



# Analogs to Instill HSI Considerations into DoD Acquisition Programs

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# Agenda

- **Motivation**
- **Preferred Methods for Human Considerations in Acquisition**
- **Human as the Weapon System**  
...and Subsystem
- **Constructs using Human as a Weapon System**
- **Limitations & Concerns**
- **Summary**



# Motivation

- **Why do avionics limitations have a higher priority than human limitations?**
  - **Environmental Control System burden**
  - **Upgraded avionics have created a larger thermal output**
    - Provides “increased capability”
    - Lack of specification for “no increase in thermal load”?
    - COTS items?
    - Thermal “offset” is often gained from the operator
- **Many processes used for hardware/software can be applied to humans**



# Preferred Methods for Human Considerations

## Data Item Descriptions (DIDs)

- **Common HSI and HSI-related DIDs**
  - **DI-HFAC-81743 - Human Systems Integration Program Plan**
  - **DI-HFAC-80746 - Human Engineering Design Approach Document – Operator (HEDAD-O)**
  - **DI-HFAC-80747 - Human Engineering Design Approach Document – Maintainer (HEDAD-M)**
  - **DI-HFAC-81742 - Human Engineering Program Plan (HEPP)**
- **Can be tailored down (reduced in scope)**

Human Systems Integration Guide for Contracts: Integration of HSI Language into Acquisition Contracts

**SURVIAC-TR-10-869**

# AIRMAN

HOME TABLET EDITION DEPA

## THE HUMAN WEAPON

Performance Program grows stronger, healthier operators

STORY BY STAFF SGT. DAVID SALANITRI PHOTOS BY MASTER SGT. JEFFREY ALLEN MULTIMEDIA BY ARTHUR ANDREW BREESE

2 September 2014

*In air combat, "The Weapon" is a...*  
*In a similar spirit, Air and Space...*  
*join the intellectual battlespace. P...*

## Managing th

## A Vision for an A

LT COL ANTHONY P. TVARY  
COL LEX BROWN, USAF  
NITA L. MILLER, PhD



STORY // STAFF SGT. DAVID SALANITRI  
PHOTOS // MASTER SGT. JEFFREY ALLEN  
PHOTO ILLUSTRATIONS // MAUREEN STEWART

Officers,  
Escape  
Personnel  
el  
non-



# The Human Subsystem (or System of Systems)



# Interface Control Document

## DI-SESS-81248B

The ICD provides a record of all **interface information...** generated for the project

- a. All released/approved interface information for the project
- b. A revision record for all released/approved interface information for the project, including release dates
- c. A cross-reference listing relating all released/approved interface information for the project to the configuration items and system elements to which they apply
- d. **A description of the physical and functional relationships** between all released/approved interface information for the project



# FMECA Report DI-SESS-81495A

- Failure Modes, Effects, and Criticality Analysis Report  
“provides an analysis of independent **single item failures** and the resulting potential impact on mission success, performance, safety, and maintainability.” MIL-HDBK-502A, Product Support Analysis, states: “A FMECA systematically identifies the **likely modes of failure**, the possible effects of each failure, and the criticality of each effect on mission completion, environmental impacts, health hazards, and system safety.”





# FMECA - Identify Failure Modes

- **Human failure modes**
  - **Workload exceedance**
  - **Physiological limits being exceeded**
    - **Not enough oxygen**
    - **Fatigue**
  - **Loss of Situational Awareness**
  - **Other sources of human error**



# FMECA (from DAU)

- 2. “Define the Ground Rules and Assumptions—these aid in better understanding the results of the analysis. Some examples include: mission of the item, operating time, source of **failure rate data**.”



# FMECA – Detection, Isolation & Compensation

## DAU:

- “Identify means of failure **Detection, Isolation, and Compensation**—Answer how the failure is by the operator, how the failure [can be] isolated, and how is it compensated for (redundancy, monitor, back up).”
  - Human Physiological Monitoring System
  - 2+ crewmembers
  - Automatic Ground Collision Avoidance System



<https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=8680c037-6a24-4c6d-8b6f-ea2392d16871>



# Configuration Management Plan

## DI-CMAN-80858B

- “A configuration item (CI) may be an **individual item**, or may be a **significant part of a system** or of a higher-level CI. It is designated at an appropriate level for documenting **performance attributes** and managing changes to those attributes.”
  - Like a human(s)



# The Configuration Management Process

- Configuration items (humans)
- **Documents that define the performance, functional, and physical attributes of an item.** These documents are referred to as configuration documentation.
- Other documents which are used for **training**, operation and maintenance of an item
- Associated and **interfacing items** that are used for **training**, operation, or maintenance of the configuration item.



# MIL-HDBK 515, Weapon System Integrity Guide (WSIG)

This handbook provides guidance on how to integrate the existing integrity processes within systems engineering. This is accomplished through three basic thrusts:

- a. Integrating the efforts called out in the various integrity processes, namely: ASIP, ENSIP, MECSIP, and AVIP.
- b. **Synergistically integrating or coordinating specific integrity process efforts/tasks with related efforts in various other systems engineering disciplines.**
- c. Placing increased emphasis on the **sustainment** portion of the life cycle.



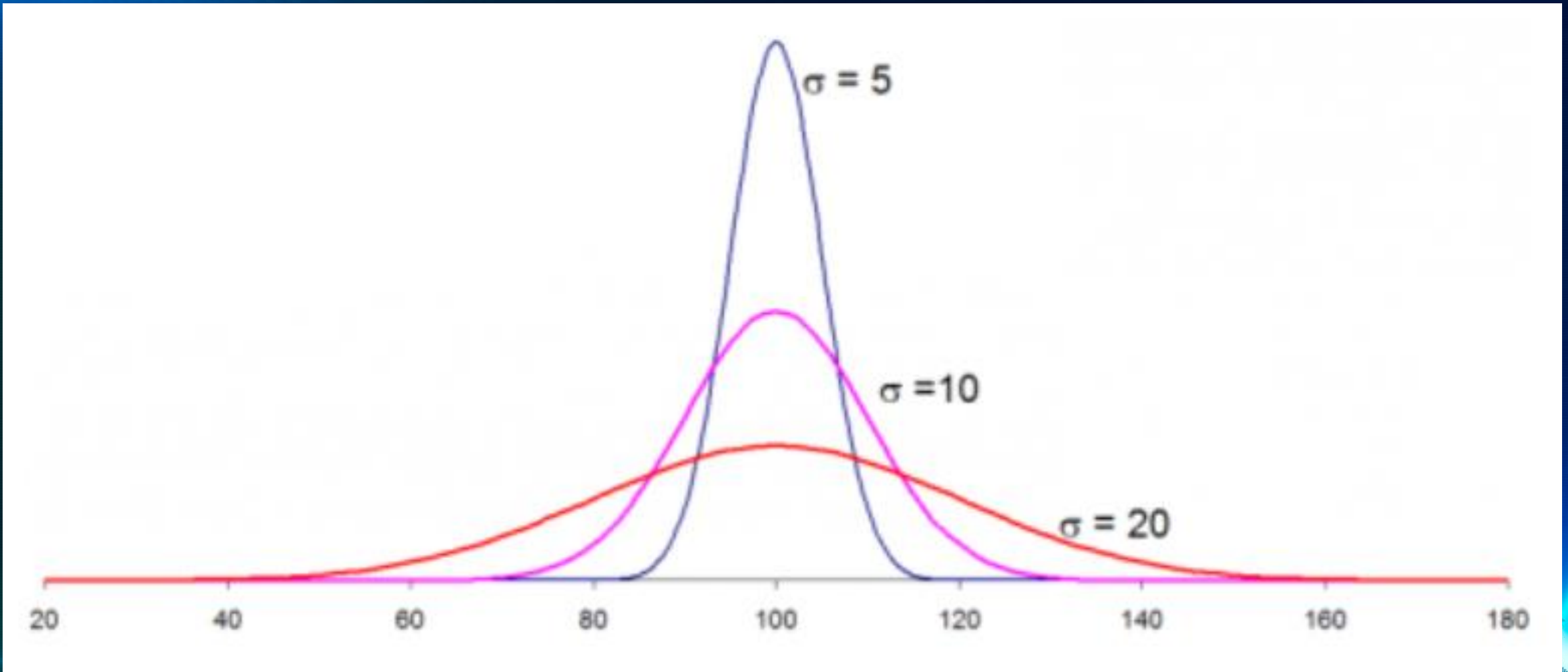
# (Human) Weapon System Integrity Program

“Establish a Weapon System Integrity Program IAW AFI 63-101, Acquisition and Sustainment Life Cycle Management. Integrity programs shall follow MIL-HDBK 515, Weapon System Integrity Guide (WSIG) to **integrate** the efforts called out in the various integrity processes.”

- MIL-STD-3024, Mechanical Equipment and Subsystems Integrity Program [MECSIP]
- Avionics/Electronics Integrity program [AVIP] MIL-HDBK-515



# Limitations?





# Summary

- **Humans can and should be considered a weapon system/subsystem**
  - HSI Practitioners can cite examples where a human trade-off would not occur with other systems (e.g. avionics)
- **Many processes used for hardware/software can be applied to humans**
- **Gaps in human performance and limitations need to be better defined (researched) for various populations**
  - **Airman Systems Directorate**



# Questions?

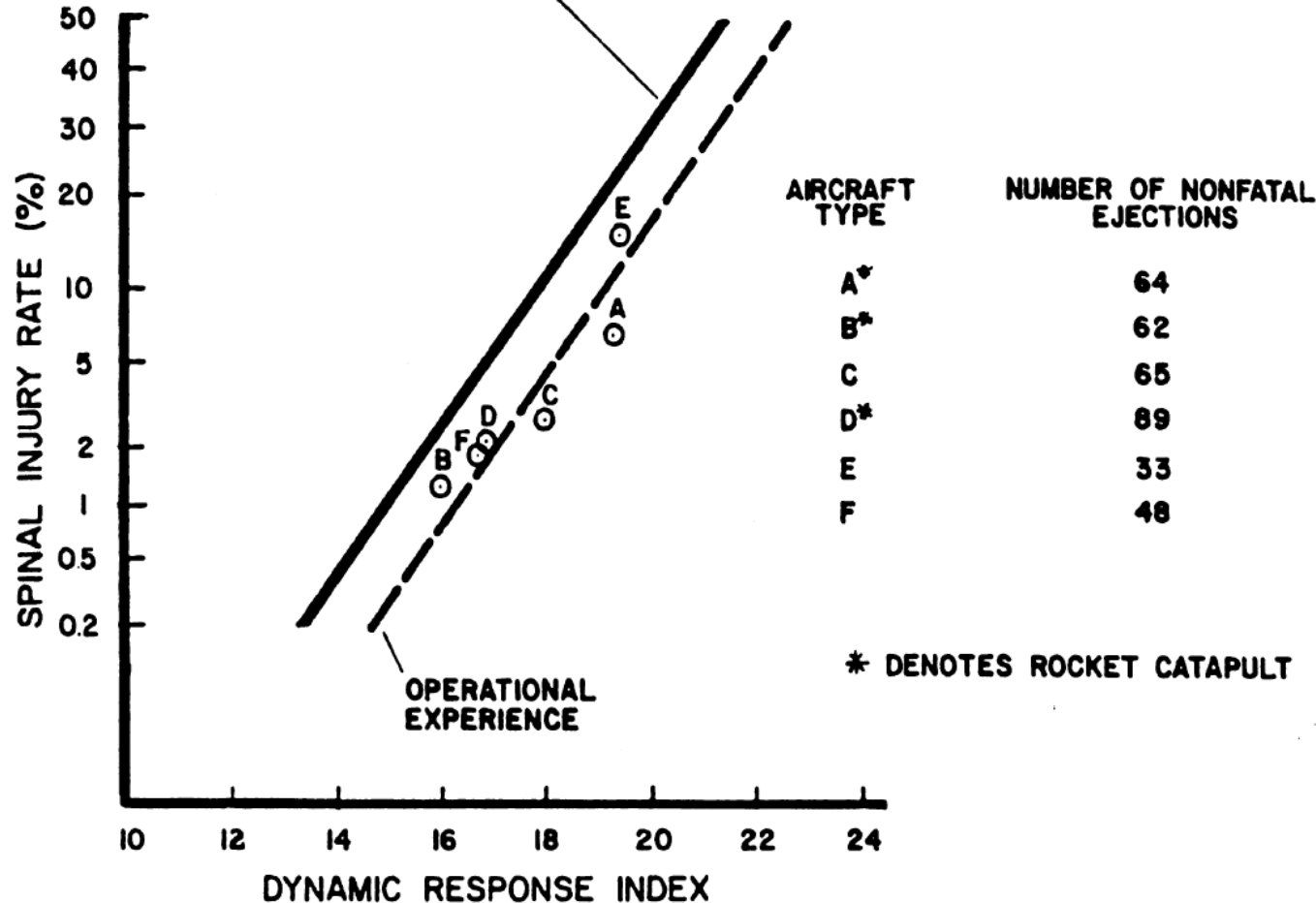


# Backup Slides



# Know Your User Population

Payne, P. R. 1975, Spinal Injury in the Crash Environment  
 CALCULATED FROM CADAVER DATA



“This could be the effect of our subject pool consisting of active duty military volunteers who are required to maintain relatively stringent Air Force fitness standards.”

Gallagher, H. L. et al (2007). An Analysis of Vertebral Stress and BMD During +Gz Impact Accelerations. AFRL-HE-WP-TR-2007-0085.

