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USAF NWSSG 97-1

FINAL VERSION

OPERATIONAL SAFETY REVIEW

OF THE

F-15E AND F-16C/D WEAPON SYSTEMS (U)

APRIL 1997

HEADQUARTERS, AIR FORCE SAFETY CENTER
WEAPONS, SPACE, AND NUCLEAR SAFETY DIVISION
UNITED STATES AIR FORCE
Kirtland Air Force Base, New Mexico

98-124

Classified By Multiple Sources
Declassification: OADR

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USAF NWSSG 97-1

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Any correspondence regarding this safety study report and the distribution list (i.e., addresses, office symbols, etc.) should be addressed to HQ AFSC/SEWN, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670.

OCT 10 1997

NOTICE
TO ALL RECIPIENTS OF THIS REPORT

This report has been approved by the USAF Nuclear Weapon System Safety Group (NWSSG). The recommendations have been approved by the HQ USAF and are directive on the action agencies. **"Immediate Action"** is assigned to recommendations which will correct deficiencies that prevent the system from meeting the Department of Defense (DoD) Nuclear Weapon System Safety Standards. Operation of the weapon system is restricted, as specified in the recommendations, until the recommended procedures or modifications are implemented. **"Urgent Action"** is assigned to recommendations that are considered serious and require prompt corrective action, yet do not violate any of the DoD Nuclear Weapon System Safety Standards. Peacetime restriction of the weapon system is warranted, but its use in time of war should not be precluded. A recommended completion date will be assigned. **"Time Compliance"** identifies actions which will improve nuclear safety. The weapon system meets the DoD Nuclear Weapon System Safety Standards and may be operated while actions are being taken to satisfy the recommendations.

DIRECTIVE

Action agencies will establish a schedule for compliance of the recommendations (in accordance with AFI 91-102, *Nuclear Weapon System Safety Studies, Operational Safety Reviews, and Safety Rules*, paragraph 14) and submit it to HQ AFSC/SEWN, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670, for approval.

Action agencies will submit a quarterly report of actions taken to implement recommendations until actions are complete, at which time a request for closure will be submitted. The quarterly reports are due to HQ AFSC/SEWN the 15th day of January, April, July, and October, beginning with the quarter after this report is received.

Quarterly reports and closure requests will refer to this study report (USAF NWSSG 97-1) and to the applicable recommendation paragraph.

FOR THE CHIEF OF STAFF

Francis C. Gideon Jr.

FRANCIS C. GIDEON, JR.
Major General, USAF
Commander

TABLE OF CONTENTS

OPERATIONAL SAFETY REVIEW
OF THE F-15E AND F-16C/D WEAPON SYSTEMS

This operational safety review was approved by the USAF Nuclear Weapon System Safety Group

THOMAS E. DISTELHORST, Col, USAF
Chairman, USAF Nuclear Weapon System Safety Group

DAVID J. GRENDA, Lt Col, USAF
Defense Special Weapons Agency

JOHN R. WYSOWSKI, Lt Col, USAF
Air Combat Command

SANDRA T. NANCE, Lt Col, USAF
United States Air Forces in Europe

CHARLES W. NYSTROM, JR.
Lt Col, USAF
United States European Command

WILLIAM E. BICKER, Major, USAF
Air Force Security Forces Center

BRIAN J. BORDEN, Major, USAF
Air Force Space Command

MR WILLIAM H. PECSOK
Department of Energy

Official:

MR BERNARD E. MARTINEZ
Air Force Materiel Command

JOHN C. SNIDER, Lt Col, USAF
Executive Officer, USAF Nuclear Weapon System Safety Group

PARTICIPANTS

NWSSG VOTING MEMBERS

Col Thomas E. Distelhorst	HQ AFSC/SEWN
Lt Col David J. Grenda	FCDSWA/FCPS
Lt Col John R. Wysowski	HQ ACC/SEW
Lt Col Sandra T. Nance	HQ USAFE/SEW
Lt Col Charles W. Nystrom, Jr.	HQ USEUCOM/ECJ5N
Maj William E. Bicker	HQ AFSFC/SFON
Maj Brian J. Borden	HQ AFSPC/SEWN
Mr William H. Pecsok	DOE/AL/NESD
Mr Bernard E. Martinez	HQ AFMC

TECHNICAL ADVISORS

Col Harold J. Camacho, Jr.	HQ AFSC/SEW
Col J. C. Mann	HQ AFSC/SEWA
Mr Arlie E. Adams	HQ AFSC/SEWV
Lt Col Dean R. Jansheski	HQ AFSC/SEWN
Lt Col John C. Snider	HQ AFSC/SEWN
Lt Col John D. Waskiewicz	HQ AFSC/SEWA
Lt Col Patrick L. Wittkamp	HQ AFSC/SEWN
Mr Eric T. Olson	HQ AFSC/SEWV
Maj Bruce T. Kelley	HQ AFSC/SEWN
Maj David G. Verrett	HQ AFSC/SEWA
Lt Col Richard L. Almeida, Jr.	HQ ACC/DONP
Maj Corwin D. Lemon	HQ ACC/DONP
Lt Col James P. Fingerlos	HQ DOE/DP-21
Mr Fred P. Jaramillo	DOE/AL/NESD
Mr Laurence P. Altbaum	LLNL/L-125
Mr Stanley J. Brohn	Lockheed-Martin

Mr John Bolstad	LANL/XNH
Mr Larry E. Hatler	LANL/ESA-WMM
Mr Edward S. Idar	LANL/WNH
Ms Roberta Day Idzorek	LANL/ESA-WE
Mr Mark LeDoux	LANL/ESA-WE
Mr Roger W. Taylor	LANL/ESA-WE
Mr Mark S. Burlingham	McDonnell Douglas
Mr Jerrell Bowles	SA-ALC/NWIS
Mr Larry R. Lawrence	SA-ALC/NWIS
Mr Sam E. Perry, Jr.	SA-ALC/NWIO
Mr John F. Travers	SA-ALC/NWIS
Mr Jerry D. Williams	SA-ALC/NWIO
Mr Walt J. Errickson	SNL,NM/2111
Mr Aaron L. Hillhouse	SNL,NM/2111
Mr Winford E. Mauldin	SNL,NM/12332
Mr Jack E. Stayton	SNL,NM/12334
Mr George C. Novotny	SNL,NM/12334
Mr Ronald D. Pedersen	SNL,NM/12331
Mr Brian R. Berg	Tech Reps, Inc.

SECTION 1

EXECUTIVE SUMMARY

1. The USAF Nuclear Weapon System Safety Group (NWSSG) conducted this operational safety review (OSR) to determine if the US F-15E and F-16C/D weapon systems continue to meet the DoD Nuclear Weapon System Safety Standards. It consisted of a comprehensive evaluation of the US F-15E and F-16C/D weapon systems, including applicable manuals, procedures, training, and technical and operational concepts existing at the time of the review. Two field trips were conducted to observe the weapon systems in representative operational environments. The first was to Cannon AFB NM to observe the F-16C/D weapon system. The other was to RAF Lakenheath, UK, to observe the F-15E weapon system.

2. The NWSSG unanimously concluded the F-15E and F-16C/D weapon systems continue to meet the DoD nuclear weapon system safety standards when operated in accordance with the briefed system concept of operations, operational plans, approved Air Force technical order procedures, and the proposed nuclear weapon system safety rules. While concluding the F-15E and F-16C/D weapon systems meet these standards, the NWSSG discussed a number of issues and made recommendations on:

a. Improving protection from lightning during weapon maintenance in hardened aircraft shelters (HAS).

b. Improving the condition of Type 3E weapon trainers.

c. Providing guidance for Weapon Storage and Security System (WS^3) code module handling and control.

d. Evaluating WS^3 security monitoring system.

e. Reevaluating DOE handling equipment.

f. Improving US strike aircraft Operational Plan Data Document (OPDD).

3. The group also proposed changes to the US strike aircraft weapon system safety rules.

a. Prohibited training with nuclear weapons.

b. Deleted all references to F-111E/F.

c. Clarified the definition of major maintenance on nuclear weapons.

d. Added rules to mitigate lightning risks during weapon maintenance.

e. Clarified concepts of operation involving both nuclear weapons and conventional munitions in a HAS (with and without a weapon storage vault).

f. Added Command Disable (CD) procedures.

g. Made editorial changes for clarification.

4. The NWSSG also opened the non-US NATO strike aircraft weapon system safety rules, currently in coordination, to incorporate similar rules for mitigating lightning risks and clarifying concepts of operation involving both nuclear weapons and conventional munitions in a HAS (with and without a weapon storage vault). These procedures are common to both US and Non-US NATO weapon systems.

SECTION 2

AGENDA FOR THE
OPERATIONAL SAFETY REVIEW OF THE
US F-15E AND F16C/D WEAPON SYSTEMS

Phase I
Kirtland AFB, New Mexico
14-16 Apr 97

Monday--14 Apr

1240	Security Validation	
1300	Opening Remarks	AFSC/SEWN Col Distelhorst
1315	History of Safety Studies	AFSC/SEWN Maj Kelley
1325	Nuclear Surety Inspection Results	AFSC/SEWN Lt Col Snider
1335	B61-3,-4,-10 Weapons Program Overview Design Safety Features Major Assembly Release Physics Package Arming Firing and Fuzing	SNL/Mr Hillhouse LANL/Ms Idzorek
1445	Break	
1510	Alt 339 Briefing	SNL/Mr Errickson
1605	Deficiency History	AFSC/SEWA

		Lt Col Waskiewicz Maj Verrett

Tuesday--15 Apr

0745	Security Validation	
0800	DCA Operational Planning Data Document DCA in Europe DCA in CONUS F-15/16 Mission and Force Structure Command and Control Alert and Load Configurations Dispersal Ops CONOPS	HQ ACC/DONP/Maj Lemon
0930	Break	
0945	F-15 Weapon System Overview System Description Safety Features Handling Equipment Nuclear Certified Equipment	SA-ALC/NWIS, Mr Travers
1055	Lunch	
1300	F-15 Overview Continued	
1355	PACS Upgrade	McDonnell Douglas Mr Burlingham
1410	TO Status	Mr Travers
1415	Break	
1445	F-16 Safety Features	SA-ALC/NWIS Mr Lawrence

1535	F-16 Mid-Life Update	Lockheed Martin/Mr Bohn
1545	TO Status and Handling Equipment	SA-ALC/NWIO, Mr Perry

Wednesday--16 Apr

0745	Security Validation	
0800	Lightning Protection	SNL/Mr Morris
0930	Adjourn/Travel to Cannon AFB NM	

Phase II
27 FW, Cannon AFB, New Mexico
17 Apr 97

Thursday--17 Apr

0800	NWSSG Team Chief In-Brief	27FW/CC XP, SE, GP/SQ CC's
0820	Team In-Brief/Agenda	OSS/OSO, Maj Leatherie
0830	Unit Mission/CONOPS	XP/Maj Walker
0900	F-16 Monitoring Weapons Suspension/Release System Load Crew/Crew Chief Certification	OG/OGW, SMSgt Davis
0930	Aircrew Mission Planning/Certification Training	OSS/OSTW, Capt Williams
1015	Pilot Nuclear Certification	Capt Williams
1115	Lunch	
1230	Command Post Tour/Briefing	CP/Lt Ryan

	EAM training/procedures	
1400	Load Crew Operations Weapons Loading Safety Wiring and Sealing Pilot Aircraft Acceptance Procedures	SMSgt Davis
1630	NWSSG outbrief to FW/CC	AFSC/Col Distelhorst

Friday--18 Apr

Travel to Kirtland AFB NM

Phase II
48 FW, RAF Lakenheath, UK
28 Apr-2 May 97

Monday--28 Apr

0830	NWSSG Chairman Inbrief with Vice Wing Commander	CV/Col Paladini
0900	NWSSG Inbrief - Unit Mission Briefing - Itinerary Review - Local Area Safety Brief - Base Familiarization	SE/Lt Col Martin CV
1115	Lunch	
1300	USAFE/EUCOM Briefing - EUCOM XP Brief - Operational Plan Data Document - Weapons Operations (WS^3)	EUCOM/ECJ5-N
1500	NWSSG Briefing	Col Distelhorst

Tuesday--29 Apr

0800	Concept of Operation Briefing	XP/Capt Ferguson
0845	Break	
0900	Weapon System Overview - Load Crew Certification Procedures - Maintenance on Alert Generated Aircraft	OGW/TSgt McKinnon
0930	Security Force Procedures - Generation and Alert - Convoy Procedures - Entry Control Procedures	SPS/CC/Lt Col Andersen
1000	Break	
1015	Weapons Operations - Emergency Evacuation Procedures - Custodial Procedures for SEL REL - Alternate WS^3 Opening Procedures	EMS/SMSgt Fullerton
1030	Facility Upgrades	CES/Maj Laffey
1045	Security Upgrades	CS/TSgt Hagan
1100	Lunch	
1230	Command Post Tour and Demonstration - EAM Processing and Authentication - Normal Alert Procedures - Emergency War Order Tasking - Command and Control Procedures	XP/Lt Col Lemmon CP/Maj Nagnaughton
1445	Break	

1500	Aircrew Training Certification - Aircrew Training - Target Certification Demonstration	 OSS/Capt Dunlop OG/Col Seip Capt Schuettke Capt Watson

Wednesday--30 Apr

0750	Depart 48 FW Headquarters via Bus	
0800	Weapons Upload - Pre-Notification and Purge Procedures - Aircrew Acceptance	OGW/CMSgt Midkiff
1100	Questions and Answers	
1130	Lunch	
1300	Maintenance Operations - WMT Operations	EMS/CMSgt Kennison
1600	Questions and Answers	

Thursday--1 May

0750	Depart 48 FW Headquarters via Bus	
0800	Central Security Control and Local Monitoring Facility Tour	SPS/Capt Hunt
0930	Security Force Procedures - Convoy Briefing - Security Response Scenario	Capt Hunt
1100	Lunch	

1230	Weapons Convoy (SAAM)	Capt Hunt
1500	Factors Affecting Surety	SE/Maj Baker
1530	Questions and Answers	Lt Col Martin
1730	Outbrief NWSSG	Col Distelhorst

Friday--2 May

0800	Aircrew Checklists	Capt Dunlop

Phase III
Kirtland AFB, New Mexico
5-9 May 97

Monday--5 May

1240	Security Validation	
1300	Collocation Issues	LANL Mr Hatler Mr Bolsted Mr Idar
1400	Question and Answers	
1430	Break	
	Deliberations and Review of Proposed Rules	
1630	Adjourn	

Tuesday--6 May

0745 Security Validation

0800 Deliberations on Findings and Recommendations

1130 Lunch

1300 Continued Deliberations on Findings and Recommendations

1630 Adjourn

Wednesday--7 May

0745 Security Validation

0800 Continued Deliberations on Findings and Recommendations

1130 Lunch

1300 Continued Deliberations on Findings and Recommendations

1730 Adjourn

Thursday--8 May

0745 Security Validation

0800 Review of Parts A and B

1130 Lunch

1300 Review of Parts A and B

1400 Deliberations and Review of Proposed WSSRs

1800 Adjourn

Friday--9 May

0745 Security Validation

0800 Continued Review of Proposed WSSRs

1200 Study Completed

SECTION 3

STUDY OVERVIEW (U)

1. (U) Authority. The authority for this Nuclear Weapon System Safety Group (NWSSG) operational safety review comes from:

a. (U) Department of Defense (DoD) Directive 3150.2, *Nuclear Weapon System Safety Program,* December 23, 1996 and DoD 3150.2-M, *DoD Nuclear Weapon System Safety Program Manual*, December 1996.

b. (U) Air Force Instruction (AFI) 91-102, *Nuclear Weapon System Safety Studies, Operational Safety Reviews, and Safety Rules.*

2. (U) Purpose. This Operational Safety Review (OSR) was conducted to determine if the US F-15E and F-16C/D weapon systems continue to meet the DoD Nuclear Weapon System Safety Standards.

3. (U) Scope. This operational safety review consisted of three phases. Phase I, consisting of a series of briefings, was held 14-15 Apr 97 at Kirtland AFB, New Mexico, and a Phase I continuation at RAF Lakenheath on 28 Apr 97. Phase II, the field trip, was conducted at Cannon AFB, New Mexico, from 16-18 Apr 97, and RAF Lakenheath, United Kingdom, from 28 Apr-2 May 97 to observe the F-15E and F-16C/D weapon systems in their operational environments. The group finalized the review during Phase III on 5-9 May 97 at Kirtland AFB, New Mexico. The following nuclear surety areas were reviewed:

a. (U) Aircraft description and fleet status of the US F-15E and F-16C/D.

b. (U) Weapon descriptions of the B61-3, -4, and -10.

c. (U) Weapon system Operational Plan Data Document (OPDD).

d. (U) Major Command restrictions and handling procedures.

e. (U) Credible accident scenarios and projected weapon responses.

f. (U) Stockpile information.

g. (U) Weapons maintenance procedures, including Alt 339 procedures.

h. (U) NATO Inter-Regional Deployment (IRD) concepts.

i. (U) Weapon Storage and Security System (WS^3).

4. (S-FRD) Background. The US F-15E and F-16C/D cover a wide range of combat roles, including nuclear operations. The US F-15E nuclear configuration includes up to five B61 nuclear bombs. The F-15E Preoperational Safety Review was conducted in March 1992 and an OSR was conducted in April 1994. The F-16C/D nuclear weapons may be carried singly on stations 3 through 7 with a maximum of two nuclear weapons per aircraft. The last F-16C/D OSR was conducted in April 1992.

5. (U) Criteria. The criteria for conducting this OSR are in the authority documents. As a minimum, the following DoD Nuclear Weapon System Safety Standards must be met:

a. (U) There shall be positive measures to prevent nuclear weapons involved in accidents or incidents, or jettisoned weapons, from producing a nuclear yield.

b. (U) There shall be positive measures to prevent DELIBERATE prearming, arming, launching, or releasing of nuclear weapons, except upon execution of emergency war orders or when directed by competent authority.

c. (U) There shall be positive measures to prevent INADVERTENT prearming, arming, launching, or releasing of nuclear weapons in all normal and credible abnormal environments.

d. (U) There shall be positive measures to ensure adequate security of nuclear weapons, under DoD Directive 5210.41.

6. (U) Source Materials. The NWSSG findings and recommendations (Section 4) are based on the following references:

a. (U) Operational Plan Data Document (S), Subject: Air Combat Command Operational Plan Data Document (OPDD) Dual Capable Aircraft (U), 25 Mar 97.

b. (U) F-15E/B61 Technical Nuclear Safety Analysis 92-1 (S), 26 Feb 92.

c. (U) Briefings presented to the NWSSG 14-15 Apr and 5 May 97.

d. (U) Briefings and demonstrations presented to the NWSSG for the F-16C/D on 16-18 Apr 97 and, for the F-15E, on 28 Apr-2 May 97.

7. (U) Limitations. On-base dispersal was not evaluated because of the lack of unit implementation plans. The WS^3 was demonstrated but the design was not thoroughly briefed.

8. (U) Status of Open NWSSG Recommendations. There are no open recommendations for the F-15E and F-16C/D.

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PART A

DESCRIPTION OF, AND OPERATIONAL CONCEPT FOR, THE US F-15E AND F-16C/D WEAPON SYSTEMS (U)

1. (U) GENERAL. Appendix A to this document is the HQ USAF-approved Air Combat Command Operational Plan Data Document (OPDD) Dual Capable Fighter Aircraft, 25 Mar 97. The OPDD describes the approved operational concept for the US F-15E and F-16C/D weapon systems, except as noted in Finding 7.

2. (U) DESCRIPTION

a. (U) F-15E Aircraft. The US F-15E is a two-seat, high performance, multi-role fighter designed to conduct day and night, all-weather, air-to-surface and air-to-air operations. Weapons carriage capability is provided by several aircraft hard points including tangential carriage of up to twelve 500-pound class weapons on the aircraft conformal fuel tanks. An all-weather terrain following penetration capability and night or under-the-weather attack capability is provided with low altitude navigation and targeting infrared for night (LANTIRN) system. Munitions include various nuclear and conventional weapons, air-to-air missiles, and an internal 20mm gun. The F-15E has all the air-to-air capabilities of the F-15C. For further description, see technical order 1F-15E-1.

b. (U) F-16 Aircraft. The US F-16 is a single-engine fighter with full air-to-air and air-to-surface combat capabilities. Armament includes an internal 20mm gun and air-to-air missiles, plus various nuclear and nonnuclear weapons carried on wing pylons and fuselage centerline. Some aircraft are equipped for all-weather terrain following penetration capability and night or under-the-weather terrain following penetration capability and night or under-the-weather attack capability with the LANTIRN system. For further description, see T.O. 1F-16C-1, 1F-16CG-1, and 1F-16CJ-1.

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PART B

DESIGN SAFETY FEATURES ASSOCIATED WITH THE US F-15E AND F-16C/D WEAPON SYSTEMS (U)

1. (U) GENERAL

a. (U) The US F-15E and F-16C/D aircraft have safety features inherent in the design of the weapon control system. The associated nuclear weapons also have inherent design safety features. In the event of a one-point detonation of the B61 bomb, the probability of even a low-level nuclear detonation is extremely remote. The probability is less than 1 in 1 million that a one-point initiation could result in a nuclear yield greater than a 4-pound trinitrotoluene (TNT) equivalent. The insensitive high explosive (IHE) used in the B61-3, -4, and -10 is much less sensitive to physical insult than older weapons and provides a significant increase in safety with regard to high explosive (HE) detonation and fissile material scattering.

b. (U) Compatibility between the B61-3, -4, and -10 gravity bombs and US F-15E aircraft on the left and right conformal fuel tank stations (LC2 and RC2) and the aircraft centerline and wing pylon stations has been successfully demonstrated and documented. The compatibility of these weapon system configurations is reflected in the Aircraft Compatibility and Control Drawings (ACCD) and is published in the current Technical Order 11N-50-7, *Major Assembly Release (MAR) for War Reserve Weapons* (S-RD).

c. (U) Compatibility between the US F-16C/D aircraft and B61-3, -4, and -10 gravity bombs has been successfully demonstrated and documented by DOE. The compatibility of these weapon system configurations is reflected in the ACCD and is published in the current Technical Order 11N-50-7, *Major Assembly Release (MAR) for War Reserve Weapons* (S-RD).

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2. (U) WEAPON SAFETY FEATURES

a. (U) B61-3, -4, and -10

(1) (U) HE and Nuclear. These bombs contain IHE (PBX 9502). These bombs do not contain a fire-resistant pit. The pit contains plutonium (Pu). Testing has shown that while the IHE may break up from mechanical forces or burn in a fire, the probability of detonation is very small. The resultant Pu scattering, in the vicinity of the disassembly and nearby downwind areas, will be significantly less than for weapons employing conventional HE.

(2) [redacted]

(3) (U) Primary Safety Features. The bombs contain a full Enhanced Nuclear Detonation Safety design. This design utilizes an intent strong-link, a trajectory strong-link, weak-links, exclusion regions, and an energy diversion barrier including Lightning Arrestor Connectors (LACs) which limit the voltage which may be applied to the strong-links.

(a) [redacted]

(b) (U) Trajectory Strong-Link. The trajectory strong-link is a unique signal controlled switch which, in conjunction with the intent strong-link, controls access to the electrical circuitry within the exclusion region. The trajectory strong-link switch will only operate upon receipt of a unique electrical signal which is engineered such that it is highly unlikely to be duplicated in an abnormal environment. This unique signal is stored in the Trajectory Sensing Signal Generator (TSSG) in the bomb and is transmitted by the TSSG after sensing an environment (deceleration-time for retard, spin-time for freefall) which is indicative of a normal trajectory. The function of the trajectory strong-link is to maintain, in conjunction with the intent

strong-link, electrical isolation of the WES in an abnormal environment until one or more of the weak-links (IHE or WES storage capacitors) fail irreversibly.

(c) (U) IHE Weak-Link. The IHE will break up in mechanical environments or burn in thermal environments at levels lower than those at which the strong-links will continue to provide isolation.

(d) (U) WES Storage Capacitor Weak-Link. The mylar dielectric capacitor will irreversibly short at a temperature lower than that at which the strong-links will continue to provide isolation.

(e) (U) TSSG Weak-Link. The TSSG contains a capacitor which will fail in a thermal environment and a ceramic circuit board which will fail in a shock environment. Failure of either element will result in the inability of the TSSG to transmit the unique electrical signal to the trajectory strong-link.

(f) (U) LAC. The LACs will limit any high voltage (e.g., lightning) appearing at the input of the WES to a value which will neither cause loss of the isolation provided by the intent and trajectory strong-links nor initiation of the primary detonators.

(g) (U) Exclusion Region. The exclusion region protects the WES and limits the ability of electrical energy which might be present in an abnormal environment to bypass the strong-links and be placed on the WES or directly on the primary detonator lines.

(4) (U) Other Safety Enhancements. The following features contribute to nuclear detonation safety in normal environments and have the potential for making a limited contribution in selected abnormal environments

(a) (U) A ready/safe switch, operated by the AMAC, isolates the main batteries from the rest of the WES.

(b) (U) AMAC power must be applied and maintained through bomb release from the aircraft in order to begin the arming and fuzing sequence.

(c) (U) Two independent, continuous 28 VDC arming signals are required in order to charge the WES storage capacitor.

3. (U) F-15E AIRCRAFT SAFETY FEATURES

[redacted]

a. (U) General. The US F-15E design provides sufficient separation between the nuclear weapon system controls in the two cockpits to prevent weapon prearming or release from one cockpit. The F-15E nuclear weapon system provides the aircrew with individual monitor and control capability for up to five nuclear stations and any mix of B61 nuclear weapons. The F-15E/B61 nuclear weapon system features an interdependent digital (software) and discrete (hardwired) signal set to monitor and control the nuclear weapon interface.

b. (U) Programmable Armament Control Set (PACS). The PACS provides the logic for control, monitor, release, and jettison for all air-to-air (A/A) and air-to-ground (A/G) stores. The PACS consists of the converter programmer (C-P), encoder/decoder (E/D), power supply (PS), and electronic sequencing unit (ESU). The C-P contains the armament operational flight program (OFP) and controls all weapon stations for conventional and nuclear weapons. The E/D and PS are remote units installed at the weapon station and provide power control and switching logic for nuclear capability. The E/D is designed so that no single fault or failure can result in the prearming of a nuclear weapon or the application of power to the aircraft/nuclear weapon interface. The majority of systems operations are performed via digital multiplex bus (mux bus) interfaces. Discrete hardwired inputs from dedicated cockpit switches are required to enable the arm, rack-unlock, and weapon release functions. In response to both hardwired cockpit switches and multipurpose display pushbutton selections, digital messages are generated by the multipurpose display processor (MPDP), verified through the central computer (CC), and relayed to the PACS. The PACS generates a display macro based upon system response to aircrew inputs. The display macro is relayed from the PACS through the CC to the MPDP for display. This method provides a positive, real-time feedback of system response and status to the aircrew. The C-P provides an interface between cockpit equipment and aircraft armament. The E/D and PS are used in conjunction with the C-P for monitoring, controlling, and releasing nuclear weapons. The ESU is used in conjunction with the conformal fuel tanks to provide weapon release sequencing.

c. (U) Armament Control Panel (ACP). The ACP contains a seven-position rotary knob and a lever-locked master arm switch. The ALTN REL (alternate release) position selects a nuclear weapon release mode. The master arm toggle switch provides power for launch and release signals. With the switch in the SAFE position, power is not available to the weapon release switch in either cockpit; therefore, this switch serves as a positive measure in preventing inadvertent release.

d. (U) Nuclear Consent Switches. There are two identical nuclear consent switches, one in each cockpit. The three-position toggle switch is safety wired and covered in the SAFE position. If either switch is in the SAFE position, the weapon cannot be armed or jettisoned. If both are in

the ARM position, the PACS enables the arming of selected nuclear weapons. If either switch is moved from the ARM position, prearm power either cannot be applied or will be removed from the weapon interface. Selecting JETTISON ENABLE permits rack unlock provided both switches are in JETTISON ENABLE, or with one switch in ARM and the other in JETTISON ENABLE. These switches provide positive power interruption to the arming, unlock, and release lines of the E/D, PS, and C-P respectively. These consent discretes are routed to these components via dedicated hardwired circuits. The power interrupt to the bomb rack opens the line to the reversible inflight lock solenoid, thus opening the rack cartridge firing circuits and preventing unlock of the rack. Discretes from the nuclear consent switches are also routed to the C-P where they function to remove inhibits from the operational flight program. These inhibits prevent the processing of arm and release commands unless nuclear arm consent and rack unlock consent are given via the nuclear consent switches.

e. (U) BRU-47A Bomb Rack. The bomb rack employs a reversible inflight lock (RIFL) which fails safe if power is lost. The bomb rack mechanism opens the firing circuits to the cartridges when the bomb rack is locked. As a result of this mechanical system design, when the bomb rack is locked, weapon release is prevented even if release signals are present. Additionally, the internal mechanism, when locked, is designed to prevent weapon release in the event the cartridge(s) fire.

f. (U) Unique Signal Generation (USG) Capability. The F-15E aircraft employs a USG capability which is intended to permit the use of USG weapons. This nuclear safety design feature reduces the chance of accidental or inadvertent prearming.

g. (U) Nuclear Cautions System. The nuclear cautions system in the F-15E will alert the crew and prohibit inadvertent release of a nuclear weapon for cases of inadvertent rack unlock, inadvertent prearming, inadvertent release command, and erroneous store configuration information. For a Computed Release Commanded caution, the crew is advised of the caution state, but an intended release is not prohibited.

4. (U) F-16C/D Aircraft Safety Features

a. (U) All weapons carried on the F-16C/D are monitored and controlled through the Multifunction Display (MFD) set. The MFD is the primary element of interface between the pilot and the Stores Management System (SMS). In addition to the MFD, the major elements of the SMS (for nuclear weapons purposes) are the Advanced Central Interface Unit (ACIU) and the NRIU/Ruggedized Nuclear Remote Interface Unit (RNRIU). Other elements involved in the control of nuclear weapons include the Jettison/Release Remote Interface Units (Jett/Rel RIU), the

[redacted]

MAU-12 rack, the Nuclear Consent switch, and the Master Arm Switch. The SMS has the capability of controlling USG weapons. USG requirements for prearming are intended as protection in credible abnormal environments. This feature also affords added protection against inadvertent prearming in normal environments with USG bombs. The following is a list of specific safety features in the F-16 C/D:

b. (U) Advanced Central Interface Unit. The ACIU is designed so that discrete inputs by the pilot are required prior to the issuance of a prearm or release command. The SMS Operational Flight Program (OFP) resides in the ACIU and cannot execute the critical nuclear function in the absence of the discretes. The probability of a self-generated ACIU prearm or release command is within the numerical requirements of AFI 91-107 in both normal and credible abnormal environments.

c. (U) Master Arm Switch. The Master Arm switch provides a software inhibit to the SMS OFP and a hardwired power interrupt to the Jett/Rel RIU. This switch must be in the MASTER ARM position to allow either prearming or releasing of a nuclear weapon.

d. (U) Nuclear Consent Switch. The Nuclear Consent Switch must be in the prearm and release (ARM/REL) position before a prearmed release can occur. The switch must be in the ARM/REL or REL ONLY position before any release can occur. The switch provides a power interrupt to the release and prearm software and a hardware interrupt to the arm power relay and unlock relay. It is a guarded switch and is capable of being safety wired and sealed.

(1) (U) Discretes from the Nuclear Consent switch go to the CIU where they remove inhibits to the Stores Management OFP (SMOFP). These inhibits prevent the processing of arm and release commands unless consent to arm or release is given by the Nuclear Consent switch.

(2) (U) The switch also provides a power interruption to the arming lines in the NRIUs and to the MAU-12 bomb racks. Discrete signals are routed to the NRIU through dedicated circuits. The power interruption to the MAU-12 rack opens the line to the in-flight reversible lock solenoid, preventing rack unlocking. A locked rack opens the cartridge firing circuits.

e. (U) Nuclear Remote Interface Unit/Ruggedized Nuclear Remote Interface Unit. The NRIU/RNRIU is designed so that no single fault or failure can result in the prearming of a nuclear weapon or in the application of power to the aircraft and nuclear weapon interface. This design includes a physical barrier that reduces the chances of a crash environment physically damaging a single relay and applying control power to the weapon interface. The NRIU design excludes

[redacted]

noncurrent-limited power from the weapon control switching section of the unit until positive action is taken by the pilot to command safe or arm.

f. (U) MAU-12 Rack. The MAU-12 rack employs an in-flight reversible lock that fails safe if power is lost. The mechanism opens the firing circuits to the cartridges when locked. The mechanical system, when locked, will prevent weapon release even if the cartridges fire. This rack provides a positive measure to prevent the inadvertent release of a nuclear weapon from the aircraft.

g. (U) Jettison/Release Remote Interface Unit and NRIU/RNRIU Locations. The Jett/Rel RIUs and NRIUs are physically separated. The NRIU/RNRIU processes the prearm and unlock signals and is located within the weapon pylon. The two Jett/Rel RIUs receive the commands for the release of the weapons and are located in the wing leading edges. The physical separation reduces the possibility of an accident producing both prearm and release signals.

h. (U) Stores Management System Communications. Software design, message verification, and multiplexed communication virtually eliminate the potential for generation and transmission of a prearming or release command by intermittent shorts or communications component failure in both normal and credible abnormal environments. A consent discrete is also required before a critical command can be implemented. Since the command and discrete signals are characteristically different, the potential for a prearm command due to a short between command and consent channels is virtually eliminated.

i. (U) Nuclear Caution System. The nuclear caution system in the F-16C/D will alert the pilot to the following events so that appropriate action may be taken:

(1) (U) Uncommanded store prearming condition.

(2) (U) Uncommanded rack unlock.

(3) (U) ARM or SAFE status of a weapon cannot be positively determined.

(4) (U) Uncommanded release signal present.

(5) (U) Nonarming of undisplayed store when arming is selected in dual mode.

[redacted]

(6) (U) Out-of-range condition on a critical command. The ability of the F-16C/D Nuclear Caution system to alert the pilot to an out-of-range condition on a critical command is a significant safety enhancement.

5. (U) WEAPONS STORAGE AND SECURITY SYSTEM (WS^3)

a. (U) Mechanical-Structural Description. The Weapons Storage Vault (WSV) is the mechanical portion of the WS^3. A fully configured WSV will store up to four weapons. The vault includes a reinforced concrete foundation and a steel structure recessed into the floor of existing hardened aircraft shelters (HAS). The vault barrier, barrier support, midlevel deck, and platform assembly are designed to be elevated out of the concrete foundation by means of four nonrotating jackscrews. The elevator drive system provides the means of raising the vault to provide access to the weapons in two stages or levels. This allows for access to weapons (suspended by their suspension lugs) in either the upper vault section or in both the upper and lower sections, depending on the requirement.

b. (U) Weapon Suspension Devices. Each weapon in the WSV is suspended by means of two weapon suspension devices. Suspension blocks are made of heat-treated alloy steel intended to be as strong as the weapon suspension lugs. Weapon lugs are engaged by means of a manually operated retaining pin that slides into the suspension lugs. Retaining pins are locked in the closed position by the action of a spring-loaded handle that engages a recess in the suspension block body. As the handle falls into the recess, a bright green head is exposed, indicating a properly locked state. Four steel bolts secure a single suspension device into holes tapped in the steel plate of the barrier and midlevel deck.

c. (U) Vault Body. The concrete vault body is subjected to static, earth pressure, and ground shock loads. It consists of 20 inches of concrete poured between the liner and the steel sheet piling. The floor slab is approximately 16 inches thick. Reinforcement consists of steel rebar (steel bars in concrete) latticed in the vertical, horizontal, and transverse directions. Sensors to detect intrusion attempts are imbedded in the concrete vault body.

d. (U) Motors. The primary and backup motors are mounted on the platform assembly. The primary motor is a 3-phase, induction motor with a shaft output of 15 horsepower at 1,450 revolutions per minute (RPM). It is capable of lifting the vault and its contents from a fully closed to midlevel position in 1.8 minutes and from the midlevel to a fully opened position in 1.5 minutes. The backup motor is a single-phase motor with a shaft output of 0.5 horsepower. Lifting rates are from fully closed to midlevel in 110 minutes and from midlevel to fully opened in 91 minutes.

[redacted]

e. (U) Elevator Drive System. During normal operations, the primary motor transmits power and reduces RPM from the motor shaft to the main drive shaft by a pulley and V-belt arrangement. The main drive shaft transmits power to two pairs of jacks mounted at either end of the platform. Gear reduction boxes at both ends further reduce the shaft speed before power is received at the jacks. The output shaft of the backup motor is connected to a gear reduction box that is mounted in-line with the main drive shaft.

f. (U) Electrical. The Vault Electrical Support Panel provides the switches, circuit breakers, and monitoring devices necessary to control and monitor the application of primary or emergency generator power to the vault assembly. The panel contains the power transfer panel, vault main power panel, surge voltage protection panel, vault power safety panel, power distribution panel, shelter control panel, and conduit sections and fittings.

g. (U) Coder Transfer Group. The Coder Transfer Group consists of the Code Transfer Unit; a set of A and B Code Storage Modules; and Unlock, Recode, and Rekey Modules. The Code Storage, Recode, and Rekey Modules contain enough codes and keys for 1 year of unit operations under normal conditions. After that time, they require replacement. The Code Storage Modules are loaded by the National Security Agency; depending on the size of the unit, they contain up to 80 blocks of 40 maintenance unlock codes and 20 mass upload unlock codes. The transfer of unlock codes is accomplished by the A part of the Two-Person Concept team connecting the A Code Storage Module to the "code in" receptacle on the Code Transfer Unit and the A Unlock Module to the "code out" receptacle of the Code Transfer Unit. The A team member then enters his unique, three-digit, hexadecimal access code. If it checks, the A team member initiates the transfer of up to six Maintenance Unlock codes, one Mass Upload Unlock code, or one Universal Release Unlock code. The pointer of the Code Storage Module is then permanently incremented so the codes can be used only once. There is also a set of backup Code Storage Modules that must be periodically updated and are kept in the event the primary Code Storage Modules fail. The Universal Release Unlock code is transferred without the use of the Code Storage Modules. It is kept on a two-part, laminated card set and must be entered by typing it into the Code Transfer Unit and transferring it to the Unlock Modules. After the A team member is finished, the B team member performs the same sequence of operations. Two authorized team members then proceed to the HAS to unlock the WSV. The Unlock Modules are then erased by the Code Transfer Unit. The Code Transfer Unit is also used to initiate Identification/Time Delay operations when the vault is first put into operation. The same procedure is used as in the transfer of unlock codes, except that a unique identification number and a time delay number are entered. The numbers are marked on one block of Maintenance Unlock codes in the Code Storage Modules. The identification number and time delay information is then transferred to the unlock modules. One

[redacted]

maintenance unlock code is transferred and expended in the Identification/Time Delay operation. The Identification/Time Delay is then transferred to the specific vault through the Shelter Control Panel. The vault is not unlocked during this operation, but the Maintenance Unlock code is expended for verification.

h. (U) Monitoring System. The monitoring system at the vault consists of the Shelter Control Panel, Vault Processor, Authentication Unit, Vault Modems, Camera and Television Set, Fiber Optic Video Transmitter, and Splice Closures between the vaults and monitoring facility. The monitoring system at the monitoring facility consists of indoor junction boxes, equipment cabinets, Data Communicator, Interface Unit, Message Processor, Data Authenticator, Fiber Optic Video Receiver, Video Switching Unit, Video Presence Detector, Keyboard Printer, and operator consoles.

(1) (U) Shelter Control Panel. The Shelter Control Panel is the operator's interface for opening or closing the vault using the primary operating system. The Shelter Control Panel also monitors and reports the status of Vault Electrical Support Panel sensors and selected components. It is mounted on the Vault Electrical Support Panel. Primary and backup battery power (+12.5 VDC nominal) is input by conduit from the Power Distribution Panel. Data transmission between the Shelter Control Panel, Vault Processor, and Authentication Unit is by fiber optic cables installed in underground conduits. Three spare cables are provided for future functions. Control switches, panel indications, and Unlock Module receptacles are conveniently located on the enclosure door and are clearly marked for ease of operation. Two tamper switches are provided to detect access to connector and enclosure doors. The Shelter Control Panel is lined internally with sensor panels to detect intrusion. The connector and enclosure doors incorporate quick release fasteners for security and ease of operation.

(2) (U) Vault Modems. A vault modem consists of a printed circuit (PC) board. Each vault has two identical modem PC boards. They plug into an assembly which is mounted in the vault power distribution panel. One modem provides two-way data communication between the vault and the local monitoring facility. The other modem provides the same data communication between the vault and the remote monitoring facility.

(3) (U) Camera and Television Set. The Camera and Television Set provide continuous black-and-white video signals for viewing on the television monitors at the monitoring facility's console. The camera operates on 120 VAC at 50/60 Hz. The camera is fully solid state with a 1/4- by 3/16-inch target image area and has a 5.7-millimeter auto-iris lens. The camera is installed in a housing pressurized with dry nitrogen to about 5 pounds per square inch gauge. The housing has a safety relief valve. Replaceable desiccant material is used to dry the interior of the housing.

[redacted]

A humidity indicator monitors the conditions of the desiccant. The housing contains a thermostatically controlled heater and blower.

(4) (U) Data Authenticator. The Data Authenticator is similar to the Authentication Unit at the vault. The Data Authenticator connects to the Message Processor through the Interface Unit. It receives data from the Message Processor for decoding as appropriate. The altered data are then sent back to the Message Processor. The Data Authenticator contains three microprocessors: Input Processor, Custom Data Processor, and Output Processor. The Input Processor contains the encrypting keys and controls the Custom Data Processor. The Custom Data Processor does the actual encrypting and decrypting operation. The Output Processor receives requests for data from other devices and outputs data.

6. (U) TEST AND MONITOR EQUIPMENT SAFETY FEATURES. The approved electrical test and monitor equipment has been evaluated to assure that:

a. (U) Malfunctions and circuit faults will be detected before weapons are loaded.

b. (U) Malfunctions of test or monitor equipment will not introduce currents into the weapons that cause malfunctions or inadvertent activation of weapon components.

c. (U) The required test procedures can be safely accomplished.

d. (U) The possibility of human error is minimized.

PART C

PROPOSED REVISED SAFETY RULES FOR US STRIKE AIRCRAFT

1. GENERAL GUIDANCE

1.1. These safety rules apply to the F-15E and F-16C/D aircraft and nuclear weapons dedicated for use with the aircraft.

1.2. Safety rules always apply, even during war. A commander may deviate from a specific rule in an emergency, but may not expend a nuclear weapon until authorized by an authenticated emergency war order. DoD 3150.2-M, *DoD Nuclear Weapon System Safety Program Manual, December 1996*, defines an emergency as "an unexpected occurrence or set of circumstances in which personnel or equipment unavailability due to accident, natural event, or combat, may demand immediate action that may require extraordinary measures to protect, handle, service, transport, jettison, or employ a nuclear weapon."

1.3. Do not fly with nuclear weapons until authorized.

1.4. Training is prohibited with nuclear weapons.

1.5. These rules, weapon system features, operational controls, and technical procedures, ensure US strike aircraft meet the Nuclear Weapon System Safety Standards in AFI 91-101, *Air Force Nuclear Weapons Surety Program* and DoDD 3150.2, *Nuclear Weapon System Safety Program*, December 23, 1996.

1.6. **Temporary Limitations**. The Air Force may impose more stringent restrictions on application of safety rules.

2. Authorized Weapons. The following weapons are authorized:
- **B61-3**
- **B61-4**
- **B61-10**

3. Nuclear Identification. Develop procedures to distinguish nuclear bombs from test or training shapes.

4. Troubleshooting and Use of Equipment, Procedures, and Checklists.

4.1. Do not use nuclear weapons to troubleshoot faults.

4.2. Use only equipment and procedures that are consistent with US Air Force-approved publications for nuclear weapons or nuclear weapon system operations.

4.3. Approved publications must conform with weapon system safety rules and meet the DoD Nuclear Weapon System Safety Standards.

5. Security Criteria. AFI 31-101 Volume I, *The Air Force Physical Security Program*, AFI 31-101, Volume II, *The Air Force Nuclear Program Standards*, and DoD 5210.41-M, *Nuclear Weapon Security Manual*, April 1994, apply.

6. Tamper Control and Detection. AFI 91-104, *Nuclear Surety Tamper Control and Detection Programs*, which defines the Two-Person Concept and sealing requirements, applies.

7. Handling and Storage of Certified Software. AFI 91-105, *Critical Components*, applies.

8. Personnel Reliability. AFI 36-2104, *Nuclear Weapons Personnel Reliability Program*, and DoDD 5210.42, *Nuclear Weapon Personnel Reliability Program (PRP), May 25, 1993*, apply.

9. Basic Weapon Configurations. Use applicable technical orders to verify B61-3, -4, or -10 is configured correctly.

10. Basic Aircraft Configurations. Place aircraft in the following configuration prior to loading nuclear weapons:

10.1. F-15E:
10.1.1. Nuclear Consent switches in the SAFE position.
10.1.2. Nuclear Consent switch guards down, safety wired, and sealed.
10.1.3. Master Arm switch in the OFF position.
10.1.4. Ensure impulse cartridges are not installed in the wing or centerline pylon breaches when nuclear weapons will be loaded on those stations.

10.2. F-16C/D (Forward Cockpit):
10.2.1. Nuclear Consent switch in the OFF position.
10.2.2. Nuclear Consent switch guard down, safety wired, and sealed.
10.2.3. Master Arm switch in the OFF position.

11. **Storage, Maintenance, Testing, Ground Transportation, Loading, and Unloading.**

11.1. Store nuclear weapons in US Air Force-approved, locked, and secured facilities.

11.2. Use applicable technical data to verify weapon condition prior to handling.

11.3. Load nuclear weapons only on aircraft certified mission capable for the mission to be performed.

11.4. Perform nuclear weapon maintenance only in a Maintenance and Inspection Facility or in a hardened aircraft shelter (HAS).

11.5. Major nuclear weapon maintenance in a HAS must be performed using a weapons maintenance truck (WMT). (Major maintenance is defined as any activity in which major bomb subassemblies are separated.)

11.5.1. Before raising the vault or otherwise introducing a nuclear weapon to the HAS for major maintenance:

11.5.1.1. Remove all conventional munitions and aircraft from the HAS.

11.5.1.2. Position the WMT at least seven feet from the HAS walls or wall attachments.

11.5.2. Do not begin any major maintenance if lightning potential is forecast to occur before task completion.

11.5.3. If lightning becomes a threat when major maintenance is in progress, isolate the WMT from the HAS by disconnecting electrical power, communications lines, and ground lines. Operations may continue on auxiliary power unit (APU) power to reach a safe stopping point in the procedure, provided the APU exhaust hose is equipped with an electrical isolation feature.

11.5.4. If lightning actually occurs within five nautical miles, isolate the WMT as described above and cease operations as soon as the bomb can be brought to a safe configuration.

12. Logistics Movement of Nuclear Weapons by Cargo Aircraft. AFI 91-115, *Safety Rules for Nuclear Logistics Transport by Prime Nuclear Airlift Force*, applies.

13. Operations involving both nuclear weapons and conventional munitions in a HAS. This paragraph applies to storing conventional munitions in a HAS during nuclear generation and subsequent alert operations.

13.1. Simultaneous presence of conventional munitions (except for air-to-air missiles) and nuclear weapons (exposed or with vault not fully down) during practice alerts, exercises, or evaluations is prohibited for operations involving a HAS with a Weapon Storage Vault (WSV), see paragraph 14.

13.2. Operations involving both nuclear and conventional munitions in a HAS require MAJCOM-approved plans. The appropriate group commander must authorize each operation prior to start.

13.3. Before bringing nuclear weapons into a HAS containing conventional munitions:

13.3.1. Have qualified load crew or munitions personnel verify that all conventional munitions are safe.

13.3.2. Fuel the mission-capable aircraft and prepare it for loading, as required.

13.4. When a nuclear weapon-loaded aircraft is in a HAS containing conventional munitions conduct:

13.4.1. Engine runs only when necessary to check aircraft status, perform maintenance, or prepare for authorized flying operations.

13.4.2. Fueling operations only to maintain the aircraft for its mission requirements.

13.4.3. All other operations only as approved by the appropriate group commander. Use appropriate technical data.

13.5. Remove all conventional munitions and aircraft from the HAS before performing any major maintenance on nuclear weapons inside a HAS.

14. Operations Involving Weapons Storage and Security System (WS^3).

14.1. Control the vault processor, authentication unit, and data authenticator under the Two-Person Concept when the WSV is unlocked.

14.2. When the WSV contains a nuclear weapon, do not conduct fuel cell maintenance operations in the HAS.

14.3. Aircraft and associated ground support equipment can remain in the HAS while performing maintenance on a WSV.

14.4. Remove all conventional munitions and aircraft from the HAS before performing any major maintenance on nuclear weapons inside a HAS.

Signature

14.5. Operations involving both nuclear weapons and conventional munitions in a HAS with a WSV require MAJCOM-approved plans. The appropriate group commander must authorize each operation prior to start.

14.5.1. Simultaneous presence of conventional munitions (except for air-to-air missiles) and nuclear weapons (exposed or with vault not fully down) during practice alerts, exercises, or evaluations is prohibited.

14.5.2. In a HAS with a nuclear weapon-loaded WSV, conventional munitions may not exceed 10,000 pounds net explosive weight (NEW).

14.6. Conventional munitions (except for wall-mounted or aircraft-mounted air-to-air missiles) must be positioned at least 15 feet from the WSV. Do not position forward firing ordnance with nose or exhaust pointed directly at the WSV.

14.7. Perform normal day-to-day aircraft maintenance operations only when the WSV is fully down.

14.8. Unlock the WSV only after complying with appropriate security measures.

14.9. Before raising a nuclear weapon-loaded WSV:

14.9.1. Verify all conventional munitions are safe.

14.9.2. Fuel the mission capable aircraft and prepare it for loading, as required.

14.9.3. Cease aircraft maintenance operations.

14.10. When a nuclear weapon-loaded WSV is not fully down, perform only those operations approved by the appropriate group commander.

14.10.1. Do not move aircraft into or out of the HAS.

14.10.2. Move only mission essential equipment into or out of the HAS.

14.10.3. Do not perform engine runs, fueling, or liquid oxygen servicing operations.

14.10.4. Do not perform conventional integrated combat turnaround procedures.

14.10.5. If a fuel, liquid oxygen, hydrazine, or similar hazardous substance release within the HAS is deemed an emergency, return the nuclear weapon-loaded WSV to a fully down position until the emergency is terminated by proper authority.

14.11. Maximize the use of the WSV safety features by keeping the nuclear weapon-loaded WSV fully down unless the specific operation being performed requires vault access.

14.12. Comply with paragraph 13.4 when a nuclear weapon-loaded aircraft is in a HAS containing conventional munitions.

15. Onbase Dispersal of Nuclear Weapons. This paragraph applies only to units without the WS^3:

15.1. Disperse nuclear weapons from weapons storage areas only when directed by appropriate authority and according to MAJCOM-approved plans.

15.2. Only disperse weapons to the following locations:

15.2.1. An empty HAS.

15.2.2. A HAS containing support equipment or war readiness support kits not posing a hazard to the weapons.

15.2.3. A HAS containing no more than one aircraft (with or without weapons) parked nose out. (Only minor maintenance, of the type authorized on nuclear weapon-loaded aircraft, is permitted in the HAS.)

15.2.4. An empty bay of a semihardened fuel truck shelter (FTS). In a double-bay FTS, a fuel truck may be housed in the adjacent bay. Do not store nuclear weapons and fuel trucks in the same bay.

15.3. Do not use nuclear weapons for training, practice alerts, exercises, or evaluations involving onbase dispersal.

16. Ground Operations Involving Nuclear Weapon-Loaded Aircraft.

16.1. Apply power to a loaded nuclear weapon only for authorized permissive action link (PAL) operations or to monitor the weapon. Keep power applications to a minimum.

16.2. Apply power to a nuclear weapon-loaded aircraft only to:

16.2.1. Perform authorized maintenance.

16.2.2. Perform authorized preflight operations.

16.2.3. Start the engine or engines.

16.2.4. Warm up equipment.

16.2.5. Monitor the radio.

16.2.6. Perform authorized PAL operations.

16.3. Keep aircraft towing to a minimum.

16.3.1. A qualified and authorized individual must be in the cockpit during towing.

16.3.2. A Two-Person Concept team must verify the basic aircraft configuration when towing is complete.

16.4. Engine Runup.

16.4.1. F-15E. Allow only authorized aircrews to perform engine runup.

16.4.2. F-16C/D. Allow only an authorized pilot to conduct engine runup.

16.4.3. Use a physical barrier to prevent an unauthorized takeoff during engine runup.

16.4.4. Have a Two-Person Concept team verify the basic aircraft configuration following engine runup.

16.5. Run the engine or engines only if necessary to:

16.5.1. Check aircraft status.

16.5.2. Perform maintenance.

16.5.3. Prepare for authorized flying operations.

16.5.4. Conduct practice alerts, exercises, or evaluations (except as restricted when conventional munitions are in a HAS with nuclear weapons or when a nuclear weapon-loaded WSV is not fully down).

16.6. Do not move a nuclear weapon-loaded aircraft under its own power except:

16.6.1. For authorized flying operations.

16.6.2. When necessary to preserve the safety of the weapon system.

16.7. Fuel the aircraft only to maintain its mission requirements.

17. Flying Operations Involving Carriage of Nuclear Weapons in a Nonstrike Configuration.

17.1. Conduct only when directed by appropriate authority.

17.2. Verify that the PAL is locked prior to loading the nuclear weapon.

17.3. Do not make electrical or mechanical pullout connections between the nuclear weapons and the aircraft.

17.4. Lift the Nuclear Consent switch guards and operate the controls using approved checklists only when weapon jettison is authorized.

17.5. Plan flight routes to avoid populated areas to the maximum extent possible.

18. Flying Operations Involving Carriage of Nuclear Weapons in a Strike Configuration.

18.1. Conduct only when directed by appropriate authority.

18.2. Lift the Nuclear Consent switch guards and operate the controls using approved checklists only when:

18.2.1. Weapon jettison is authorized.

18.2.2. Prearming and release of nuclear weapons are authorized.

18.3. Plan flight routes to avoid populated areas to the maximum extent possible.

18.4. If loss of the aircraft is anticipated or weapon jettison becomes necessary, relock (Disenable) PAL if time and conditions permit.

19. Operations Involving the Lateral Dispersal of Nuclear Weapons for Survival. Lateral dispersal is a wartime contingency movement of nuclear weapons by US transportation from the main operating base to a dispersed operating location (DOL) and subsequent alert operations.

19.1. Disperse nuclear weapons only when directed by appropriate authority and according to MAJCOM-approved plans.

19.2. Use appropriate technical orders to prepare for subsequent alert operations when aircraft and nuclear weapons arrive at the DOL.

19.3. Position nuclear weapon-loaded aircraft in a HAS or alternate shelter (if available) according to MAJCOM-approved plans.

19.4. Do not use nuclear weapons for training, practice alerts, exercises, or evaluations involving lateral dispersal.

19.5. Configure nuclear weapons for carriage on tactical fighter aircraft using the following safety priorities:

19.5.1. Nonstrike configuration.

19.5.2. Strike configuration.

20. PAL Procedures. Use PAL codes and PAL devices only as directed by appropriate authority. Relock (Disenable) PAL if a strike mission is aborted or terminated.

21. Command Disable (CD) Procedures. Use CD codes and CD equipment only as directed by appropriate authority.

APPENDIX A

Operational Plan Data Document (U)

[redacted]

AIR COMBAT COMMAND

OPERATIONAL PLAN DATA DOCUMENT (OPDD) DUAL CAPABLE AIRCRAFT

24 Mar 97

Prepared By: Corwin D. Lemon, Maj, USAF
Submitted By: Donn M. Lewis, Colonel, USAF
Reviewed By: HQ USAFE/HQ PACAF
Approved By: HQ USAF/XONO

[redacted]

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PREFACE

1. (U) This document is classified SECRET-RD to protect information revealing operational plans of U.S. military forces. Information contained herein will be disseminated only to those agencies and personnel whose official duties specifically require knowledge of this document, including those required to develop supporting documents.

2. (U) This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, United States Code, sections 793 and 794. The transmission or revelation of information contained herein, in any manner, to an unauthorized person is prohibited by law.

[redacted]

OPERATIONAL PLAN DATA DOCUMENT (OPDD)
FOR DUAL CAPABLE AIRCRAFT (DCA) (U)
United States Air Force

24 Mar 97

TABLE OF CONTENTS

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CHAPTER 1

PP. 1-1 THROUGH 1-3
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SECTION 4

FINDINGS AND RECOMMENDATIONS (U)

1. (U) Overall NWSSG Assessment

a. (U) Finding. The USAF Nuclear Weapon System Safety Group (NWSSG) conducted an operational safety review and unanimously concluded the F-15E and F-16C/D weapon systems continue to meet the DoD nuclear weapon system safety policy and standards when operated in accordance with briefed system concept of operations, operational plans, approved Air Force technical order procedures, and the existing nuclear weapon system safety rules. Several rule changes were proposed for clarity and to enhance nuclear surety.

b. (U) Recommendation. Air Staff approve the proposed rules.

ACTION AGENCY: HQ USAF/SE
ACTION: Time Compliance

2. (U) Lightning Protection for Weapons Maintenance in Hardened Aircraft Shelters (HAS)

a. (U) Findings:

(1) (U) The NWSSG received briefings on concerns and risks associated with lightning during weapons maintenance in a HAS. The major concern is the effect of lightning when weapons are in a disassembled state and no longer afforded the considerable protection from high voltages inherent in the weapon design. Uncertainty exists as to whether HAS construction provides an adequate Faraday cage to protect operations during lightning storms. Information is not always available to verify if steel in the shelter arch is electrically bonded to rebar in the floor. Bonding is necessary to ensure lightning has a path to ground that minimizes the possibility of arcing in the interior of a HAS. Finally, during maintenance in the Weapons Maintenance Truck (WMT), connections are made to the HAS structure for AC power, communications lines, and grounding. These connections provide current paths from the HAS to the WMT. If the WMT is isolated from the HAS, considerable protection is provided.

(2) (U) It cannot be assured that the B61 meets military characteristics (MC) requirements in abnormal environments when the electrical exclusion regions are breached and the nuclear

system remains functional. Under these conditions, nuclear detonation may occur if energy capable of initiating the nuclear system is present.

(3) (U) Major weapon maintenance may involve disassembly in which the electrical exclusion regions are breached. Lightning is a threat to nuclear safety when such maintenance operations occur in a HAS. Some relevant factors are:

(a) (U) The normal operating mode for the WMT is to use facility AC power, ground the WMT, and connect a communication line to the WMT. These practices eliminate what would otherwise be substantial electrical isolation of the WMT.

(b) (U) When operating the WMT on its APU power, isolation may be compromised by exhaust hose metallic reinforcement as well as the communication and ground lines.

(c) (U) There is no electrical surge protection for HAS AC-power, communication, and security systems.

(d) (U) The quality of connection between wall metal sheeting and floor rebar for many HASs is unknown (i.e., a HAS may not be an effective Faraday cage).

b. (U) Conclusions reached by Sandia National Laboratories assessment are:

(1) (U) A lightning induced surge in the AC power line would probably exceed 25kV.

(2) (U) Ceiling-to-floor voltages depend strongly on the quality of connections between wall metal sheeting and floor rebar. Without effective connections, ceiling-to-floor voltages could be as high as hundreds of kV.

(3) (U) For HASs in which the floor and walls are adequately bonded, and the WMT is electrically disconnected from the HAS, isolation is adequate, even if weapon disassembly is occurring on the floor of the HAS behind the WMT.

(4) (U) Major weapon maintenance in a HAS using current practices is not advisable during lightning activity. Protection depends upon timely and accurate notification of adverse weather. Safety would be significantly enhanced by:

(a) (U) Adding surge protection for AC-power and communication system connections between the WMT and the HAS.

(b) (U) Implementing an electrical isolation feature for the APU exhaust hose.

(c) (U) Establishing (as required) effective connections between wall metal sheeting and floor rebar for all HASs in which major weapon maintenance is to be performed.

(d) (U) Emphasizing the importance of reliable adverse weather warning to personnel performing weapon maintenance in a HAS.

(e) (U) Implementing the expanded requirements for major weapon maintenance as stated in the proposed weapon system safety rules in this report.

c. (U) Recommendations:

(1) (U) For all US and non-US NATO WS^3-equipped sites:

(a) (U) Develop and incorporate electrical surge protection for AC-power and communication system connections between the WMT and the HAS.

ACTION AGENCIES: USAFE/CE
Joint Staff/J4
ACTION: Time Compliance

(b) (U) Develop and incorporate an electrical isolation feature for the APU exhaust hose.

ACTION AGENCY: USAFE/LG
ACTION: Time Compliance

(c) (U) Determine the quality of connections between wall metal sheeting and floor rebar for all HASs in which major maintenance is to be performed. Improve those connections as needed to ensure the HAS becomes an effective Faraday cage.

ACTION AGENCIES: USAFE/CE
Joint Staff/J4
ACTION: Time Compliance

(d) (U) Upgrade weather warning equipment and procedures at affected sites as appropriate to ensure reliable and timely adverse weather warning to personnel performing weapon maintenance in a HAS.

ACTION AGENCY: USAFE/LG
USAFE/DOW
ACTION: Time Compliance

3. (U) Type 3E Load Trainers

a. (U) Finding. The mission is adversely affected by inadequate nuclear weapon load trainers. The Type 3E training munitions at RAF Lakenheath and Cannon AFB are in unacceptable condition. Further, some units do not have trainers that match their assigned weapons. The NWSSG was briefed these conditions have existed for a number of years and that efforts to obtain needed replacement parts and maintenance on these load trainers have been unsuccessful. For example, at RAF Lakenheath, the pull-out connector on one of the training munitions had no tri-lock pins to secure the mating cable to the bomb. A second trainer was observed to have one tri-lock pin missing and the remaining two were extremely loose. These discrepancies led to illumination of a Nuclear Caution light during post load inspection. As a workaround, a crew member had to hold the cable on the connector to extinguish the caution light. Training with munitions of this poor quality will result in load crews becoming accustomed to inappropriate indications and/or relying on workaround procedures to accomplish training requirements.

b. (U) Recommendations

(1) (U) ACC, USAFE and SA-ALC/NW should provide assistance in obtaining needed replacement parts and maintenance assistance in accomplishing trainer repairs.

ACTION AGENCY: SA-ALC/NW
OCR: ACC/LG, USAFE/LG
ACTION: Time Compliance

(2) (U) Make condition of trainers an item of interest during higher headquarters inspections.

ACTION AGENCIES: ACC/IG, USAFE/IG
ACTION: Time Compliance

4. (U) WS^3 Code Module Handling and Control

a. (U) Finding. The NWSSG was briefed by HQ USAFE CSS/SCBS on present procedures for controlling, handling, receiving, and storing the various components used to code, recode, rekey, and unlock the vault. The procedures are found in AFSSI 3012, dated 18 December 1991. However, AFSSI 3012 was rescinded and no further guidance was given to manage these WS^3 code items. Further review also indicated there is apparently no AF or DoD agency taking responsibility for the WS^3 code management process.

b. (U) Recommendation. USEUCOM take ownership of the code management for WS^3 and, in coordination with NSA/V3, provide guidance to HQ USAFE/LGWN on proper handling and control of WS^3 code components.

ACTION AGENCY: USEUCOM/J5N/J36
ACTION: Time Compliance

5. (U) WS^3 Security Monitoring System

a. (U) Findings:

(1)

(2)

(3)

b. (U) Recommendation. Qualified vulnerability assessment personnel perform a study on the WS^3 remote security monitoring system to determine if vulnerabilities exist that pose unacceptable risks.

ACTION AGENCY: HQ AFSC/SEW
ACTION: Time Compliance

6. (U) DOE Handling Equipment

a. (U) Finding. Various DOE provided handling equipment used with nuclear weapons, especially for lifting or supporting nuclear weapons, is not subject to periodic revalidation for continued safe use. This handling equipment may be used beyond its originally projected operational life. An assessment of DOE designed handling equipment is necessary to assure its continued safe usage.

b. (U) Recommendation. DOE reevaluate requirements for maintaining DOE designed handling equipment.

ACTION AGENCY: HQ DOE/DP
ACTION: Time Compliance

7. (U) US Strike Aircraft Operational Plan Data Document (OPDD)

a. (U) Finding. The OPDD, dated 25 Mar 97, provided for use in this study represented a major improvement and update over the previous document. However, the document still contains some outdated and incorrect information. The NWSSG had the following specific concerns:

(1) (U) Chapter 2, paragraph 3b(5), mentions emergency destruction, which is no longer an accepted concept. The NWSSG did not consider this to be part of the concept of operations for the F-15 and F-16 weapon systems. It was not evaluated in this OSR and is not authorized.

(2) (U) Annexes 1 and 2 (paragraphs 4a) identify specific switch positions for F-16 and F-15 aircraft on nuclear alert. These differ from the switch positions identified in the WSSRs' "Basic Aircraft Configuration" section. The "basic aircraft configuration" in the WSSRs is the aircraft configuration required for nuclear alert postures.

b. (U) Recommendation. The OPDD needs to be corrected to provide an accurate description of how the F-15 and F-16 weapon systems will conduct their nuclear mission.

ACTION AGENCY: ACC/DON
ACTION: Time Compliance

SECTION 5

Air Staff Letter of Concurrence

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

OCT 10 1997

MEMORANDUM FOR RECORD

FROM: HQ USAF/SE
9700 G Avenue, SE
Kirtland AFB NM 87117-5670

SUBJECT: USAF Nuclear Weapon System Safety Group (NWSSG) 97-1, Operational Safety Review of the F-15E and F-16C/D

We have reviewed the subject report and concur with the NWSSG findings and recommendations. Action agencies will implement recommendations. This is a HQ USAF/ILM/SE/SF/XON coordinated memorandum. My point of contact is Lt Col Gilbert, DSN 224-3907.

Francis C. Gideon Jr.

FRANCIS C. GIDEON, JR.
Major General, USAF
Chief of Safety

cc:
OATSD(NCB)
AFPEO/AT
HQ AFSC/SEWN

SECTION 6

Distribution

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OATSD(NCB)
The Pentagon, Rm 3C125
Washington DC 20301-3050

Director of Operations (J-3)
ATTN: NOB
3000 Joint Staff Pentagon
Washington DC 20318-3000

Joint Staff/J-4
Washington DC 20318-3000

HQ DSWA/OPOM/OPOA
6801 Telegraph Road
Alexandria, VA 22310-3398

HQ DOE (ATTN: DP-21)
PO Box A
Germantown, MD 20874

HQ USEUCOM/J5N/J36
Unit 30400, Box 1000
APO AE 09128-1000

HQ AFMC/SE
4375 Chidlaw Rd, Ste 6
Wright-Patterson AFB OH 45433-5006

OL-EL/ELO
Unit 8745, Bldg 528
APO AE 09094-5000

HQ USAFE/SE/LG/CE/IG/DOW
Unit 3050, Box 165
APO AE 09094-0165

USSTRATCOM/J443
901 SAC Blvd, Ste 1B21
Offutt AFB NE 68113-6300

Lawrence Livermore Nat'l Lab
PO Box 808, L-125
Livermore, CA 94551

Los Alamos National Lab
PO Box 1663, ESA-WE
Los Alamos, NM 87545

HQ ACC/SEW
219 Dodd Blvd
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HQ ACC/LG
130 Douglas Street
Langley AFB VA 23665-2791

HQ AFSFC/SFON
1720 Patrick Street
Lackland AFB TX 78236-5226

SA-ALC/NW
413 N. Luke Dr, Bldg 1420
Kelly AFB TX 78241-5314

DOE/AL/NESD
PO Box 5400
Albuquerque, NM 87185-5400

Sandia National Laboratories
Org 12332/Org 12334
PO Box 5800
Albuquerque, NM 87185-5800

FCDSWA/FCPSA
1680 Texas Street, SE
Kirtland AFB NM 87117-5669

SA-ALC/NWIS
1651 First Street, SE
Kirtland AFB NM 87117-5617

HQ AFSC/SEWA
9700 G Avenue, SE
Kirtland AFB NM 87117-5670

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