412TW-PA-15211

# T-2 MOD SAFETY AND AIRWORTHINESS ASSESSMENTS


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412TW




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This presentation was prepared for the International Test and Evaluation Association's (ITEA) 19th Test Instrumentation Workshop held in Las Vegas, NV from 12-15 May 2015. It describes recent changes in how T-2 Modification hazards are identified at the Air Force Test Center (AFTC), and how the hazards and corresponding mitigations are assessed with respect to modification safety and airworthiness. The presentation concludes with an exercise involving a fictitious modification, which provides an opportunity for audience participation.

**15. SUBJECT TERMS**
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*War-Winning Capabilities … On Time, On Cost*

# T-2 Mod Safety and Airworthiness Assessments

## 13 May 2015

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U.S. AIR FORCE

# Overview

- T-2 Mod process developed and used to maintain safety for aircraft modification and instrumentation
- Formal airworthiness evaluation recently included as a parallel process
- The AFTC Form 6238, *T-2 Modification Airworthiness Determination and Preliminary Hazard Analysis*, form developed to support both processes

# Previous Form

## PRELIMINARY HAZARDS ANALYSIS

| MDS | SERIAL NUMBER | MOD NUMBER |
|---|---|---|
| | | |

COLUMN 1 APPLICABILITY / COLUMN 2 ACCEPTABILITY

INSTRUCTIONS: ALL ITEMS CHECKED IN COLUMN 1 MUST BE EVALUATED IN COLUMN 2 AND EXPLAINED ON REVERSE OR ON AN ATTACHED SHEET

| NOT APPLICABLE | APPLICABLE | ACCEPTABLE | UNDEFINED | HAZARD LIST |
|---|---|---|---|---|
| | | | | 1. ISOLATION OF ENERGY SOURCES |
| | | | | 2. FUELS AND PROPELLANTS |
| | | | | 3. SYSTEM ENVIRONMENTAL CONSTRAINTS |
| | | | | 4. EXTERNAL ENVIRONMENTAL IMPACT |
| | | | | 5. EXPLOSIVE DEVICES |
| | | | | 6. COMPATABILITY OF MATERIALS |
| | | | | 7. EMI EFFECTS OR SUSCEPTABILITY |
| | | | | 8. PRESSURE VESSELS |
| | | | | 9. CRASH SAFETY |
| | | | | 10. OPERATION AND MAINTENANCE |
| | | | | 11. TRAINING AND CERTIFICATION |
| | | | | 12. EGRESS, RESCUE, SURVIVAL |
| | | | | 13. LIFE SUPPORT REQUIREMENTS |
| | | | | 14. FIRE IGNITION AND PROPAGATION |
| | | | | 15. SHOCK DAMAGE RESISTANCE |
| | | | | 16. EQUIPMENT LAYOUT AND LIGHTING |
| | | | | 17. FAIL SAFE DESIGN |
| | | | | 18. VULNERABILITY AND SURVIVABILITY |
| | | | | 19. PROTECTIVE CLOTHING, EQUIPMENT, OR DEVICES |
| | | | | 20. LIGHTNING AND ELECTROSTATIC PROTECTION |
| | | | | 21. OPERATION ERROR |

RECOMMENDATIONS:

1. SAFETY REVIEW BOARD ☐ IS ☐ IS NOT REQUIRED
2. FLIGHT TEST ☐ IS ☐ IS NOT REQUIRED TO VERIFY AIRWORTHINESS AND SUITABILITY

| NAME, GRADE, AND OFFICE SYMBOL OF MODIFICATION PROGRAM MANAGER | SIGNATURE | DATE |
|---|---|---|
| | | |

412 MXG Form 5338 Mar 03 (EF) (PerFORM PRO) PREVIOUS EDITIONS ARE OBSOLETE

# Previous Form (Cont.)

- Typically prepared by Modification Managers with some inputs from engineers
- Listed hazard areas rather than specific hazards
  - Areas did not numerical coincide with MIL-HDBK-516C
- Once an area is checked as applicable, the mitigation would be listed on the back side of the form

# AFTC FORM 6238

412 TW

This form has gone through a number of changes, with this representing the current version awaiting approval by the airworthiness community

**T-2 MODIFICATION AIRWORTHINESS DETERMINATION AND PRELIMINARY HAZARDS ANALYSIS**

| MDS: | SERIAL NUMBER: | MOD NUMBER: | DATE: |
|---|---|---|---|

**INSTRUCTIONS:** Answer the questions and determine AW impact. Hazards checked Yes (Y) in the Applicable column (APP) must also be checked Yes (Y) or No (N) in the Compliance (COMP) column indicating compliance with MIL-HDBK-516C criteria, or as approved by the MEA and CE/DTA. Use the back to expand/explain.

| YES | NO | **Airworthiness impact questions:** *A positive response is a good indicator of an AW impact (but is not the final decision)* |
|---|---|---|
| | | 1) Is re-accomplishment of verification activities required to show compliance to the baseline certification basis? |
| | | 2) Have any existing safety hazards been impacted or have new safety hazards been identified? |
| | | 3) Are any safety/flight-critical items, logic and/or functions impacted? |
| | | 4) Is formal flight test to validate the mod required? |
| | | 5) Does the operational usage change? |
| | | 6) Does the flight envelope change? |
| | | 7) Does the service life change? |
| | | 8) Other |

AIRWORTHINESS IMPACT

☐ YES

☐ NO

| Y/N APP | Y/N COMP | MIL-HDBK-516C SECTION | Y/N APP | Y/N COMP | MIL-HDBK-516C SECTION |
|---|---|---|---|---|---|
| | | 4 – SYSTEMS ENGINEERING | | | 12 – ELECTRICAL SYSTEM |
| | | 5 – STRUCTURES | | | 13 – ELECTROMAGNETIC ENVIRONMENTAL EFFECTS (E³) |
| | | 6 – FLIGHT TECHNOLOGY | | | 14 – SYSTEM SAFETY |
| | | 7 – PROPULSION AND PROPULSION INSTALLATIONS | | | 15 – COMPUTER SYSTEMS AND SOFTWARE |
| | | 8 – AIR VEHICLE SUBSYSTEMS | | | 16 – MAINTENANCE |
| | | 9 – CREW SYSTEMS | | | 17 – ARMAMENT |
| | | 10 – DIAGNOSTIC SYSTEMS | | | 18 – PASSENGER SAFETY |
| | | 11 – AVIONICS | | | 20 – AIR TRANSPORTABILITY, AIRDROP, MISSION/TEST EQUIPMENT AND CARGO/PAYLOAD SAFETY |

**HAZARD AND COMPLIANCE SUMMARIES (See reverse for summary format)**

RECOMMENDATIONS:

☐ SAFETY REVIEW BOARD REQUIRED ☐ SAFETY REVIEW BOARD IS NOT REQUIRED

☐ FLIGHT TEST REQUIRED ☐ FLIGHT TEST IS NOT REQUIRED

| NAME, GRADE, AND OFFICE SYMBOL OF MEA | SIGNATURE | DATE |
|---|---|---|
| NAME, GRADE, AND OFFICE SYMBOL OF CE/DTA | SIGNATURE | DATE |

# Form 6238 (Cont.)

412 TW

**T-2 MODIFICATION AIRWORTHINESS DETERMINATION AND PRELIMINARY HAZARDS ANALYSIS**

| MDS: | SERIAL NUMBER: | MOD NUMBER: | DATE: |
|---|---|---|---|

**INSTRUCTIONS:** Answer the questions and determine AW impact. Hazards checked Yes (Y) in the Applicable column (APP) must also be checked Yes (Y) or No (N) in the Compliance (COMP) column indicating compliance with MIL-HDBK-516C criteria, or as approved by the MEA and CE/DTA. Use the back to expand/explain.

| YES | NO | **Airworthiness impact questions:** *A positive response is a good indicator of an AW impact (but is not the final decision)* | AIRWORTHINESS IMPACT |
|---|---|---|---|
| | | 1) Is re-accomplishment of verification activities required to show compliance to the baseline certification basis? | ☐ YES |
| | | 2) Have any existing safety hazards been impacted or have new safety hazards been identified? | ☐ NO |
| | | 3) Are any safety/flight-critical items, logic and/or functions impacted? | |
| | | 4) Is formal flight test to validate the mod required? | |
| | | 5) Does the operational usage change? | |
| | | 6) Does the flight envelope change? | |
| | | 7) Does the service life change? | |
| | | 8) Other | |

The form asks questions similar to the Air Force Life Cycle Management Center's (AFLCMC) Airworthiness Determination Form (ADF) shown at right.

**2. Airworthiness Impact Assessment.**

**2.1 Airworthiness impact questions (AWB-007):**

*A positive response is a good indicator of an Airworthiness impact but is not the final decision.*

**Yes/No**

Y/N 1) Does the approved certification basis (applicable criterion, standards and methods of compliance) need to be updated (*refer to Section 3.1*)?

Y/N 2) Is re-accomplishment of verification activities required to show compliance to the certification basis?

Y/N 3) Have any existing safety hazards been impacted or have new safety hazards been identified?

Y/N 4) Are any safety-/flight-critical items, logic and/or functions impacted?

Y/N 5) Is analysis/test/simulation/demonstration required to assess the change?

Y/N 6) Is formal flight test required?

Y/N 7) Does the operational usage change?

Y/N 8) Does the flight envelope change?

Y/N 9) Does the service life change?

Y/N 10) Does this require a new Mission Design Series (MDS)?

**2.2 Does this modification impact airworthiness?**

*The final impact assessment is a judgment made by the CE/DTA with DOE/DTA oversight.*

Y/N

# Form 6238 (Cont.)

| Y/N | | MIL-HDBK-516C SECTION | Y/N | | MIL-HDBK-516C SECTION |
|---|---|---|---|---|---|
| APP | COMP | | APP | COMP | |
| | | 4 – SYSTEMS ENGINEERING | | | 12 – ELECTRICAL SYSTEM |
| | | 5 – STRUCTURES | | | 13 – ELECTROMAGNETIC ENVIRONMENTAL EFFECTS ($E^3$) |
| | | 6 – FLIGHT TECHNOLOGY | | | 14 – SYSTEM SAFETY |
| | | 7 – PROPULSION AND PROPULSION INSTALLATIONS | | | 15 – COMPUTER SYSTEMS AND SOFTWARE |
| | | 8 – AIR VEHICLE SUBSYSTEMS | | | 16 – MAINTENANCE |
| | | 9 – CREW SYSTEMS | | | 17 – ARMAMENT |
| | | 10 – DIAGNOSTIC SYSTEMS | | | 18 – PASSENGER SAFETY |
| | | 11 – AVIONICS | | | 20 – AIR TRANSPORTABILITY, AIRDROP, MISSION/TEST EQUIPMENT AND CARGO/PAYLOAD SAFETY |

HAZARD AND COMPLIANCE SUMMARIES (See reverse for summary format)

*SECTION # – SECTION TITLE*
*HAZARD SUMMARY: (Subsection number(s)) Description of hazard and impact.*
*COMPLIANCE SUMMARY: Standard(s) – Description of the method of compliance.*

Identify which sections of MIL-HDBK-516C that are applicable and indicate whether the risk mitigation steps comply with applicable standards and/or guidance. Hazards are, where possible, further tied to handbook subsections and standards identified in the compliance summary.

# Form 6238 (Cont.)

412 TW

| RECOMMENDATIONS: | | |
|---|---|---|
| ☐ SAFETY REVIEW BOARD REQUIRED ☐ FLIGHT TEST REQUIRED | ☐ SAFETY REVIEW BOARD IS NOT REQUIRED ☐ FLIGHT TEST IS NOT REQUIRED | |
| NAME, GRADE, AND OFFICE SYMBOL OF MEA | SIGNATURE | DATE |
| NAME, GRADE, AND OFFICE SYMBOL OF CE/DTA | SIGNATURE | DATE |

A carryover from the previous form 5338 by providing Safety Review Board and Flight Test recommendations, followed by approvals of the Modification Engineering Authority (MEA) and the Chief Engineer/Delegated Technical Authority (CE/DTA). Nearly the entire reverse side of the form is available for additional summaries.

# Form 6238 (Cont.)

412 TW

- Prepared by engineers and signed by the MEA and CE/DTA.
- Provided to the CE/DTA for airworthiness impact evaluation prior to signing the T-2 Modification Configuration Control Board Directive (AFMC Form 244)
- "Living Document" subject to re-evaluation and change at any time during the design and modification process

# Preparation Process

- Begins with “free form” consideration of hazards
- Consider whether common hazards are applicable
- Consult the Consolidated Criteria List to help ensure all areas are considered
- Formulate risk mitigations
- Assess whether the mitigations coincide with the applicable standards and/or guidance

# Preparation Process (Cont.)

412 TW

- Once the engineers have developed the form it is presented to other engineers during staff peer reviews
- The MEA then reviews and signs the document to be passed on to the CE/DTA to support their airworthiness impact assessment
- Will be coordinated through the Director Of Engineering (DOE) for impact modifications
- It is presented to the Configuration Control/Design Review Board (DRB) for both Preliminary CCB and Design Approval requests

# Common Hazards

412 TW

- **Aero/ME**
  - Cockpit/Flight Deck mounted items dislodge resulting in damage to equipment and/or injury to personnel
  - Instrumentation installation impairs aircraft control
  - Pressure bulkhead or skin penetrations prevent adequate cabin pressurization
  - Installed system inhibits egress
- **EE**
  - Installed system or components interfere with the avionics system
  - Power requirements of installed system exceed available aircraft power
  - Avionics bus tap degrades operation of the bus
  - Inadequate current protection or wire selection results in overheat and possible combustion of wire and electronic components

# Exercise

412 TW

- A new, four engine transport aircraft needs to be tested to develop handling characteristics for publishing in the flight manual. Among the alterations needed are:
  - Provide control switches to close production fuel valves to any one of the engines in order to evaluate the engine out characteristics during all phases of flight
  - Install an in-line load cell in one yoke to measure pilot's pitch and roll control loads
  - Install rack with DAS/Recorder and a transmitter and antennas to telemeter data to a ground station providing both on-board and ground data recording
  - Provide a display for airspeed on the glare shield. Airspeed developed from Special Instrumentation

# Exercise (Cont.)

412 TW

- Begins with “free form” consideration of hazards
- Consider whether common hazards are applicable
- Consult the Consolidated Criteria List to help ensure all areas are considered
- Formulate risk mitigations
- Assess whether the mitigations coincide with the applicable standards and/or guidance

# BACKUP SLIDES

# Possible Exercise Answer

## T-2 MODIFICATION AIRWORTHINESS DETERMINATION AND PRELIMINARY HAZARDS ANALYSIS

| MDS: | SERIAL NUMBER: | MOD NUMBER: | DATE: |
|---|---|---|---|

**INSTRUCTIONS:** Answer the questions and determine AW impact. Hazards checked Yes (Y) in the Applicable column (APP) must also be checked Yes (Y) or No (N) in the Compliance (COMP) column indicating compliance with MIL-HDBK-516C criteria, or as approved by the MEA and CE/DTA. Use the back to expand/explain.

| YES | NO | **Airworthiness impact questions:** *A positive response is a good indicator of an AW impact (but is not the final decision)* |
|---|---|---|
| X | | 1) Is re-accomplishment of verification activities required to show compliance to the baseline certification basis? |
| | X | 2) Have any existing safety hazards been impacted or have new safety hazards been identified? |
| | X | 3) Are any safety/flight-critical items, logic and/or functions impacted? |
| | X | 4) Is formal flight test to validate the mod required? |
| | X | 5) Does the operational usage change? |
| | X | 6) Does the flight envelope change? |
| | X | 7) Does the service life change? |
| | X | 8) Other |

AIRWORTHINESS IMPACT

☐ YES

☑ NO

| Y/N | | MIL-HDBK-516C SECTION | Y/N | | MIL-HDBK-516C SECTION |
|---|---|---|---|---|---|
| APP | COMP | | APP | COMP | |
| | | **4 – SYSTEMS ENGINEERING** | X | X | **12 – ELECTRICAL SYSTEM** |
| X | X | **5 – STRUCTURES** | X | X | **13 – ELECTROMAGNETIC ENVIRONMENTAL EFFECTS ($E^3$)** |
| X | X | **6 – FLIGHT TECHNOLOGY** | | | **14 – SYSTEM SAFETY** |
| | | **7 – PROPULSION AND PROPULSION INSTALLATIONS** | | | **15 – COMPUTER SYSTEMS AND SOFTWARE** |
| | | **8 – AIR VEHICLE SUBSYSTEMS** | | | **16 – MAINTENANCE** |
| X | X | **9 – CREW SYSTEMS** | | | **17 – ARMAMENT** |
| | | **10 – DIAGNOSTIC SYSTEMS** | | | **18 – PASSENGER SAFETY** |
| | | **11 – AVIONICS** | | | **20 – AIR TRANSPORTABILITY, AIRDROP, MISSION/TEST EQUIPMENT AND CARGO/PAYLOAD SAFETY** |

# Possible Exercise Answer (Cont.)

**HAZARD AND COMPLIANCE SUMMARIES (See reverse for summary format)**

- HAZARD SUMMARY: (Subsection 5.1.9, 5.3.1, & 9.7.6) Installed equipment (Rack, recorder and glare shield mounted display) dislodge resulting in damage to equipment and/ or injury to personnel
- COMPLIANCE SUMMARY: JSSG-2006 & JSSG-2010 – All installations will be evaluated for adequate strength for the expected maximum loading conditions

- HAZARD SUMMARY: (Subsection 5.3.1 & 6.2.2.2) In-line load cell fails resulting in loss of aircraft control
- COMPLIANCE SUMMARY: JSSG-2006 & JSSG-2008 – Load cell and installation will be evaluated for adequate strength for the expected maximum loading conditions. Co-pilot yoke will not be modified and a co-pilot will be present during all testing to assume control in the event of load cell failure

- HAZARD SUMMARY: (Subsection 6.2.6.1) Engine is shut down at the wrong time, or multiple engines are shut down instead of only one engine, resulting the loss of aircraft control
- COMPLIANCE SUMMARY: JSSG-2008 – Fuel shutoff circuitry will only allow one engine to be shut down. Fuel shutoff switches will be set up to clearly indicate which engine is selected and prevent inadvertent changes or activation

- HAZARD SUMMARY: (Subsection 9.2.1.2) Glare shield mounted display obstructs the pilot's view
- COMPLIANCE SUMMARY: JSSG-2001 – Display installation will be assessed by the project pilot and Flight Safety personnel using mock-ups during development and with the final product during installation

- HAZARD SUMMARY: (Subsection 12.1.1) Installed modification electrical power requirement exceeds available aircraft power
- COMPLIANCE SUMMARY: JSSG-2009 – Power loads analysis will be performed to verify that power consumption does not exceed safe limits

RECOMMENDATIONS:

☐ SAFETY REVIEW BOARD REQUIRED ☑ SAFETY REVIEW BOARD IS NOT REQUIRED

☐ FLIGHT TEST REQUIRED ☑ FLIGHT TEST IS NOT REQUIRED

| NAME, GRADE, AND OFFICE SYMBOL OF MEA | SIGNATURE | DATE |
|---|---|---|
| NAME, GRADE, AND OFFICE SYMBOL OF CE/DTA | SIGNATURE | DATE |

# Possible Exercise Answer (Cont.)

**HAZARD AND COMPLIANCE SUMMARIES (Cont.)**

SECTION 13 – ELECTROMAGNETIC ENVIRONMENTAL EFFECTS ($E^3$)
- HAZARD SUMMARY: (Subsection 13.2.1) Installed system or components interfere with avionics system
- COMPLIANCE SUMMARY: MIL-STD-464 – The aircraft will be required to successfully pass an EMI/EMC prior to release.

# Variation on the Exercise

- What if the following were required?
  - The ability to kill multiple engines
  - Load cells installed in both yokes
  - The pilot would rely solely on the airspeed displayed on the glare shield, rather than have it as a reference value.

# Variation on the Exercise Form 6238

## T-2 MODIFICATION AIRWORTHINESS DETERMINATION AND PRELIMINARY HAZARDS ANALYSIS

| MDS: | SERIAL NUMBER: | MOD NUMBER: | DATE: |
|---|---|---|---|

**INSTRUCTIONS:** Answer the questions and determine AW impact. Hazards checked Yes (Y) in the Applicable column (APP) must also be checked Yes (Y) or No (N) in the Compliance (COMP) column indicating compliance with MIL-HDBK-516C criteria, or as approved by the MEA and CE/DTA. Use the back to expand/explain.

| YES | NO | **Airworthiness impact questions:** *A positive response is a good indicator of an AW impact (but is not the final decision)* |
|---|---|---|
| X | | 1) Is re-accomplishment of verification activities required to show compliance to the baseline certification basis? |
| | X | 2) Have any existing safety hazards been impacted or have new safety hazards been identified? |
| X | | 3) Are any safety/flight-critical items, logic and/or functions impacted? |
| | X | 4) Is formal flight test to validate the mod required? |
| | X | 5) Does the operational usage change? |
| | X | 6) Does the flight envelope change? |
| | X | 7) Does the service life change? |
| | X | 8) Other |

AIRWORTHINESS IMPACT

☑ YES

☐ NO

| Y/N | | MIL-HDBK-516C SECTION | Y/N | | MIL-HDBK-516C SECTION |
|---|---|---|---|---|---|
| APP | COMP | | APP | COMP | |
| | | **4 – SYSTEMS ENGINEERING** | X | X | **12 – ELECTRICAL SYSTEM** |
| X | X | **5 – STRUCTURES** | X | X | **13 – ELECTROMAGNETIC ENVIRONMENTAL EFFECTS ($E^3$)** |
| X | | **6 – FLIGHT TECHNOLOGY** | | | **14 – SYSTEM SAFETY** |
| | | **7 – PROPULSION AND PROPULSION INSTALLATIONS** | X | | **15 – COMPUTER SYSTEMS AND SOFTWARE** |
| | | **8 – AIR VEHICLE SUBSYSTEMS** | | | **16 – MAINTENANCE** |
| X | X | **9 – CREW SYSTEMS** | | | **17 – ARMAMENT** |
| | | **10 – DIAGNOSTIC SYSTEMS** | | | **18 – PASSENGER SAFETY** |
| | | **11 – AVIONICS** | | | **20 – AIR TRANSPORTABILITY, AIRDROP, MISSION/TEST EQUIPMENT AND CARGO/PAYLOAD SAFETY** |

# Variation on the Exercise Form 6238 (Cont.)

**HAZARD AND COMPLIANCE SUMMARIES (See reverse for summary format)**

- HAZARD SUMMARY: (Subsection 5.1.9, 5.3.1, & 9.7.6) Installed equipment (Rack, recorder and glare shield mounted display) dislodge resulting in damage to equipment and/ or injury to personnel
- COMPLIANCE SUMMARY: JSSG-2006 & JSSG-2010 – All installations will be evaluated for adequate strength for the expected maximum loading conditions

- HAZARD SUMMARY: (Subsection 5.3.1 & 6.2.2.2) Both in-line load cells fail resulting in loss of aircraft control
- COMPLIANCE SUMMARY: JSSG-2006 & JSSG-2008 – Load cells and installations will be evaluated for adequate strength for the expected maximum loading conditions. Because both yokes will have in-line load cells, another way to provide redundancy is needed, so the installation will be designed such that if the load cells fail it will be possible to still input commands, though there may be slop in the system

- HAZARD SUMMARY: (Subsection 6.2.6.1) Engines are shut down at the wrong time, or the wrong engines are shut down, resulting in loss of aircraft control
- COMPLIANCE SUMMARY: JSSG-2008 – Fuel kill switches will be set up to clearly display which engines are selected and prevent inadvertent changes or activation. Due to program cost and time constraints, fuel shutoff control components could not be integrated into an aircraft simulator. Control components evaluated by Flight Safety and will be tested during a couple of flight tests after the aircraft is released from its modification.

- HAZARD SUMMARY: (Subsection 9.2.1.2) Glare shield mounted display obstructs the pilot's view
- COMPLIANCE SUMMARY: JSSG-2001 – Display installation will be assessed by the project pilot and Flight Safety personnel using mock-ups during development and with the final product during installation

- HAZARD SUMMARY: (Subsection 12.1.1) Installed modification electrical power requirement exceeds available aircraft power
- COMPLIANCE SUMMARY: JSSG-2009 – Power loads analysis will be performed to verify that power consumption does not exceed safe limits

RECOMMENDATIONS:

☐ SAFETY REVIEW BOARD REQUIRED ☑ SAFETY REVIEW BOARD IS NOT REQUIRED

☐ FLIGHT TEST REQUIRED ☑ FLIGHT TEST IS NOT REQUIRED

| NAME, GRADE, AND OFFICE SYMBOL OF MEA | SIGNATURE | DATE |
|---|---|---|
| NAME, GRADE, AND OFFICE SYMBOL OF CE/DTA | SIGNATURE | DATE |

# Variation on the Exercise Form 6238 (Cont.)

HAZARD AND COMPLIANCE SUMMARIES (Cont.)

SECTION 13 – ELECTROMAGNETIC ENVIRONMENTAL EFFECTS ($E^3$)
- HAZARD SUMMARY: (Subsection 13.2.1) Installed system or components interfere with avionics system
- COMPLIANCE SUMMARY: MIL-STD-464 – The aircraft will be required to successfully pass an EMI/EMC prior to release.

SECTION 15 – COMPUTER SYSTEMS AND SOFTWARE
- HAZARD SUMMARY: (Subsection 15.6.2) Airspeed on the glare shield mounted display is incorrect due to errors in the software
- COMPLIANCE SUMMARY: JSSSEH – Due to the short term nature of the test program, it's decided not to proceed with full software certification. Software performance will be verified during a couple of test flights following the aircraft's release from the modification

# Variation on the Exercise Form 6239

| T-2 MODIFICATION AIRWORTHINESS COMPLIANCE | | | T-2 MODIFICATION NUMBER (ARTIFACT LOCATION) | |
|---|---|---|---|---|
| INSTRUCTIONS: Complete columns 1-3 for affected criteria when a T-2 mod is determined to impact airworthiness. Assign an overall AWHI value to determine reportability. This is the Cert Basis and must be approved/signed by the CE/DOE DTAs. After analyses and tests are accomplished, complete columns 4-5, update the overall AWHI and reportability assessment as necessary. OG accepts/signs for operational risk. This becomes the Compliance Report and must be approved/signed by the CE/DOE DTAs. | | | | |
| Impacted MIL-HDBK-516C Sections | Criteria (specific para #) | Required Analyses/Tests (Include document number when applicable) | Compliance (Y/N-Residual AWHI) | Hazard Summary/Mitigations |
| **4 - Systems Engineering**<br>4.1 ☐ Design criteria<br>4.2 ☐ Tools and databases<br>4.3 ☐ Materials selection<br>4.4 ☐ Manufacturing and quality<br>4.5 ☐ Op. & maint. manuals/TOs<br>4.6 ☐ Configuration Management | | | | |
| **5 - Structures**<br>5.1 ☐ Loads<br>5.2 ☐ Structural dynamics<br>5.3 ☐ Strength<br>5.4 ☐ Damage tolerance and durability (fatigue)<br>5.5 ☐ Mass properties<br>5.6 ☐ Flight release | | | | |
| **6 - Flight Technology**<br>6.1 ☐ Flying Qualities<br>6.2 ☑ Vehicle Control Functions (VCF)<br>6.3 ☐ Air vehicle aerodynamics and performance | 6.2.2.2<br>6.2.6.1 | (6.2.2.2) JSSG-2008 – Laboratory tests to demonstrate the ability to input commands after complete failure of the load cell. Minimum three samples tested.<br>(6.2.6.1) JSSG-2008 – Fuel shutoff control components integrated into the aircraft's simulator for testing. | N | Engines are shut down at the wrong time, or the wrong engines are shut down, resulting in loss of aircraft control<br>Due to program cost and time constraints, fuel shutoff control components could not be integrated into the aircraft's simulator. Control components were instead evaluated by Flight Safety and will be tested during a couple of flight tests after the aircraft is released from its modification. |
| **7 – Propulsion**<br>7.1 ☐ Propulsion risk management<br>7.2 ☐ Gas turbine engine applications<br>7.3 ☐ Alternate propulsion systems | | | | |

# Variation on the Exercise Form 6239 (Cont.)

| Impacted MIL-HDBK-516C Sections | Criteria (specific para #) | Required Analyses/Tests (Include document number when applicable) | Compliance (Y/N-Residual AWHI) | Hazard Summary/Mitigations |
|---|---|---|---|---|
| **13 – EMI/EMC**<br>13.1 ☐ Component/subsystem E3 qualification<br>13.2 ☐ System-level E3 qualification | | | | |
| **14 – System Safety**<br>14.1 ☐ System safety program<br>14.2 ☐ Safety design requirements<br>14.3 ☐ Software safety program | | | | |
| **15 – Computer Resources/Software**<br>15.1 ☐ System Processing Architecture (SPA)<br>15.2 ☐ Design and functional integration of SPA elements<br>15.3 ☐ Processing hardware/electronics<br>15.4 ☐ Software development process<br>15.5 ☐ Software architecture and design<br>15.6 ☑ Software qualification and installation | 15.6.2 | JSSSEH – Full qualification testing and report prepared | N | Airspeed on the glare shield mounted display is incorrect due to errors in the software<br>Due to the short term nature of the test program, it's decided not to proceed with full software certification. Software performance will be verified during a couple of test flights following the aircraft's release from the modification |
| **16 – Maintenance**<br>16.1 ☐ Maintenance manuals/checklists<br>16.2 ☐ Inspection requirements | | | | |
| **17 - Air Vehicle/ Stores Integration**<br>17.1 ☐ Gun/rocket integration and interface<br>17.2 ☐ Stores integration<br>17.3 ☐ Laser integration<br>17.4 ☐ Safety interlocks | | | | |
| **18 – Passenger Safety**<br>18.1 ☐ Survivability of passengers<br>18.2 ☐ Fire resistance<br>18.3 ☐ Physiology requirements of occupants | | | | |
| **20 – Air Transportability, Airdrop, Mission/Test Equipment and Cargo/Payload Safety**<br>20.1 ☐ Air transportability and airdrop<br>20.2 ☐ Mission/test equipment operations and installation | | | | |

# Variation on the Exercise Form 6239 (Cont.)

**Reportability Determination/Certification Basis Approval (columns 1-3)**

| NAME, GRADE, AND OFFICE SYMBOL OF CE/DTA | REPORTABLE: Y/N | DATE | SIGNATURE |
|---|---|---|---|
| NAME, GRADE, AND OFFICE SYMBOL OF DOE/DTA | REPORTABLE: Y/N | DATE | SIGNATURE |

**Aircraft Operation Risk Acceptance** (For AWHI of 18-20 Squadron CC or equivalent signs, for AWHI of 10-17 Group CC or equivalent signs)

| NAME, GRADE, AND OFFICE SYMBOL OF OG | ACCEPT RISK Y/N | DATE | SIGNATURE |
|---|---|---|---|

**Compliance Report Approval (columns 4-5)**

| NAME, GRADE, AND OFFICE SYMBOL OF CE/DTA | DATE | SIGNATURE |
|---|---|---|
| NAME, GRADE, AND OFFICE SYMBOL OF DOE/DTA | DATE | SIGNATURE |

# Variation on the Exercise Form 6239 (Cont.)

Overall Airworthiness Hazard Index (AWHI)

The overall modification AWHI is typically the worst of all the sections, however, as several hazards are combined, the resultant overall AWHI could be more extreme due to the interaction between system/subsystem updates as described in AWB-007.

| HAZARD CATEGORIZATION | | SEVERITY* | | | |
|---|---|---|---|---|---|
| | | CATASTROPHIC (1) | CRITICAL (2) | MARGINAL (3) | NEGLIGIBLE (4) |
| FREQUENCY | FREQUENT (A) = or > 100/100K flt hrs | 1 | 3 | 7 | 13 |
| | PROBABLE (B) 10-99/100K flt hrs | 2 | 5 | 9 | 16 |
| | OCCASIONAL (C) 1.0-9.9/100K flt hrs | 4 | 6 | 11 | 18 |
| | REMOTE (D) 0.01-0.99/100K flt hrs | 8 | 10 | 14 | 19 |
| | IMPROBABLE (E) = or < 0.01/100K flt hrs | 12 | 15 | 17 | 20 |

*__Severity__ is the worst credible consequence of a hazard in terms of degree of injury, property damage or effect on mission defined below:

(1) **Catastrophic:** Class A (damage > $2M / fatality / permanent total disability / loss of Aircraft)
(2) **Critical:** Class B ($500K < damage < $2M / permanent partial disability / hospitalization of 5 or more personnel)
(3) **Marginal:** Class C ($50K < damage < $500K / injury results in 1 or more lost workdays)
(4) **Negligible:** All other injury/damage less than Class C

(Table Adapted from MIL-STD-882D Table A-I thru Table A-IV)
(For T-2 Modifications, "FREQUENCY" is evaluated for the duration of use within the 100K flt hr aircraft life span)

**Overall Modification AWHI = 12**

**Reportable AWHI is 1-9.**