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ADDENDUM #1 TO THE MINUTES OF THE 2nd RELIABLE REPLACEMENT WARHEAD PROJECT OFFICERS GROUP MEETING Dated 9 Jun 05 (U)

LANL DESIGN OPTIONS

A-05-243(R)

9 June 2005

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW	
1st REVIEW-DATE: 11/9/06 AUTHORITY: (DC) DD NAME: TY SANDERS 2nd REVIEW-DATE: 1-22-07 AUTHORITY: DD NAME: Eric Ziegler	DETERMINATION [CIRCLE NUMBER(S)] (1) CLASSIFICATION RETAINED 2. CLASSIFICATION CHANGED TO: 3. CONTAINS NO DOE CLASSIFIED INFO (4) COORDINATE WITH: DOD 5. CLASSIFICATION CANCELED (6) CLASSIFIED INFO BRACKETED 7. OTHER (SPECIFY):

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Addendum #1 To The 2nd Reliable Replacement Warhead Project Officers Group Meeting (U)
LANL Design Options (U)
Sandia National Laboratories, Albuquerque, NM

9 June 2005

(U) This document contains the limited distribution LANL Proprietary Design Options Review presentations from the 2nd Reliable Replacement Warhead Project Officers Group Meeting.

(U) The List of Attendees for this LANL Proprietary breakout session is on the following page.

(U) LIST OF APPENDICES

Appendix		Page
N	LANL PRIMARY DESIGN & CERTIFICATION	N-1
O	LANL RRW DESIGN OPTIONS	O-1

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Addendum #1 To The 2nd Reliable Replacement Warhead Project Officers Group Meeting (U)
LANL Design Options (U)
Sandia National Laboratories, Albuquerque, NM

(U) List of Attendees for the LANL Design Options Meeting

9 June 2005

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APPENDIX N

LANL PRIMARY DESIGN & CERTIFICATION (U)

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PRIMARY DESIGN AND CERTIFICATION

(WITHOUT NUCLEAR TESTING) (U)

RRW JPOG

June 9, 2005

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RRW Meets Requirements for the Future Nuclear Deterrent

- **RRW must be credibly certified w/o nuclear testing**
  - Design technology and space selected for certification
  - [redacted] 1.4 (a)(e)
  - Use gates and QMU for certification
- **RRW must reduce costs**
  - Infrastructure costs (factories)
  - Manufacturing costs (personnel and processes)
  - Maintenance costs (field level repair and rebuild)
- **RRW must be mission flexible**
  - Multiple missions and delivery platforms
  - DOE b(3) [redacted] Sec 6.2 RD
- **RRW must be used to train new nuclear staff**
  - Judgment is lacking in inexperienced staff

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Design Space is Essentially Unlimited

Sec 6.2 RD

DOE 6(3)

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N-4

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LANL RRW Design Derivation

~~SECRET RESTRICTED DATA / CNWDI / PROPRIETARY~~

N-5

1.4(a)(e)

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RRW Technology Selection Enables Certification without Nuclear Testing

- **Many Technologies have NTS heritage**
  - Gun assembly

DOE b(3) RD

- **Which can be certified without nuclear testing?**

DOE b(3) RD

1.4 (a)(e)(g)

- **Other considerations**

DOE b(3) RD

1.4 (a)(e)(g)

- **Other technologies more speculative**

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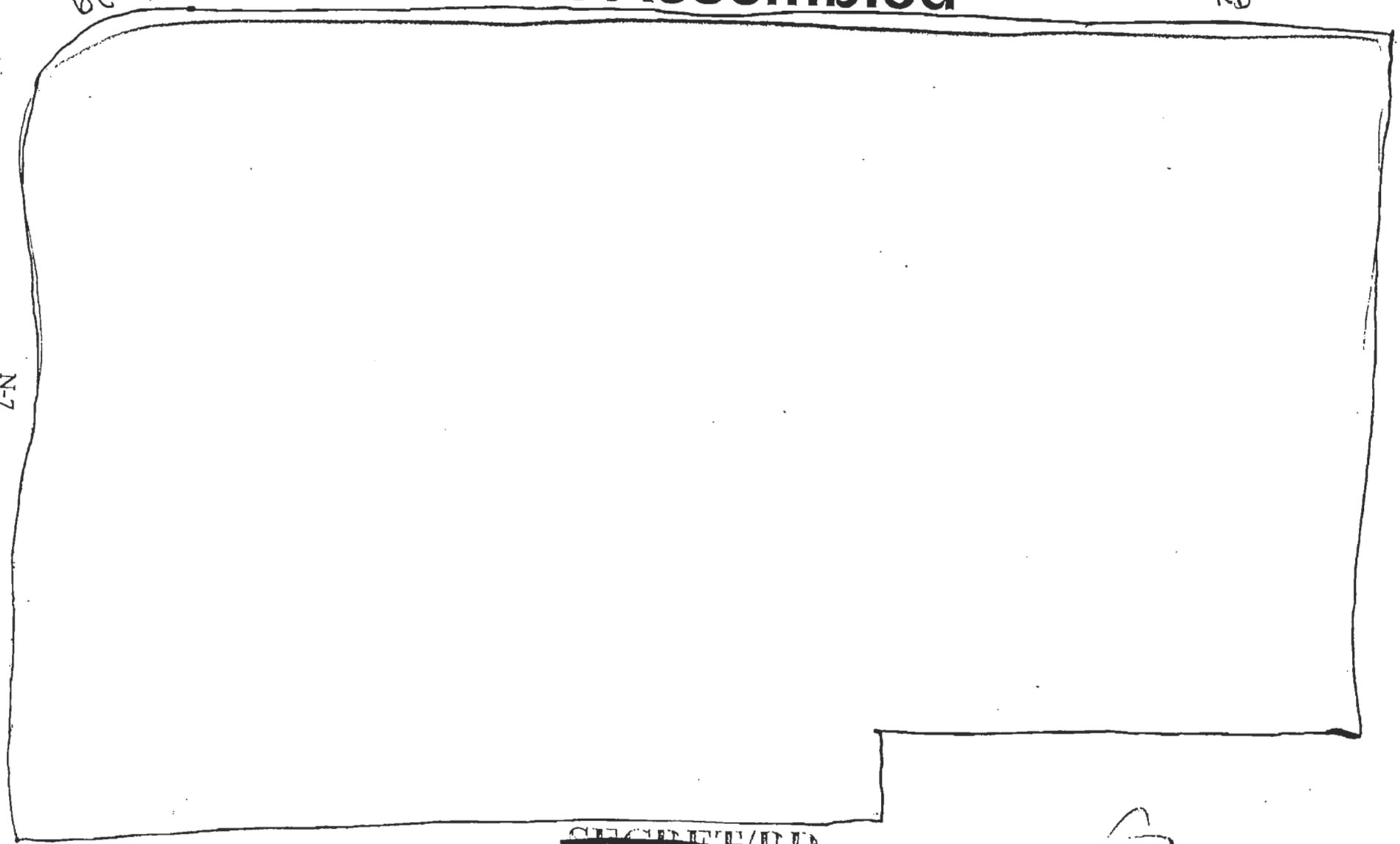
Gun Assembled

Sec 6.2 RD



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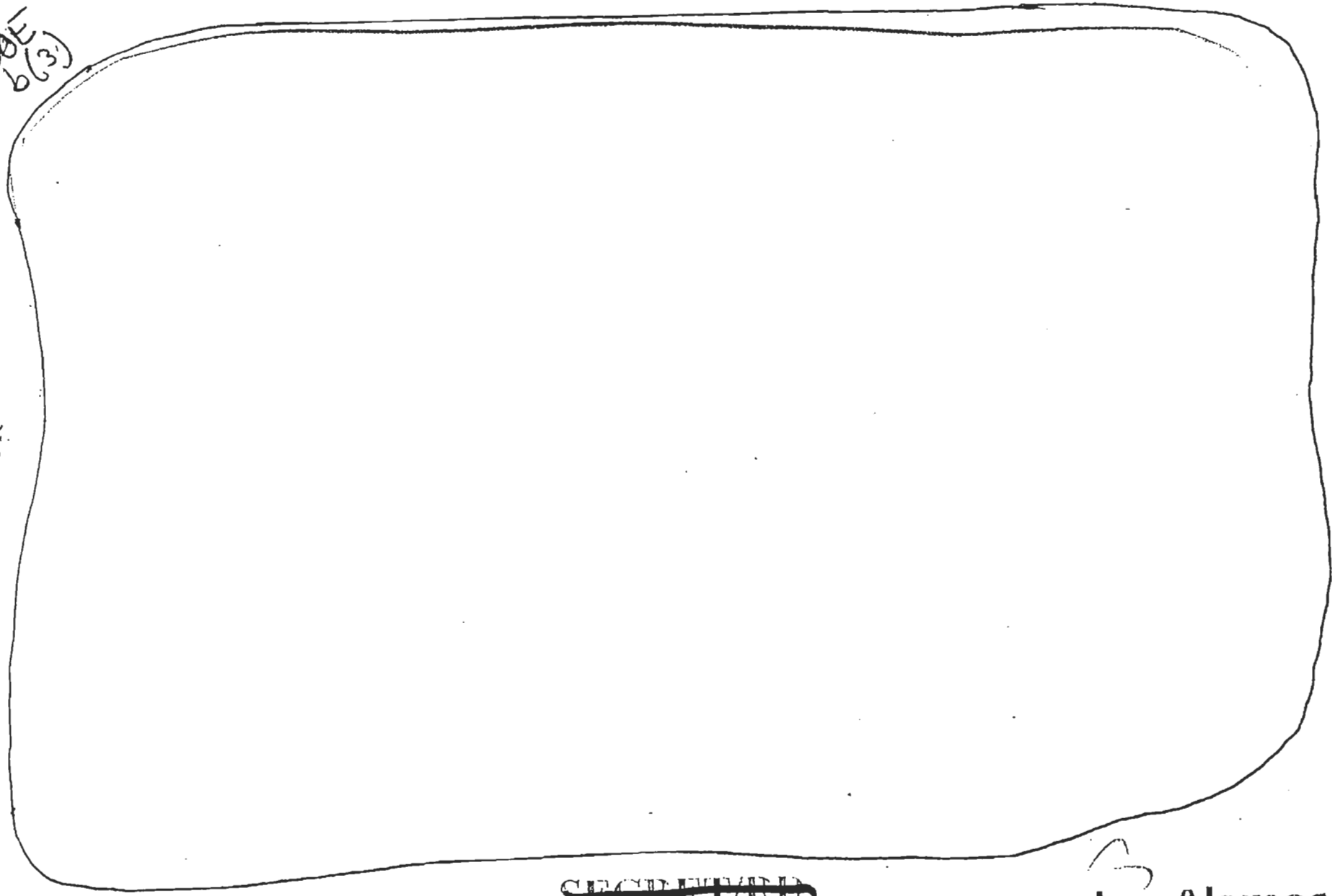

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11

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TECHNOLOGY SUMMARY

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LANL RRW Design Derivation

- **Technology selection for certification**
  - Lack of nuclear RRW testing limits technology choices

[redacted]

1.4 (a)(e)(g)

[redacted]

1.4 (a)(e)(g)

- **Pedigree**
  - LANL design by NTS experienced designers with a proven record

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Lesson on Manufacturing Changes

Sec 6.2 RD

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Lesson on Material Change

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Lesson on Alpha and Yield

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Lesson on Safety

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Lesson on Surety

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NUCLEAR TEST LESSONS SUMMARY

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Sec 6.2
RD

1.4 (a)(e)(g)

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LANL RRW Design Derivation

- **Technology selection for certification**
  - Lack of nuclear RRW testing limits technology choices
- **Lessons from nuclear testing**
  - NTS results show surprising sensitivities
- **Limits to computer simulations**
  - Without experienced designer judgment, calculations are questionable
- **Design for certification without nuclear testing**

[redacted] 1.4(a)(e)(g)

- **Pedigree**
  - LANL design by NTS experienced designers with a proven record

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Modeling, Local Testing, and Science Data are Not Definitive for Design

- **Device modeling has empirical base**

DOE b(3) [redacted] 6.2

  - Predictive boost models are not yet available

- **Tests of weapon like assemblies**

DOE b(3) [redacted] 6.2

[redacted] 1.4(g)

  - Modeling is required to interpret results

DOE b(3) [redacted] 6.2

- **Science experiments are inferior to NTS testing**

DOE b(3) [redacted] 6.2

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Calculations are Insufficient for New Design

DOE b(3)

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Calculations are Insufficient for New Design

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Sec 6.2

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CALCULATION SUMMARY

- **Computer models can be inferior to physics models**
  - B54 test history fit better by simple physics models
  - Never underestimate the value of insight

[redacted] 1.4(g)

DOE b3 N-27

[redacted] 6.2

  - Never overestimate the value of calculations
- **NTS data + primitive computers are superior to modern computers alone**
  - Never underestimate the value of data

[redacted]

  - Design and data can enhance confidence
  - Never underestimate the value of thinking

1.4(g)

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LANL RRW Design Derivation

- **Technology selection for certification**

[redacted] 1.4(g)

[redacted] 1.4(g)

- **Limits to computer simulations**
  - Without experienced designer judgment, calculations are questionable

- **Design for certification without nuclear testing**

[redacted] 1.4(g)

- **Pedigree**
  - LANL design by NTS experienced designers with a proven record

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Sandia: A Critical Partner

DOE b(3)

Sec 6.2 RD

[redacted]

❑Weapon Electrical Systems (WES)

- ➢Must survive same adverse environments as the physics package
- ➢Consumes considerable system mass and volume

DOE b(3)

Sec 6.2 RD

[redacted]

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Eliminating Known Problems via Design leaves more Margin for Unknowns

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DOE b.(3)

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Non-Nuclear Experiments can be used with Gates/QMU

1.4(a)(e)

DOE b(3)

Sec 6.2

1.4(a)(e)

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Certification by Era

- **Classical era (real kt at NTS)**
  - 1945 to 1992
  - Scientific method
  - Highly optimized designs win cold war
- **Transitional era (derivative kt)**
  - 1992 to 2007
  - Perturbation calculations from specific events
  - SLEPS maintain deterrence but are expensive
- **Future era (calculated kt)**
  - Begin 2007
  - Much improved simulations, maybe predictive
  - General tie to NTS data base, not specific shots
  - Advanced diagnostics for legacy and RRW weapons
  - Designs optimized for 21st century appear

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RRW DESIGN SUMMARY

(Design choices and statistics lead to certifiable weapon)

- **Historical precedent guides RRW design**
  - Technology selection for success without testing
  - Lessons from NTS show limits to judgment and calculations
- **Eliminate known problems through design**
  - Leave the margin for unknown unknowns

DOE b(3)

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LANL RRW Design Derivation

- **Technology selection for certification**

[redacted] 1.4(g)

[redacted] 1.4(g)

- **Limits to computer simulations**
  - Without experienced designer judgment, calculations are questionable
- **Design for certification without nuclear testing**

[redacted] 1.4(g)

- **Pedigree**
  - LANL design by NTS experienced designers with a proven record

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LANL has Long History with SLBM

(Design Continuity for Excellence)

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LANL has Long History with SLBM

(Design Continuity for Excellence)

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LANL has Long History with SLBM

(Design Continuity for Excellence)

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LANL has Long History with SLBM

(Design Continuity for Excellence)

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DESIGN PEDIGREE SUMMARY

- **LANL has successfully met SLBM requirements**
  - 30 year history of successful support
- **LANL designs to SLBM specifications**
  - Not recycled concepts adapted to SLBM use
- **LANL innovations to meet SLBM needs**
  - Stockpiled systems were developed, stockpiled, and maintained
  - RRW is SWPP

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- **Design team continuity for the future**
  - Overlap of designers ensures excellence
  - Designers of the future trained on the systems they will maintain

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LANL RRW DESIGN CONCLUSION

DOE b(3)

6.2 RD

[redacted]

1.4(c)(g)

- Keep it simple with respect to options we cannot test

❑Limits to computer simulations

N-45 DOE b(3)

- Judgment and insight are prerequisites to calculations

6.2 RD

[redacted]

❑Pedigree

- LANL SLBM design by NTS experienced designers with a proven record

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APPENDIX O

LANL RRW DESIGN OPTIONS (U)

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RRW Design Options (U)

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Outline

Overview of Design Options

RRW-1a Secondary Design Work

Next Steps

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The trade space under consideration based on TOR guidance includes the following.

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Current Calculational Model

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Weapon Code Utilization

Early mainline design efforts will rely heavily on legacy codes.

- demonstrated capability, rapid turn-around

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Future Design Activities

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