Human Systems Integration (HSI)

HSI Execution in the U.S. Air Force

Col Bill Mueller

Director, Human Systems Integration
711th Human Performance Wing
Air Force Research Laboratory

U.S. AIR FORCE

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.
PA Case No: 88ABW-2014-1126 Date Cleared: MAR 20, 2014

OVERVIEW

- **What is Human Systems Integration (HSI)?**
- **Who is the Human Systems Integration Directorate (711HPW/HP)?**
- **How does HP execute HSI?**
- **HSI case-studies**
- **Current challenges**

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

What is Human Systems Integration?

- **The systematic *<u>integration</u>* of nine human-centered domains to optimize total system performance, decrease cost**
- ***Much* more than simply Human Factors Engineering (HFE)**
- **HSI affects every mission w/in DoD**
- **Requires extensive & pervasive *<u>teamwork</u>* (e.g., program manager, systems engineer, acquisition team, etc.)**

HSI is NOT:

- **Another name for human factors**
- **"Just good Systems Engineering"**
- **What we've always done**
- **Another stovepipe**

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

What is Human Systems Integration?

Provides user centric design SMEs in support of acquisition and airman life cycles

Acquisitions

- **Embedded in SPO or Reach Back**
- **Systematic *integration* of nine human-centered domains**
- **Optimize total system performance (vs. a single domain), decrease cost**
- **Informs the life cycle decision making process with a human-centered focus**

AF Medical Services

- **Still the systematic *integration* of nine human-centered domains**
- **But less mature and structured than in LAF acquisitions**
- **Influences diffuse centers of gravity (multiple technology portals into AFMS and its health delivery platforms)**
- **Maximizes health and performance outcomes & decreases health services delivery costs (*optimizing value*) = BEST VALUE**

Informs the acquisition and medical life cycle decision making process with a human-centered focus

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

Who we are…

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

711th Human Systems Integration Directorate

Mission

Optimize warfighter capability through a human-centric approach to system development, sustainment, and enhancement

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

HP Organization

- **Four focus areas…**

Medical

Materiel

C4ISR

Force Projection

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

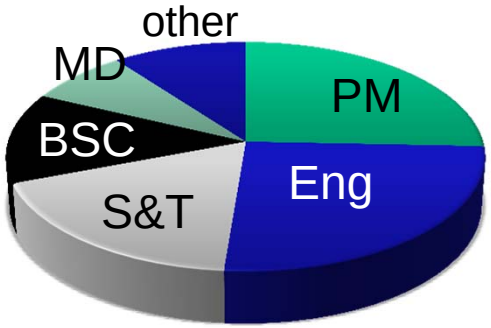
What resources do we utilize? PEOPLE

- **40 personnel**
  - **MD x2**
  - **PhD x3**
  - **HSI Masters x2**
  - **HSI certification x16**
- **Career Fields**
  - **Program Managers x10**
  - **Engineers x10**
  - **Scientists x7**
  - **Biomed Service Corp x5**
  - **Medical Doctors x2**
- **Expertise in all 9 AF HSI domains…**

Domain/program SMEs

HSI SMEs

Users

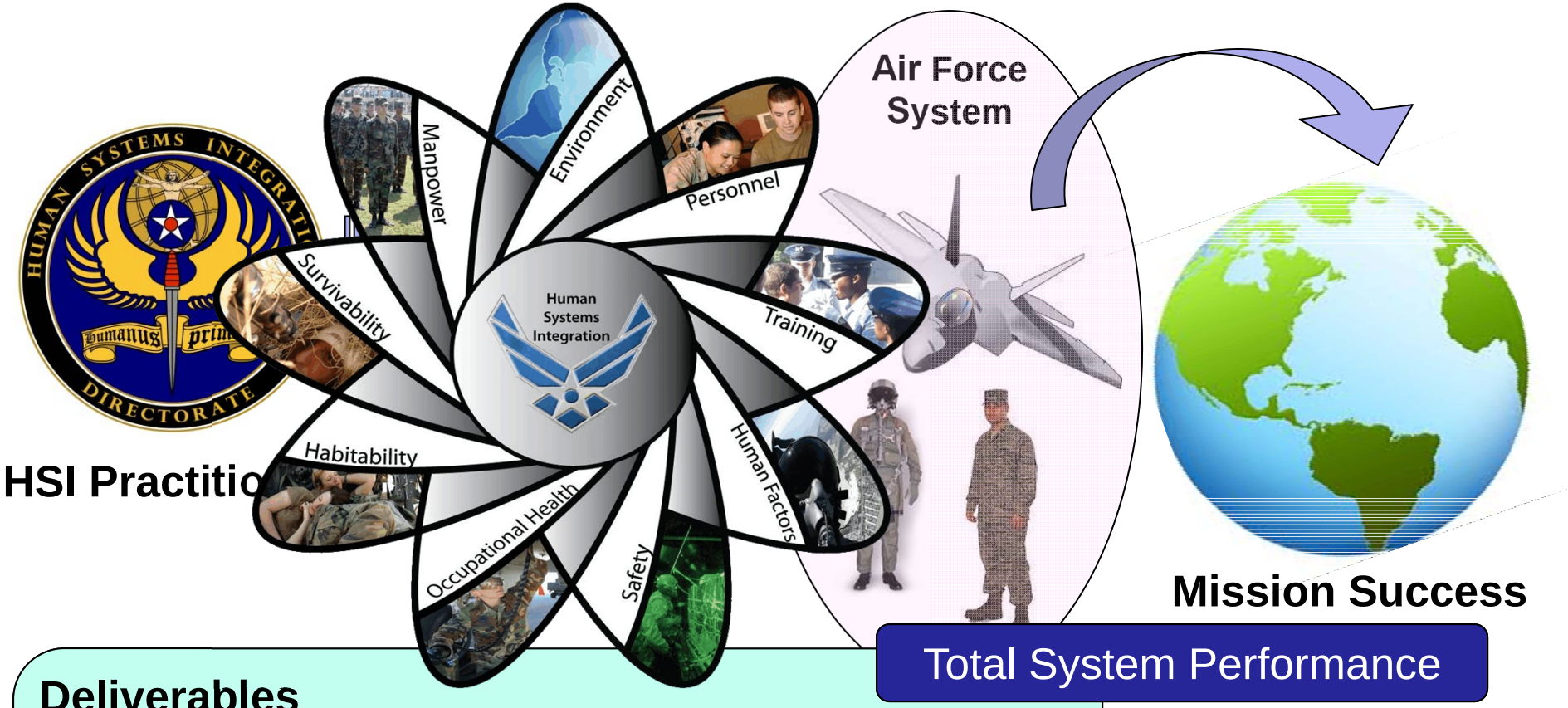


DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

HSI Execution

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

HP Role in the USAF



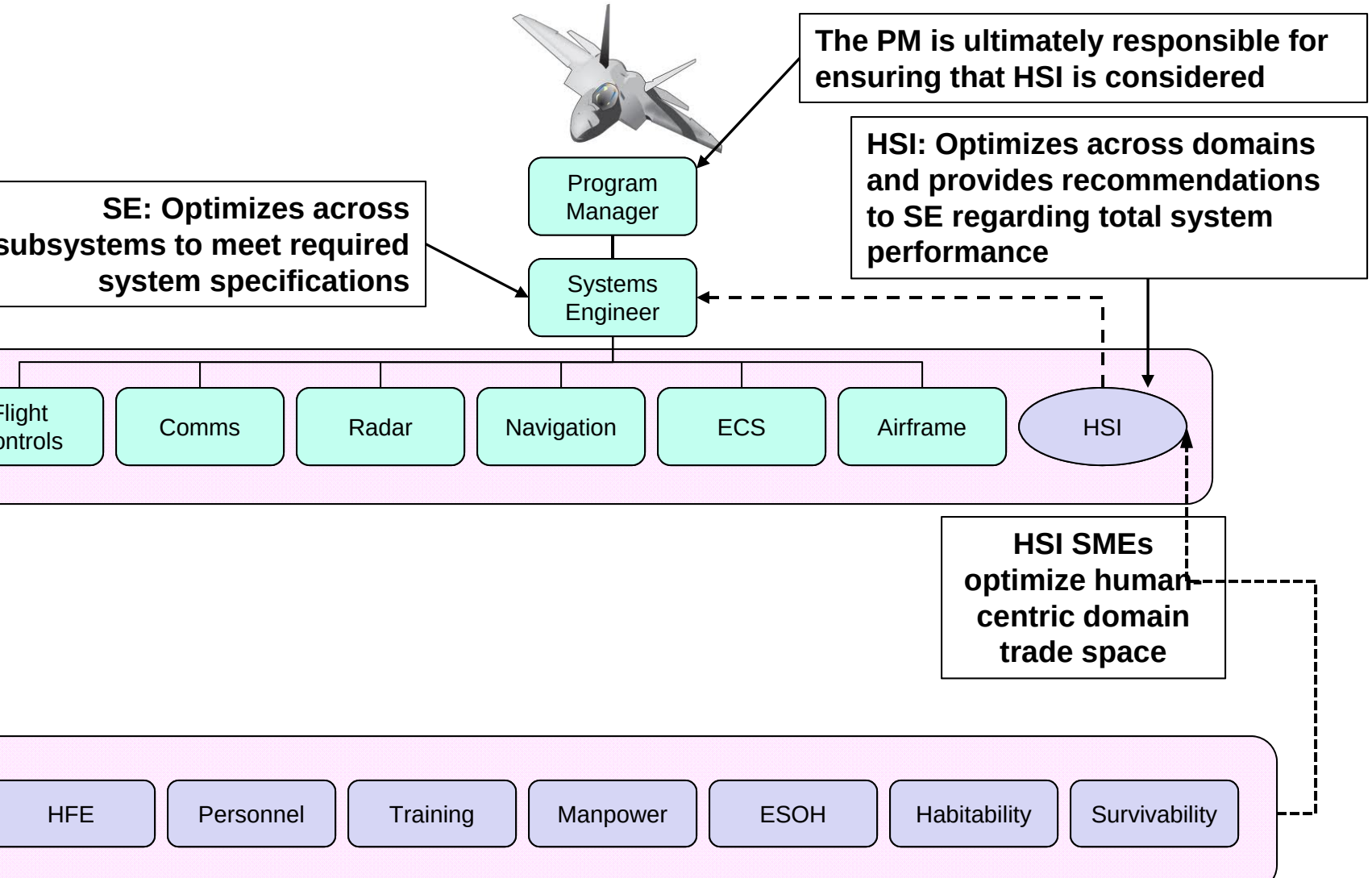
Total System Performance

Deliverables

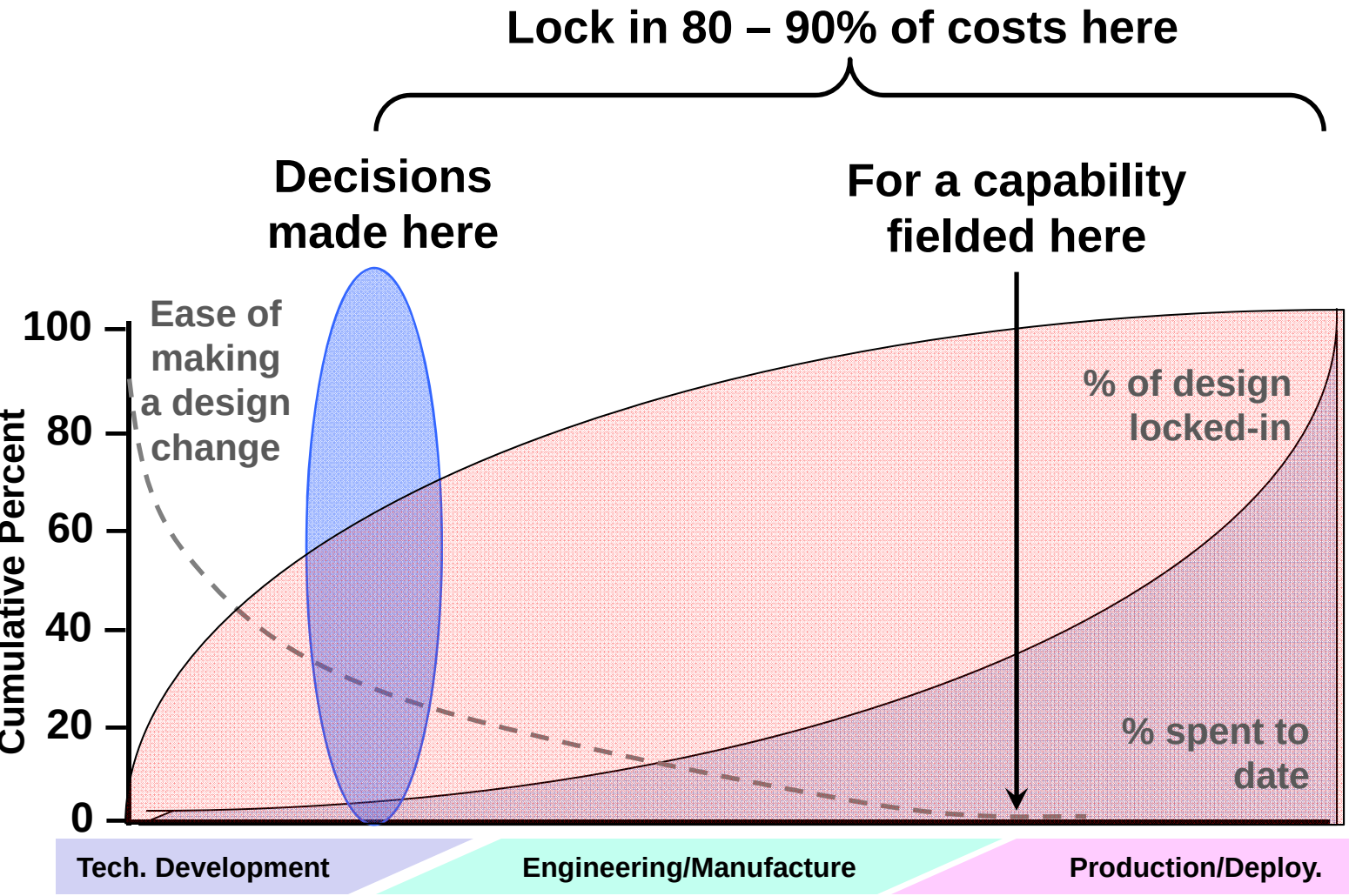
-Provide HSI Risk assessments at key program decision points
 --***Inform*** decision makers
 --Provide ***risk reduction***
 --Optimize human ***performance***
 --Reduce life cycle ***costs***

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

HSI Involvement in 'notional' SPO



Importance of Early HSI



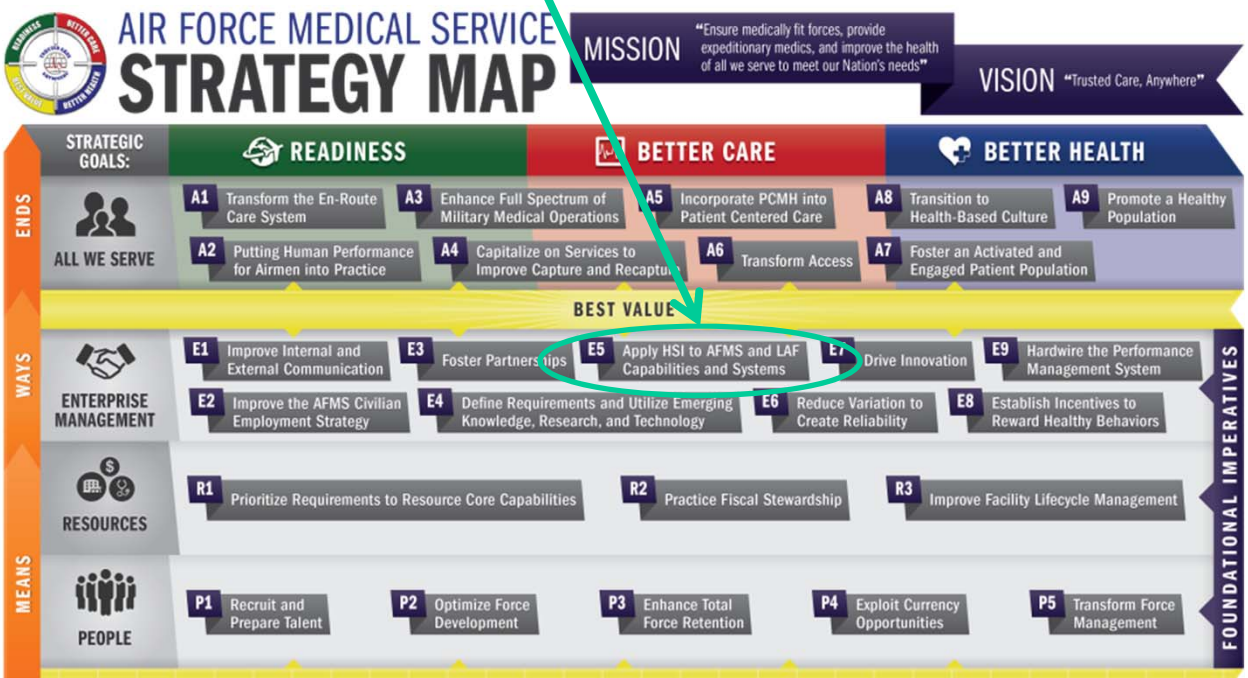
Ops Tempo

Up to 80% of all Life Cycle Costs post IOC are HSI related

Why HSI in AFMS Now

Improved healthcare workflow & process management (e.g. Base Operational Medicine Cell)

Strategic Map Objective E5 "Apply HSI to AFMS and LAF capabilities and systems"



How is HSI applied in the AFMS

ame process, whether applied
o acquisitions or medicine

urrently support BOMC, FOMC,
CS Human Systems Division

lentifying HSI touchpoints to
upport AFMS processes

nitially for AFMS requirements,
&E, acquisition & logistics

eveloping approaches to
ealthcare management, policy
nd clinical care

- HSI in AFMS will look different:
  - Core “weapon systems” are health care delivery systems (more people than technology)
  - Not dependent on traditional acquisition framework for primary systems; multiple entry pathways for technology (especially COTS)
  - Decentralized development of sys
  - Practitioners need medical knowledge

Examples of ineffective HSI implementation

Oxygen (O_2) System

O_2 System design resulted in no emergency backup after engine failure

Reduced power- off glide range due to lack of HSI input

Spirit Maintenance Manpower

Initial B-2 manpower force template identical to B-52

- Low utilization rates = “unemployed” technicians

Used legacy figure instead of task analysis for initial manpower estimate

Examples of effective HSI implementation

2 Raptor Maintenance AFSC Restructure

Conducted Maintenance AFSC structure nalysis – offered three options

- Final solution reduced footprint by 33 % Savings: $335M

Proposed ACC maintenance organization estructure Savings: $442M

7 Refueling and Manpower

Fueling station design reduced manpower equired from 3 to 1

Early analyses reduced cost – made job asier / people more effective

Current HSI Case-studies

Avionics Upgrade

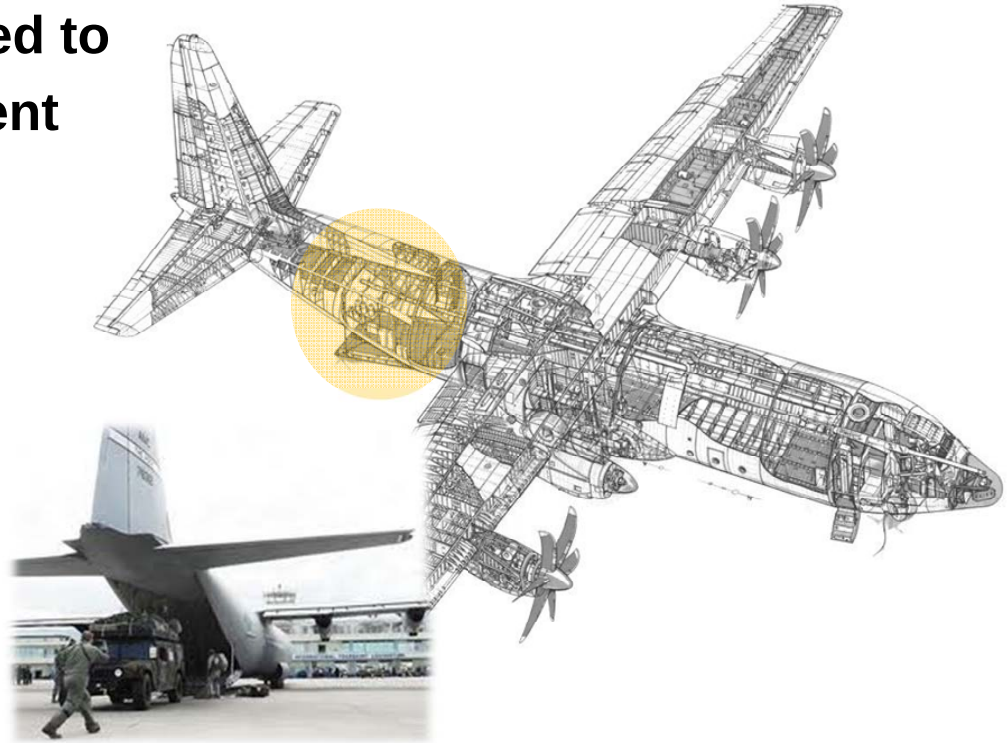
Avionics modernization upgrades

- Front-end analysis to include aircrew/mission needs, environment, operations, etc.
- Ensure aircrews can effectively accomplish all missions without excessive workload or performance degradation, minimal training
- Maintenance/logistics considerations

Aircraft Upgrades

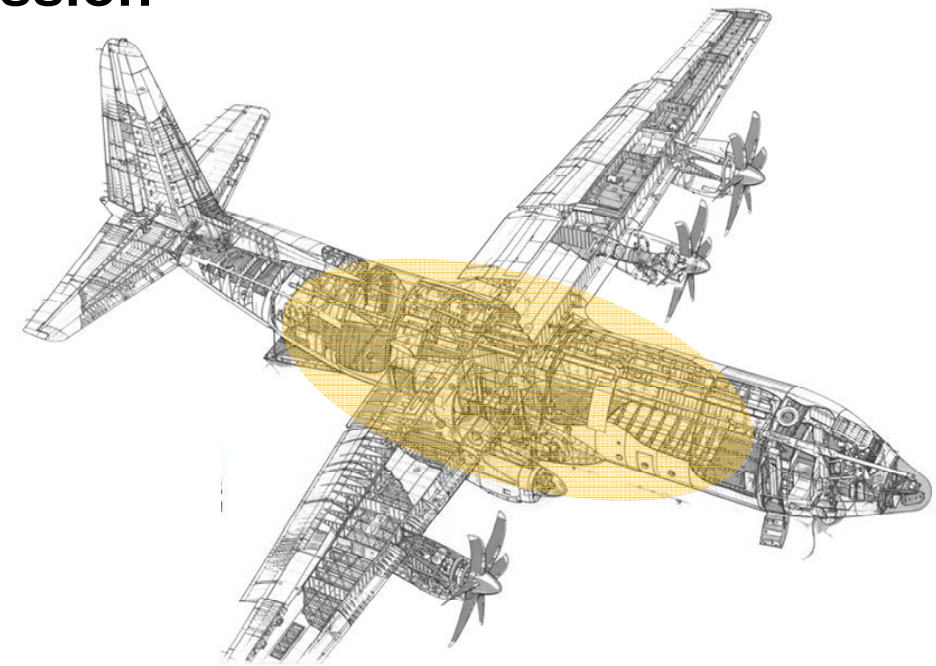
Loading/unloading equipment & supplies

- **Eliminate or minimize:**
  - **Extra personnel required to handle and lift equipment**
  - **Safety mishaps due to drops, falls, equipment shifting during flight**
  - **Damage to equipment due to mishaps**



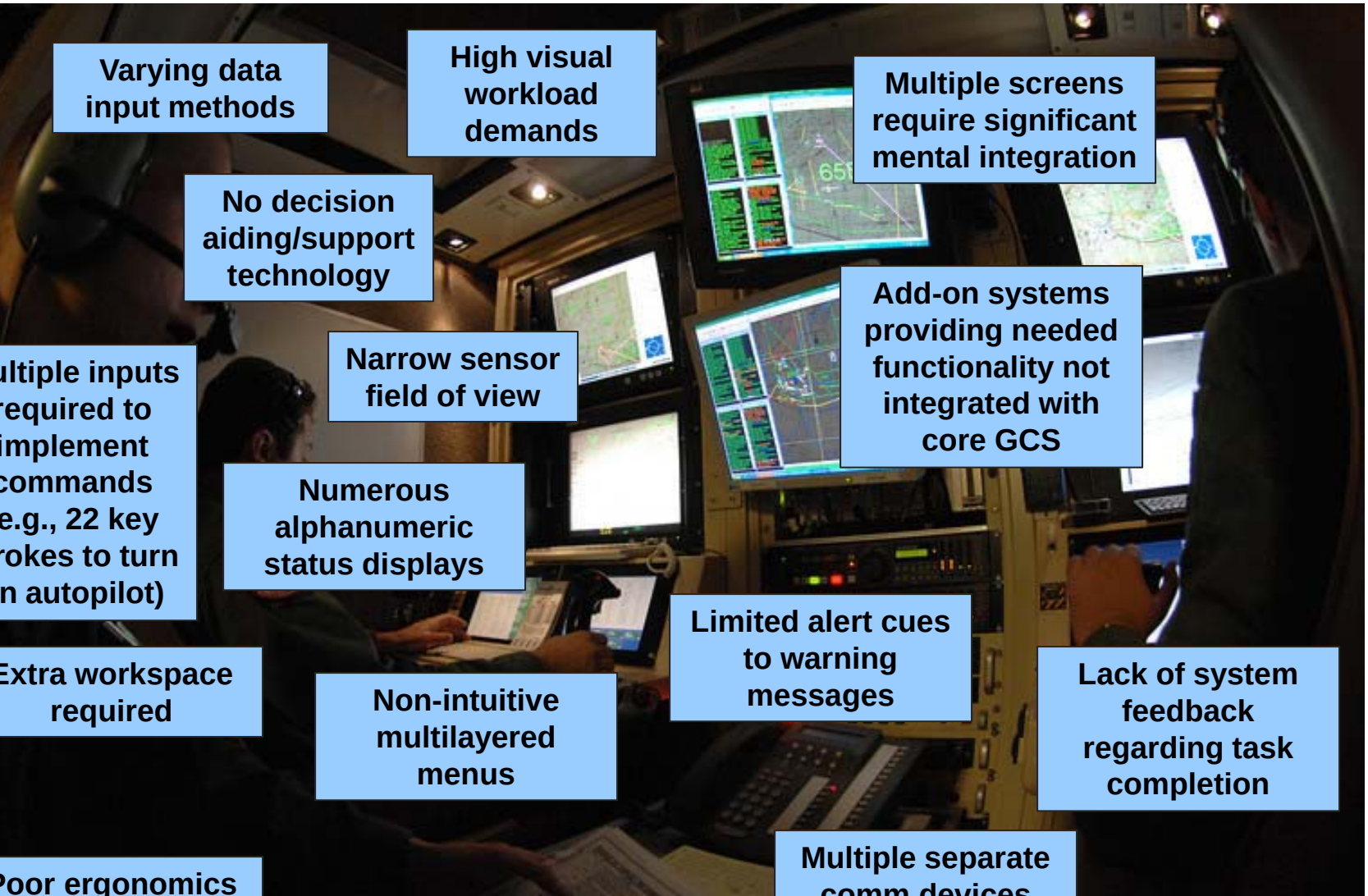
Aircraft systems

- **Workspace design for patient transport and medical care**
  - **Addresses aircraft & mission effectiveness**



HFE | Personnel | Training | Manpower | ESOH | Habitability | Survivability

Ground Control Station



Aircrew Life Support Equipment

- Developed human centric test plan for aircraft integration events
- Evaluated design impact on human performance and affected design changes
- Supported development of training requirements
- Conducted research to support requirements development
- Embraced effects-based HSI to identify performance risk of designs

HFE | Personnel | Training | Manpower | ESOH | Habitability | Survivability

HSI Challenges

2012 USAF SAB Report on Aircraft Oxygen Generation

<u>commendation #2:</u>

‘Re-energize the emphasis on Human Systems integration throughout a weapon system’s lifecycle, with much greater emphasis during Pre-Milestone A and Engineering & Manufacturing Development phases.”

Focus Areas

- ***Roles & Responsibilities***: **Codify the roles and responsibilities, organizational relationships, HSI processes and products for the "HSI Enterprise" in AF policy and guidance**
- ***Forcing Functions***: **Drive consistent use of the existing forcing functions at key ILCM touch points to ensure HSI issues are appropriately addressed and Senior Leaders are adequately informed on HSI risks and issues**
- ***Tools & Metrics***: **Use standardized HSI tools and metrics to assist, evaluate, and report HSI activities for systems in all lifecycle phases, from Capabilities Based Assessments to Operations & Sustainment**
- ***Training & Competencies***: **Describe, develop and resource the HSI competencies required for "cradle to grave" execution of Air Force system portfolios**

Future HSI Considerations

- **Who are operators of the future?**
- **Operator workload/overload**
- **What environments will we fight in?**
- **Medical standards/fitness for UAS operations**
- **How will we train for future/nonexistent systems?**
- **Mental health effects of remote warfare**
- **Autonomous operations and HSI implications**

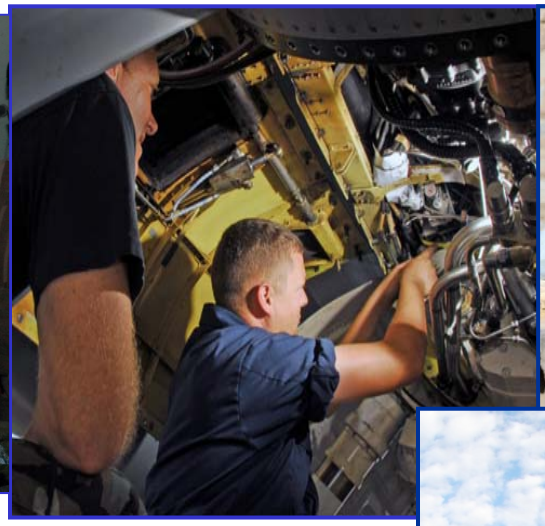
Manpower

Personnel

Training

Human Factors

Final Message



HSI is contributing to life-cycle excellence in acquisition today!

HSI is much more than just Human Factor Engineering

HSI <u>optimizes</u> system performance through human-centric integration

Questions?