUT SYSTEM
    - LOWER INDUCED RATES
  - SHORTEN DRIFT TIME
    - SINGLE RV REDUCES SEPARATION REQUIREMENT
    - SICBM SHORTENED TIME

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Range vs Gamma for Various Payload Mass

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JOE, USAF DTRA b(3)

HPRF / SEWG

JUNE 15, 1994

LOS ALAMOS NATIONAL LABORATORY
SANDIA NATIONAL LABORATORY / NM

Michael Haertling, ESA-1
Joseph Petranto, ESA-1
Lee Anderson, ESA-5
Jim Burns, ESA-5
Tom Ilg, ESA-5
Robert Okagawa, ESA-5
Steve Black, ESA-7
Ronald McFee, X-2
Troy Eddleman, X-4
Michael Bernardin, X-5
Jerry Adams, Dept. 2883
Jim Schulze, Dept. 5161

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HPRF / SEWG (U)

- **NM CANDIDATES**
  - **CANDIDATE 1 (CAT D)**
  - **CANDIDATE 1A (CAT F)**
  - **CANDIDATE 2 (CAT D)**
  - **CANDIDATE 2 (CAT F) (in design)**
  - **CANDIDATE 3 (preliminary)**

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DERIVATIVE CLASSIFIER
L. E. Edwards

Administrative and Criminal Sanctions.

[redacted]

CANDIDATE 1 (CAT D) (U)

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- STANDARD TRAJECTORY
- CATEGORY D PAL

[redacted]

[redacted]

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[redacted]

DERIVATIVE CLASSIFIER
L. E. Edwards
WX-1 Associate Group Leader

[redacted]

UNCLASSIFIED

[redacted]

b(3)

DERIVATIVE CLASSIFIER
i.e., Edwards
WX-3 Associate Group Leader

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CANDIDATE 1 (CAT F) (U)

- STANDARD TRAJECTORY
- CATEGORY F PAL

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DERIVATIVE CLASSIFIER
L.E. Edwards
WX-3 Associate Group Leader

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06/10/94

NEW MEXICO CANDIDATE 1A
WARHEAD ELECTRICAL SYSTEM

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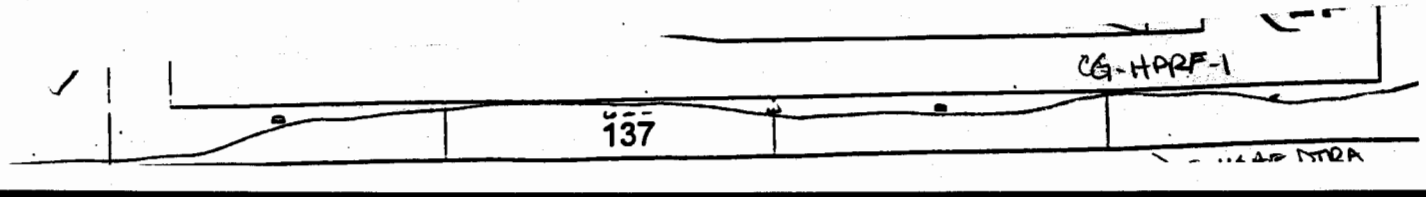

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APPENDIX I
VULNERABILITY WORKING GROUP REPORT

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Vulnerability Working Group (VWG)
Input to HPRF Phase II Meeting Minutes, 16 Jun 94

On 25 and 26 May 94 the Assessments and Analysis Branch (FCPRA) of Field Command, Defense Nuclear Agency, hosted a joint meeting of the Mission Analysis and Vulnerability Working Groups for the High Power Radio Frequency (HPRF) Phase 2 Study. During the meeting representatives from FCPRA, Lawrence Livermore National Laboratory, Phillips Laboratory, and Sandia National Laboratory reported on the progress of test, analysis, and modeling activities supporting the HPRF study. Dr.

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He described the test methodology and highlighted failures in each of the test objects. These tests complete the Sandia National Laboratory test effort in support of this study. Final tests reports will be published during Nov-Dec 94. Mr. S. Gutierrez (PL/WSM) reviewed the status of Phillips Laboratory test programs.

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These results form the basis for further vulnerability testing and analysis. A joint sub-group was formed to review the system stress and strength data included in pre-simulation scenario development. This ensures that the most recent vulnerability test and analysis results are incorporated into the mission analysis portion of the study. The chairmen identified a primary report author for each of the participating laboratories. The meeting concluded with a discussion of the content, format and schedule for inputs to the study final report.

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Capt Warzinski / FCPRA / 6-8575 / 13-Jun-94

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HPRF Phase 2 Study

VWG

HPRF Phase 2 Study
Vulnerability Working Group

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HPRF Phase 2 Study

VWG

MAWG/VWG JOINT MEETING

FCDNA - 25 & 26 May 94

- **Updated status of vulnerability and mission analysis programs supporting HPRF Phase 2 Study**

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- **MIPR $29K (SA-ALC/NWIC to PL) to continue Kaman Science Corp input to model vunerability data**
- **Discussed content and format for inputs to final report**
- **Identified and assigned specific responsibilites for required information exchange**
- **Coordinated schedules for remaining MAWG/VWG activities**

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TEST PROGRAM OBJECTIVES

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HPRF Phase 2 Study

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TEST PROGRAM STATUS

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HPRF Phase 2 Study

VWG

WORKING GROUP INPUT

- **Schedule**
  - Author Assignments — May 94
  - Outlines to Chairman — 1 Jul 94 — *-Final Report Planning*
  - Draft Author Inputs — 30 Sep 94 — *-Chairman Consolidates*
  - Distribute & Review Draft — 31 Oct 94 — *-Comments NLT 1 Dec 94*
  - Forward to Study Director — 15 Dec 94 — *-Final Draft Due 1 Mar 95*
- **Content**
  - Executive Summary — 1 to 2 pages
  - Program Description — NTE 20 pages
    - » Objectives
    - » Methodology
    - » Data Analysis
    - » Conclusions and Recommendations

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MaWG/VuWG Vulnerability Data Transfer/Usage

Issue: It is not clear how VuWG data will be transferred and used by the MaWG.

Concerns:

1) How will VuWG data be used, that is generalized to a larger set of threat targets and engagement conditions?
2) In what form are vulnerability test data required for MaWG analyses?

Importance: These data must be used and interpreted correctly so that maximum confidence can be placed in the results.

Actions Taken:

1) A sub-group of VuWG and MaWG members met after the last meeting (5/26 at FCDNA) to discuss this issue.
2) Focus was on philosophical approaches to data transfer/usage.
3) Two approaches identified, detailed technical discussions to follow.

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MaWG/VuWG Vulnerability Data Transfer/Usage

Approaches:

1) **Stress Model:**
   - **Electronic system response & failure determined by modeled response/failure of a discrete internal component.**
   - **Downside: System response is non-linear. Other components can (and do!) fail. Result is more uncertainty.**

Resolution Path:
Discuss technical merits of each approach (or others?) and reach a MaWG/VuWG consensus on the best one. Document in reports.

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APPENDIX J
MISSION ANALYSIS WORKING GROUP REPORT

High Power Radio Frequency
Mission Analysis Working Group Report

(U) The Mission Analysis Working Group (MAWG) held a joint meeting with the Vulnerability Working Group (VWG) on 25-26 May 1994.

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[redacted]The penetration mission analysis is behind schedule; the baseline scenario will not be completed until the end of July. This slip is due to scheduling conflicts within FCDNA/ FCPRA but should not impact delivery of the draft analysis to SA-ALC/NWIC.

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A final review of the FAAT estimates is being planned for the near future.

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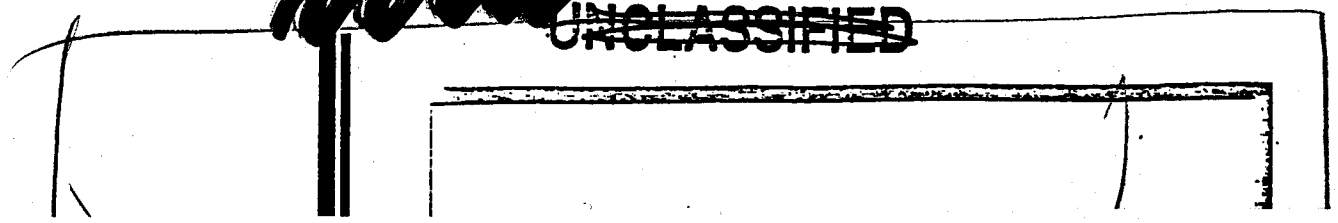

- No test data has been acquired during PHASE II
  - Current test data is not related to this mission area

- New approaches will be considered if there is enough time in the schedule

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HPRF Phase 2 / FCDNA: Capt Langbehn / 6/15/94 / page 8

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