Aviation Individual Protection Acquisition Strategy Brief

(Caveat: This is a Deputy JPM IP, Aviation Concept Brief. What the Future CB Aviation system is or is not requires additional coordination with all involved DoD agencies)

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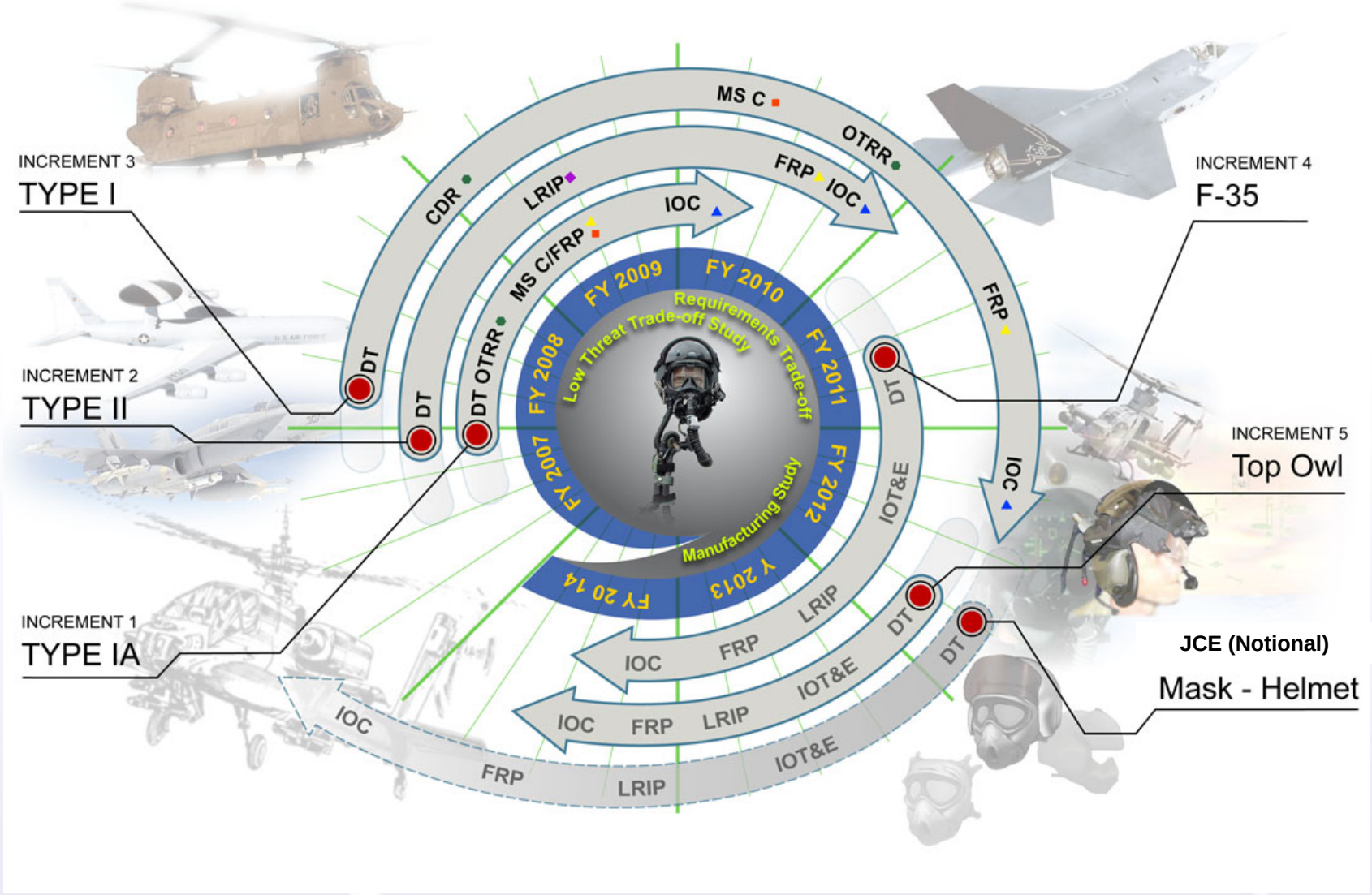
Outline

- Current Programs (JSAM, JPACE, JSMLT)
- Traditional Approaches
- Aviation Requirements
- Systems Engineering Approach
- Vision and Strategy
- Integration Efforts
- Technology Needs
- Current and Near Term Efforts
- Path Forward

Joint Service Aircrew Mask (JSAM) Family of Systems Schedule



JSAM Family of Systems Solutions Per Platform

USAF USA USN/USMC JOINT

Six Planned Increments:

- *Increment 1 - JSAM Apache Variant (Type IA):*
  - **Fully compatible with the Integrated Helmet and Display Sighting System (IHADSS)**
  - **Platforms integrated with:** AH-64A/D
- *Increment 2 - JSAM Fixed Wing Variant (Type II):*
  - **Compatible with Pressure Breathing for G (PBG) in high performance aircraft**
  - **Platforms integrated with:**

Agile (Fast Movers)
A/OA-10
F-15A/B/C/D/E
F-16A/B/C/D
F-16CG/CJ
F/A-22
AV-8B
EA-6B
F/A-18A/B/C/D/E/F
EA-18G

Others:
USAF:
B-1B, B-2A, B-52H, E-3B/C, E-8C, E-4B, C-5B/C, KC-10A, C-9A, C-12,C-17A, C-21, CV-22, C-26B, LC-130H
MC-130E/H/P, WC-130E/H/J
KC-135E/R, OC-135B
RC-135S/U/V/W, KC-X, AC-130H/U, EC-130E/H/J, HC-130N/P, C-130E/H/J/J-30, C-32A

USN/USMC:
C-35, C-37, C-40, C-130T, KC-130J/R/T, C-2A, E-2C, EP-3E, P-3C, E-6B, C-12, C-20, MV-22, C-9,

USA:
C-12, RC-12, C-20, C-23A/B/C, C-26B, UC-35, C-37

JSAM Family of Systems Solutions Per Platform

USAF USA USN/USMC JOINT

- *Increment 3 - JSAM Rotary Wing Variant (Type I):*
  - **Incorporates don-in flight capability to allow face free flight in non-CB threat environment**
  - **Platforms integrated with:**

USN/USMC:
AH-1W, UH-1N, HH-1N, HH-60H, SH-60B/F, MH-60R/S, CH-46E, CH-53D/E, MH-53E HH-60H, SH-60B/F, MH-60R/S

USA:
AH/MH-6, AH64D, MH-47D/E CH/MH-47D/E/F, OA/OH-6, OH-58D MH-60K/L, HH-60L/M, UH-60A/L/M/Q LRA, LUH

USAF:
UH-1N, HH-60G

- *Increment 4 – Joint Strike Fighter Variant (F-35):*
  - **Integrates JSAM Type II capabilities into JSF development upfront and early**
  - **Platforms integrated with:** F-35 (JSF) A/B/C

JSAM Family of Systems Solutions Per Platform

USAF USA USN/USMC JOINT

- *Increment 5 – Top Owl Variant (Type IB):*
  - **Integrates JSAM solution into Top Owl development upfront and early**
    - **Top Owl is the new helmet and helmet mounted display sighting system being developed by the Navy**
    - **Schedule being synchronized with TOP OWL**
  - **JSAM Type I or II may be adapted for TOP OWL integration**
  - **Platforms integrated with:** AH-1Z, UH-1Y

- *Increment 6 - Integrated Mask-Helmet Variant: (notional)*
  - **A revolutionary product that incorporates CB protection in the next generation aviation mask-helmet technology**
  - **Potential to demonstrate via an Advanced Technology Demonstration (ATD)**

JSAM Increments 1-3

JSAM Increment 1
(Apache Variant)

JSAM Increment 2
(Fixed Wing Variant)

JSAM Increment 3
(Rotary Wing Variant)

Joint Protective Aircrew Ensemble (JPACE) Increment I Overview

- **JPACE is a Chemical Protective Coverall constructed of carbon based adsorptive liner and a liquid repellant, Nomex outer shell designed specifically for the Air Crew**
  - **USN/USMC will field Class 1 (sage green); USA will field Class 3 (universal camouflage)**
  - **Neck Dam component will be fielded for Army use when mask hood is worn over ALSE (Hasty Scenario)**

Class 1 Sage Green

Class 3 Universal Camo

JPACE Increment I Status

- **Full Rate Production (FRP) Aug 06**
- **USN/USMC Delivery Order Sep 06 (Class 1 sage green)**
- **Material Release/Fielding Decision Jun 07**
- **Neck Dam Contract Awarded Jun 07**
- **USA Delivery Order Awarded Jun 07 (Class 3 - universal camouflage)**
- **Remaining Issues:**
  - **Thermal Burden reduction**
  - **High Wind Rotor Wash/TIMs/NTAs performance criteria and test methods**
  - **Full Anti-Exposure Compatibility**

Joint Service Mask Leakage Tester (JSMLT)

- **Production**
  - FRP May 05
  - FUE Jun 06
  - Production rate: 20-30 systems/month
  - 479 systems delivered
  - Users: USMC, USAF, USN, USCG, SOCOM

- **Fielding/NET Progress**
  - Accelerated schedule
  - 416 systems fielded to date
  - 240 additional systems to be fielded in FY08

Joint Service Mask Leakage Tester (JSMLT)

- **Expanding Capabilities in FY08**
  - **JSGPM & M53 Adapter Suite**
  - **M42 / M45 Hose Isolation Test Adapter**
  - **M45 Mask Outlet Valve Test Adapter**
  - **Adapter Prototypes for JSAM DT / OT**

- **Emerging Issues On Our Radar**
  - **Changing Threat Condition vs. Mask Testing Standards**
  - **JSAM Integration & Test Procedures**
  - **Cost/Time Saving Concepts**

Traditional Separate Approaches

Individual Service Aircrew Life Support System Approach

=

CB Component Integration Approach

Where We Want To Go

A New Teaming Approach

A true system of systems approach with all requirements adjudicated upfront and early in a cooperative all inclusive aviation paradigm

“Pilot Joe”

An epic saga…

Eliminating Encumbered Pilot Joe!

- **Paradigm shifting to development of CB protection in a Systems Design Environment focusing on better integrated CB solutions**
  - **Multi-functional flight gear with CB protection integrated in rather than added on**
  - **Optimal integration among components providing CB protection and components of mission specific Aircrew Life Support Systems**

en•cum•ber (ĕn-kŭm'bər), adjective
1: To put a heavy load on; burden **2:** To hinder or impede the action or performance of

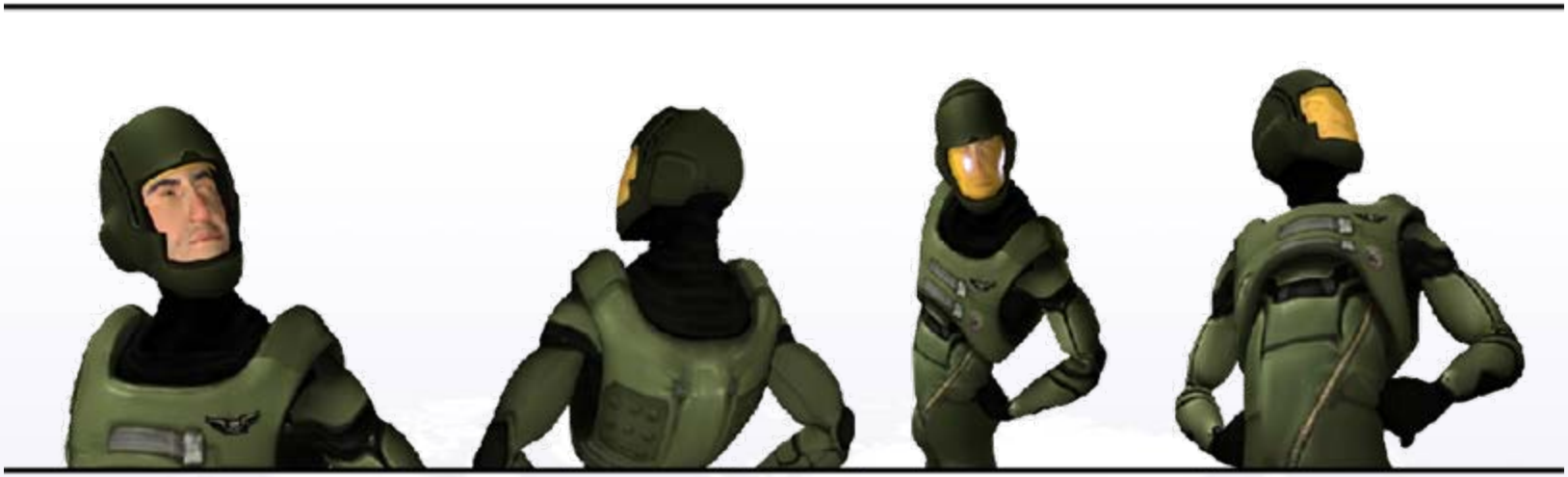
"Pilot Joe"

Integrated CB Protection Concept

Joint Project Manager – Individual Protection

Animation short produced by – Conceptual Modeling and Animation Team – Advanced Design and Manufacturing, Division of Engineering Directorate – EDGEWOOD CB CENTER

in•te•grat•ed (ĭn'tĭ-grāt'ĕd), adjective
1: organized or structured so that constituent units function cooperatively



Joint Project Manager – Individual Protection

"Pilot Joe"
Integrated CB Protection Concept

Animation short produced by - Conceptual Modeling and Animation Team - Advanced Design and Manufacturing, a division of Engineering Directorate - EDGEWOOD CB CENTER

Evolving Aviation Requirements

- **Recently completed and ongoing studies on operationally relevant challenge levels and mission profiles**
  - **JRO/IDA "Chemical Challenge Study"**
  - **JPM-IP/RAND "Chemical Challenge Level Analysis"**
  - **JRO/IDA "Operational Chemical Challenge Study"**
  - **OPNAV "Naval Aviation Life Support System Requirements Study"**
- **Paradigm is beginning to shift from historical challenge level requirements to a capabilities-based view with intelligent Operational Risk Management (ORM) decisions used to bound tradespace.**

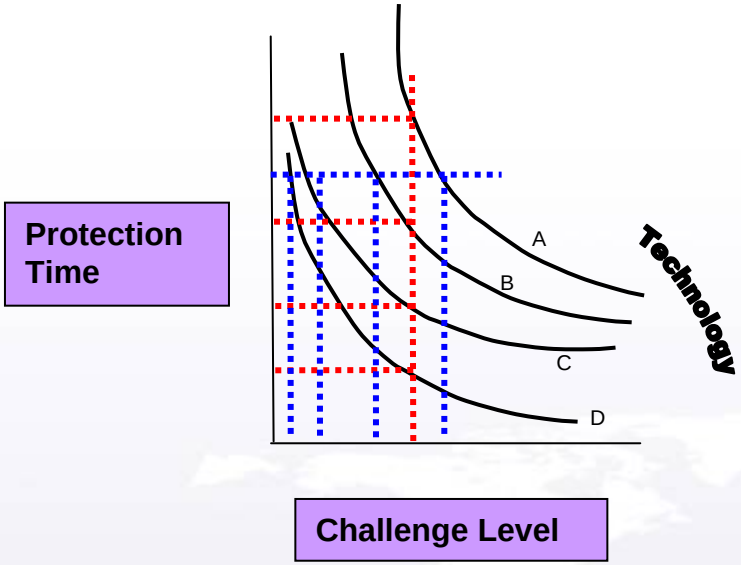
Multi-Tiered Aviation Requirements

- **Multi-tiered requirements are evolving based on threat and mission profiles**
  - **Fixed Wing Ejection Seat – Lower Threat, more trade space**
  - **Rotary Wing – Higher Threat; less trade space**
  - **Fixed Wing Non-Ejection Seat – No threat for some**
- **Examples:**
  - **Protection times ranging from 8 to 24 hours**
  - **Durability/Wear Time ranging from 48 to 480 hours**
  - **Laundering – ranging from 0 to 10 launderings**
  - **Challenge levels: (non-KPP)**
    - **Liquid – ranging from 1 to 10 gm/m2**
    - **Vapor/Aerosol – ranging from 500 to 5000CT**

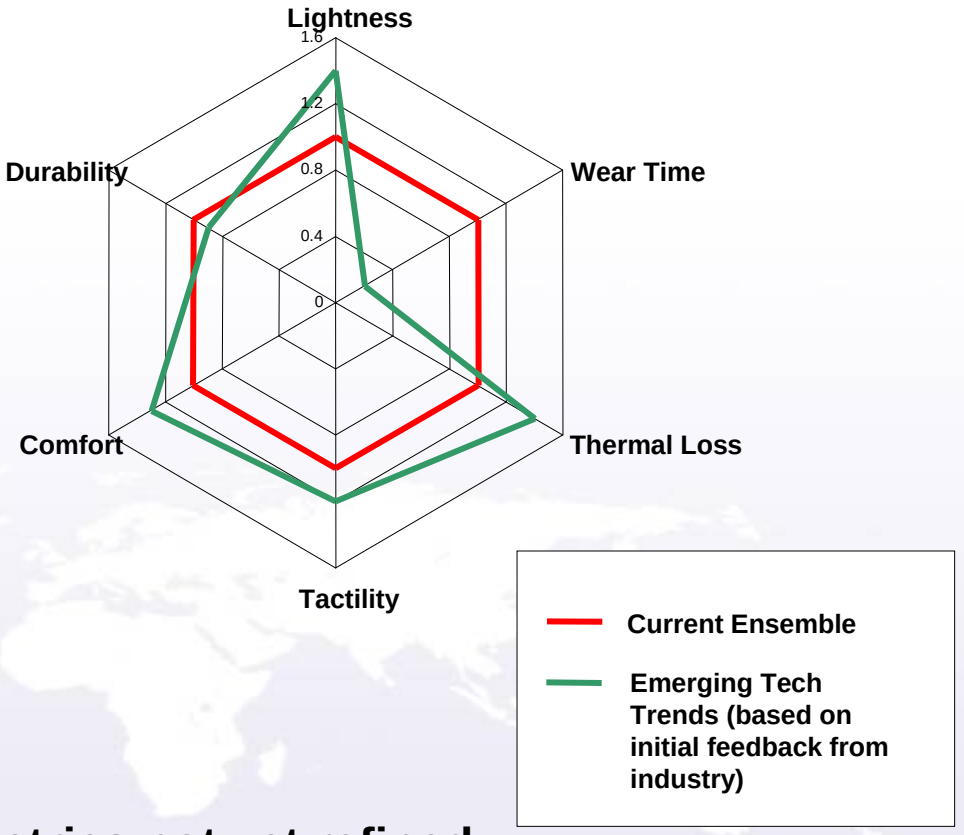
To address these multi-tiered requirements we are seeking a JCE Family of Systems solution with common components across the warfighter spectrum (ground/sea/air)

New Paradigms

Challenge Level as a Dependent Variable within the tradespace

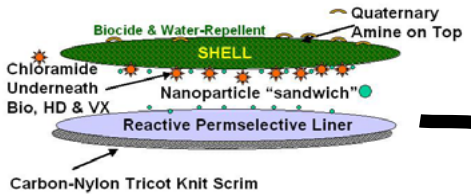


Utilizing Tradespace Analysis



Note: Illustrative Only: Metrics not yet refined

Integrated CB/Aircrew Ensembles

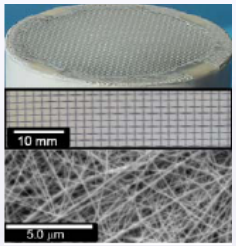


Integrated Fabrics

Clothing Design

Human Performance

Service Specific Aircrew Life Support Equipment Design



Air Purification and low profile filters

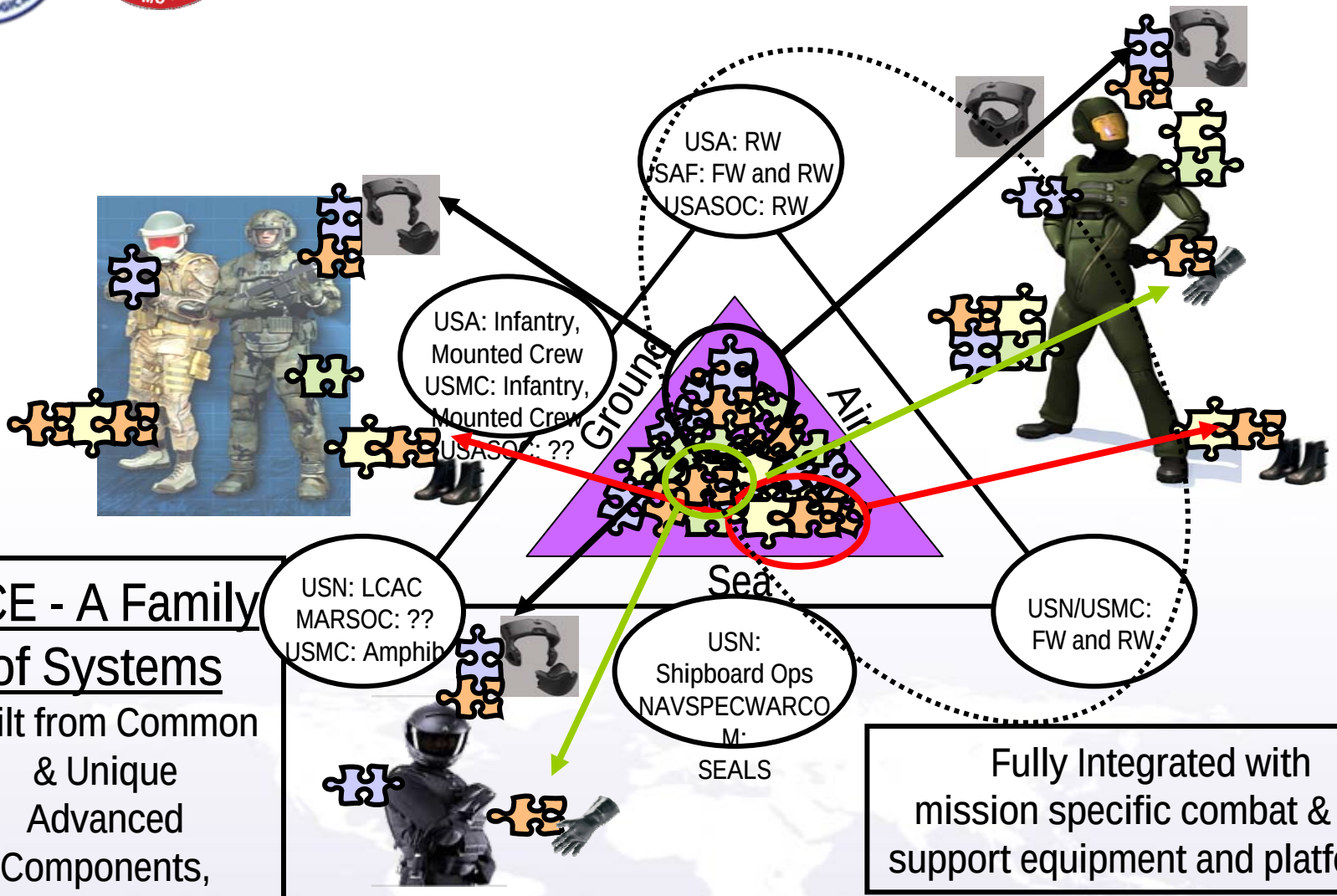
Respirator Design

Integrated System of Systems Design Environment

JCE – Aviation

Mission Specific Clothing Modules and Integrated Mask/Helmet …. with optimal integration among CB and ALSS components

JCE Aviation and Ground Commonality



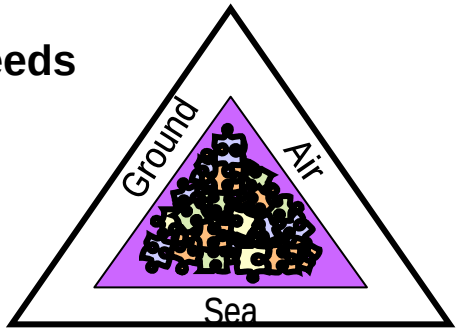
JCE - A Family of Systems

Built from Common & Unique Advanced Components, Modules & Sub-systems

Fully Integrated with mission specific combat & life support equipment and platforms

Aviation Vision

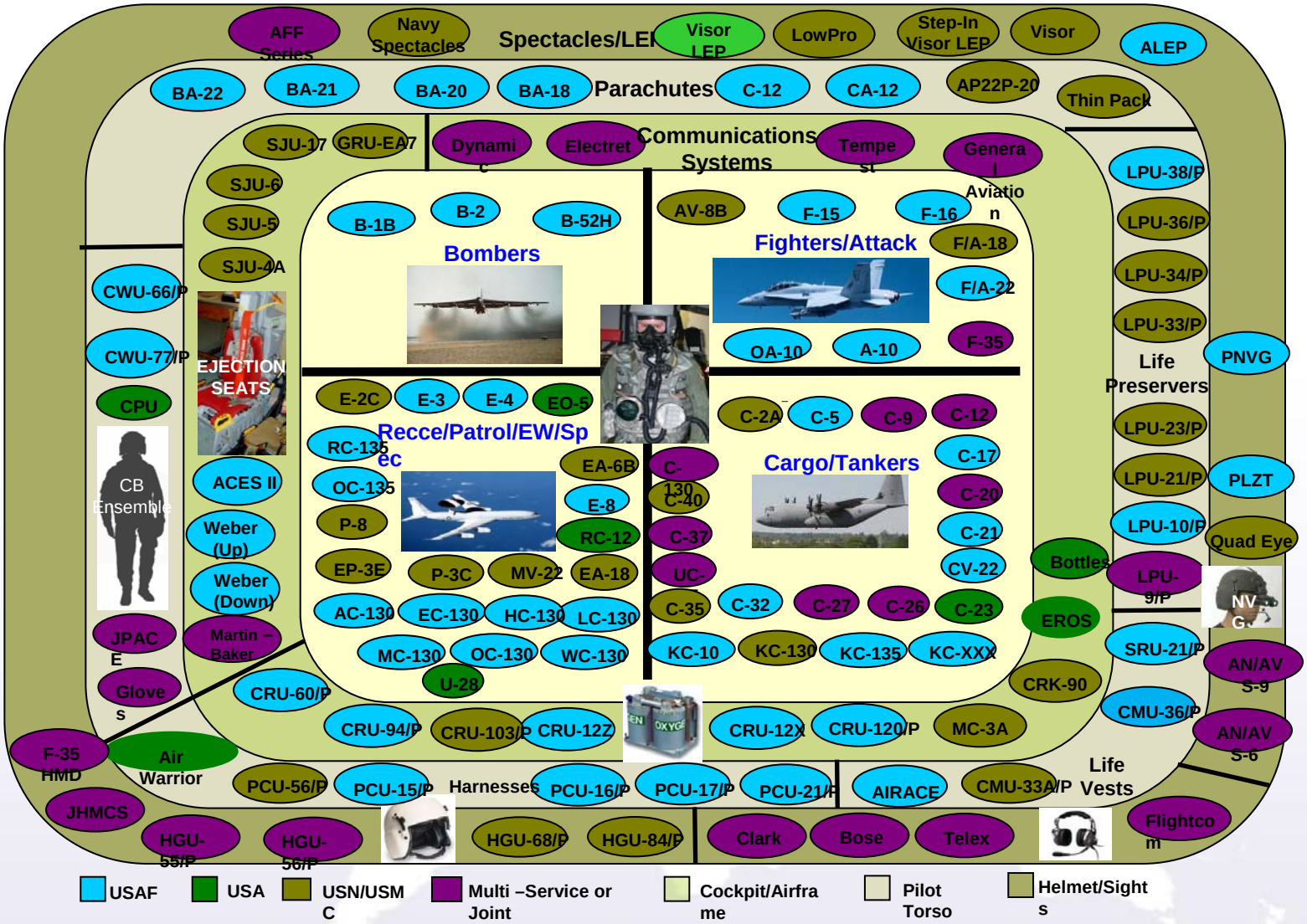
- **Modular System of components and sub-systems some of which are common with Ground users**
- **Early spiral introduction of modules that address critical needs**
  - **High Dexterity / High Tactility Gloves**
  - **Low Threat / Low Burden FW vapor protective layer**
  - **Maritime compatible CB layer**
  - **Don-in flight respiratory protection**



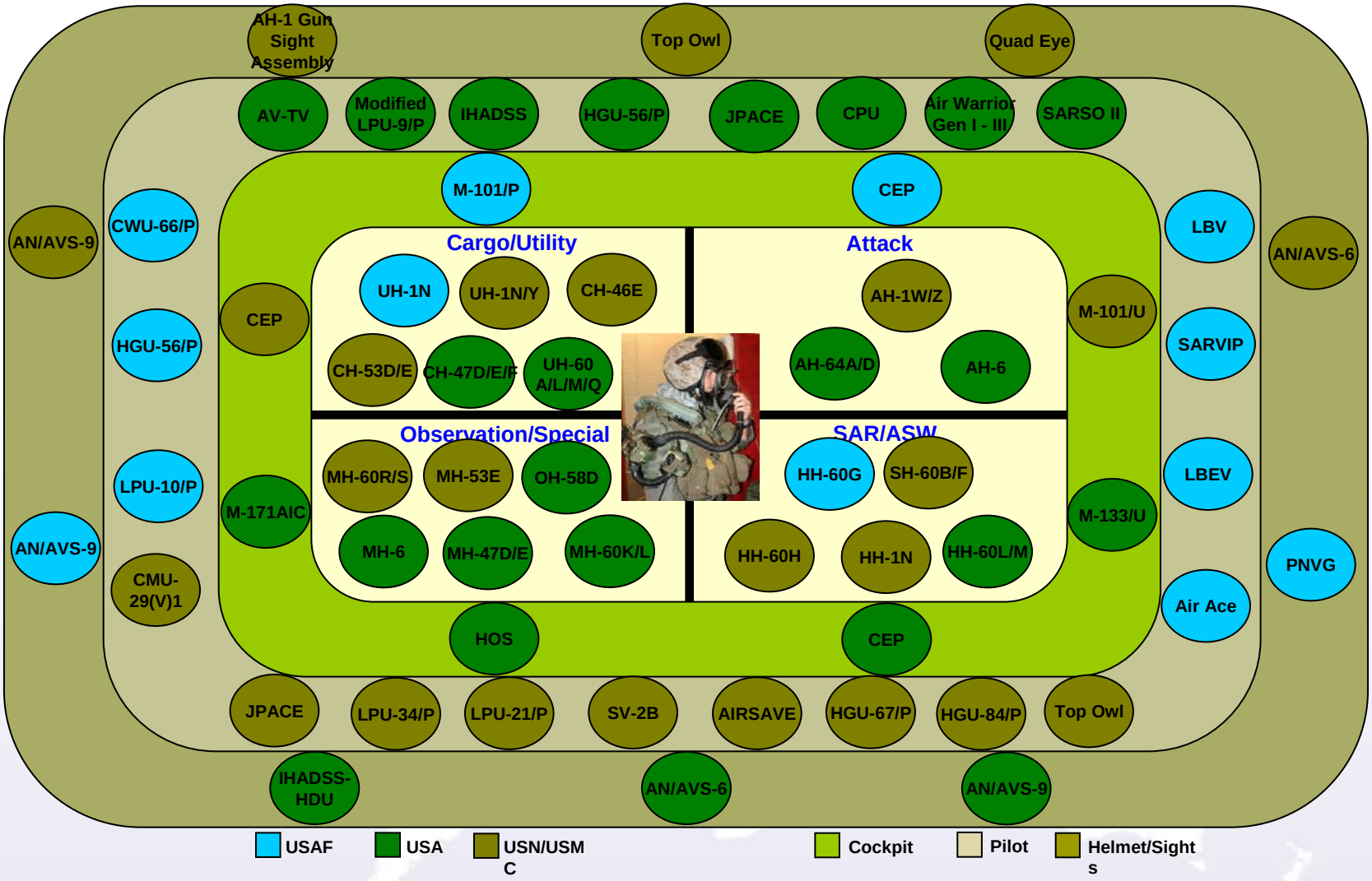
- **Mid-term introduction of modules that address emerging threats**
  - **NTAs / TICs**
  - **HWRW Driven agents**
  - **Low (weight, cube, power) active or passive Cooling**
  - **Mission/Platform specific respiratory protection (Top Owl, JSF)**
  - **Modular Mask/Helmet**
- **Future introduction of multi-functional components fully integrated with other ALSE**
  - **Integrated Mask/Helmet**
  - **Self-detoxifying basic CB protection in duty uniform**
  - **Complete modular Percutaneous capability addressing all missions and environments**

How Hard Can That Be?

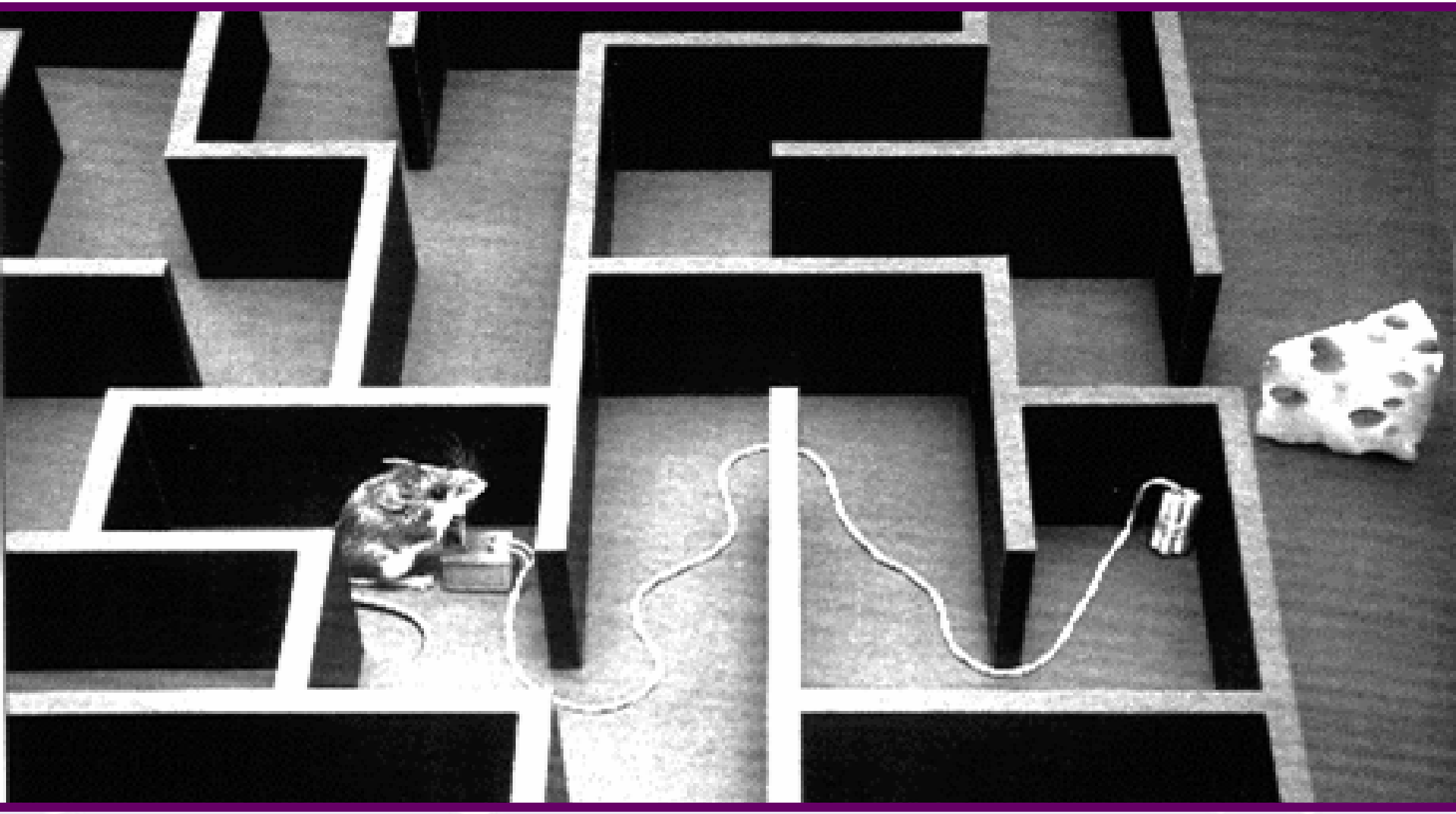
Integration Challenge: JSAM Fixed Wing Interfaces



Integration Challenge: JSAM Rotary Wing Interfaces



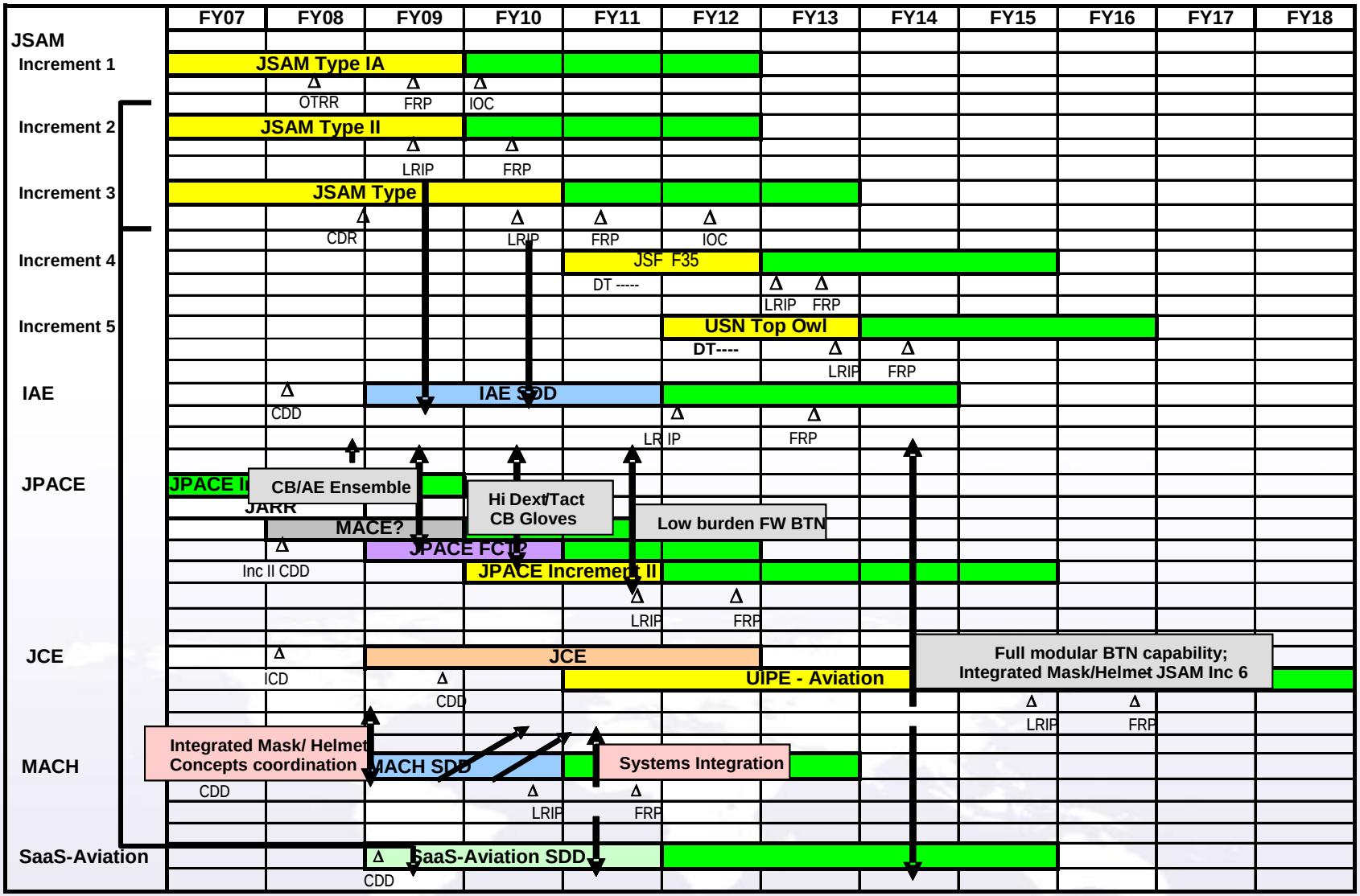
New Approaches



Aviation Programs: Opportunities

- **Integrated Aircrew Ensemble (IAE) - USAF**
  - **JPM-IP influencing CDD based on challenge studies; potential for JPM-IP module or technology insertions**
- **Modular Aircrew Common Helmet (MACH) – USAF**
  - **Seeking opportunity to influence as basis for integrated mask/helmet**
- **Soldier as a System (SaaS)-Air – USA**
  - **Will leverage JPM-IP efforts to provide Next Gen CB solution**
- **Joint Service Advanced Laser Eye Protective Visor – USA, USN/USMC**
  - **Opportunity to influence and ensure compatibility initially with JSAM and to integrate capability into combined mask /helmet of the future**
- **Combined JHMCS / NVG – USN / USMC, USAF**
  - **Opportunity to influence and ensure compatibility initially with JSAM and to integrate capability into combined mask / helmet of the future**
- **Aircrew Endurance (LOE) – USN / USMC / USAF**
  - **Opportunity to influence and improve mask interface with USN / USMC body armor and LPU**

Aviation Integration Pathway



Modular Below the Neck System

- **Envision modules to address various levels of protection while including multi-functional capability to protect against other threats such as flame and immersion hypothermia – example modules include:**
  - Coverall with integrated anti-exposure protection
  - Coverall with limited durability/service life to address short term gross liquid contamination or high wind driven agent conditions
  - Hand protection with improved tactility, dexterity and sweat management
  - Accommodation for wear of various mission dependent under-layers such as thermal liners, personal cooling garments
  - Low burden, lightweight CB protective undergarments with sweat management properties for missions with lower challenge requirements
  - Add-on outer layers to enhance liquid agent protection for high risk missions or to protect against gross contaminants (TICs/POLs)
  - Enhancements in materials and interface designs to reduce thermal burden and enhance NTA TICs/TIMs, HW&RW, and Aerosol Protection
  - Duty Uniform with Basic CB Protection Level built in – self-detoxifying

Aviation Head, Eye, Respiratory Vision Integrated Helmet Concept

Features

- Vehicle or Aircrew Focus
- Modular Integrated Design
- Integrated Filters/Seals
- Sorbent Composite
- Nanocomposite Materials

Potential Advantages

- Minimizes Body Mounted Equipment
- Improved Helmet Compatibility and Comfort
- Reduced Breathing Resistance
- Significantly Improved Visual Field-of-View
- Improved Communications Interface
- Option for Improved In-flight Donning
- Improved Center of Gravity
- Improved Display Interface (Internal) and Stability

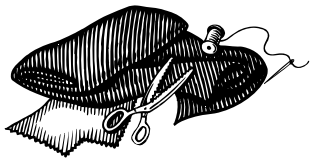
Technology Needs

- **Novel CB-Hardened Garment Pass-throughs**
  - Support use of personal cooling systems, communication lines, and personal waste management systems worn under Chem-Bio protective clothing
- **Low cost flame retardant CB materials and or treatments**
- **Improved closure and interface concepts**
- **Low thermal burden CB materials**
  - Improved moisture vapor transport properties
  - Reduced insulation
  - Lighter weight
- **Elastomeric CB Protective Materials**
  - Undergarment vapor protective material with excellent sweat management properties
  - Hood and interface material with good sweat management properties as well as chemical and biological agent resistance in liquid, vapor and aerosol forms;
  - Glove material with good tactility and dexterity, sweat management properties as well as chemical and biological agent resistance in liquid, vapor and aerosol forms
- **Maritime Reactive Fibers**
  - Smart CB materials that are permeable in air and become waterproof in sea water; again become permeable and retain CB protective qualities following immersion
- **Residual Life Indicator for Protective Garments**
  - Provide information to user on remaining CB protective service life of the garment

Technology Needs (cont)

- Revolutionary Aviation Respiratory / Ocular Protection Concepts
  - Low Burden / Low Threat Concepts
  - Low Burden / High Threat Concepts
- Integrated Mask / Helmet Technologies:
  - Conformable Filter Technology
  - Bendable Non-distorting Lens Materials
    - » Provide increased FOV without distortion by allowing tighter curvatures
    - » Integrated LEP a plus!
  - Miniature Blower Technology
    - » Low profile
    - » Light weight
    - » Low power
- Improved Filter Media with longer shelf life and service life
- Mask testing methodologies
  - Particle size / penetration and relation to standards
  - Impact of changing threat

Potential Market Surveys / RFIs



- **Will be seeking information on developmental and commercially available…**
  - **Materials**
  - **Components**
  - **Items or systems**

- **Ultimate end-product items of interest include…**
  - **Undergarments and suits including disposable low-cost items**
  - **Footwear**
  - **Handwear**
  - **Head / eye / respiratory (HER) items and systems (hoods, filters, masks, blowers, etc.)**

- **Performance sought….**
  - **Protection from chemical agent challenge levels from 1 to 10 gm/m2 liquid and 500 to 5000 CT vapor and aerosol**
  - **Chemical Protection times ranging from 8 to 24 hours**
  - **Protection from traditional biological agents (primarily respiratory)**
  - **Traditional flame resistance protection**

Potential Market Surveys/RFIs

- **Enhanced performance areas of interest:**
  - **Reduction of thermal burden**
  - **Improved sweat management**
  - **Reduction of overall weight and bulk**
  - **Toxic Industrial Chemical protection (escape only)**
  - **Protection retained after contamination with common substances found in the aviation environment (e.g. petroleum, oils, lubricants, seawater, and cleaning products)**
  - **Wind-driven agent protection**
  - **Improved tactility / dexterity (handwear and footwear)**
  - **Improved helmet / mask interoperability**
  - **increased field of view, head mobility, optics, spectacle use/compatibility, and Night Vision Goggle integration.**

JPACE Anti-Exposure Risk Reduction (JARR) Effort

- **JPACE ORD → Required compatibility with all ALSS including anti-exposure (A-E) suits – UNMET with JPACE Increment I; deferred to Increment II in JPACE CPD**
- **JARR Focus:**
  - **Early look at addressing the incompatibility so aircrew who face both a CB and an A-E threat in any given mission can be protected for both**
    - **Provide CB protection throughout the normal mission and following a crash or ejection over land**
    - **Provide emergency immersion hypothermia protection following a survivable crash or ejection at sea**
    - **No expectation that CB protection needs to be maintained following the emergency immersion – current doctrine includes CB mask tear-away prior to water entry in emergency**

JPACE Anti-Exposure Risk Reduction (JARR) Effort

- **JARR Approach:**
  - Leveraged CWU-86/P A-E Coverall Design …. fabricated from selectively-permeable membrane material
  - Full battery of tests including Centrifuge and DT Flights underway to be completed early FY08
  - Early indication is that a combined CB/A-E approach is viable
- **Lessons learned to be applied to JPACE Increment II in conjunction with other maritime CB requirements of SOCOM and DHS**

JPACE Increment II

- **CDD Draft – 1Q FY08**
  - **MACE – (Dev FY08/09; Production FY10/11)**
    - **Maritime - Anti-exposure CB Ensemble**
  - **FCT (Test FY09/10; Production FY11/12)**
    - **High dexterity/tactility CB Glove**
    - **Foreign Low thermal burden / low threat COTS modules**
  - **(SDD FY10-12; Production FY12-16)**
    - **Low thermal burden / low threat Modular System**
    - **Potentially rolled into JCE**

JCE Aviation

- ICD Draft (4Q07)
- CDD (Aviation system) Draft (~4Q09)
  - (SDD FY12-15; Production FY 16-18)
    - Integrated Mask / Helmet
      - Seeking early integration with USAF MACH program or aviation ATD
    - Full Modular BTN System
      - High Wind & Rotor Wash (HWRW) driven agents
      - All threat / environmental scenarios
      - TICs / NTAs Protection
      - Emerging threats
      - Basic Protection in Duty Uniform
        - » Self-detoxifying
        - » Minimal physiological burden

Near Term Strategy

Requirements Driving the Low Threat Solution:
- IAE CDD (USAF)
- JPACE Capability Gaps
  - Thermal Burden
- SOCOM LCBPG CDD (draft)

Studies Driving the Low Threat Solution:
- OPNAV FW Study (USN/USMC)
- JPM-IP RAND and IDA Studies

Requirements Driving MACE:
- JPACE Capability Gaps
  - Thermal Burden
- SOCOM Maritime CB Requirements
- USCG Maritime CB Requirements

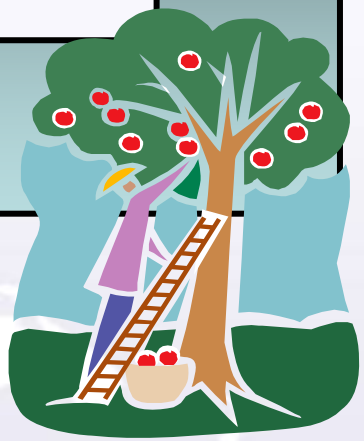
JPACE Increment II CDD:

Maritime/Anti-Exposure CB Ensemble (MACE) & Fixed Wing Low Burden

Phase One

Pick the low hanging fruit!

- Integrated CB/Anti-exposure Solution(s)
- Low thermal burden suit
  - FW Low Burden Ensemble
  - High Dexterity/High Tactility Gloves



Aviation Strategy

- **Near Term: FY08-09**
  - **JSAM Increments 1 (USA Apache), 2 (Fixed Wing), and 3 (Rotary Wing)**
  - **Coordinate with USAF IAE Program and MACH Program, USA SaaS-Air Program, and USN/USMC ALSS Development Programs**
  - **Identify common aviation / ground modules for JCE**
  - **Issue RFIs to assess COTS technology readiness**
  - **Propose FCT for Improved Gloves**
    - **Tactility / Dexterity equal to standard non-CB flight gloves**
  - **Initiate Maritime Anti-Exposure CB Ensemble (MACE)**
    - **Anti-exposure compatible CB protection**
    - **Cooperative effort with DHS and SOCOM**

Aviation Strategy

- **Mid Term: FY10-12**
  - **JPACE Increment II**
    - **Low Burden components for FW Ejection seat**
      - **Much lower threat**
      - **Lots of trade space**
    - **Improved Gloves**
      - **Tactility / Dexterity equal to standard non-CB flight gloves**
  - **Continue Maritime Anti-Exposure CB Ensemble (MACE)**
    - **Anti-exposure compatible CB protection**
    - **Cooperative effort with DHS and SOCOM**
  - **JSAM Increments:**
    - **2 (Fixed Wing)**
    - **3 (Rotary Wing)**
    - **4 (Joint Strike Fighter)**

Aviation Strategy

- **Far Term (FY-13-15)**
  - **JSAM Increment 5 (Top Owl) – if needed**
  - **JCE Aviation**
    - **Full Modular System of Components for Percutaneous**
    - **Basic protection integrated into Duty Uniform**
    - **Add-on layers for mission specific threats above basic level and for specific mission environments**
    - **Integrated Mask Helmet**

Teamwork is the Key

Joe and I thank you…..Questions?