Joint Chemical Ensemble (JCE)

(Caveat: This is a concept brief. What JCE is or is not requires additional coordination with all involved DoD agencies)

Joint Project Manager – Individual Protection

October 2007

Overview

- **CBRN protection fully integrated into combat duty uniform and helmet**
- **Looking for innovative "out-of-the box" ideas and concepts for Individual Protection that may not match historic threat data or user requirements**
  - Challenge Level and Protection Time: Flexibility based on threat/mission profile
  - Physiological and Logistical Burden: Try to achieve burden analogous to combat duty uniforms
  - Laundering and Durability/Wear Time: Will view as tradespace depending on the solution
  - Multi-functional combat and flight gear with CB protection "integrated in" rather than "added on"

JPM-IP Vision and Goal

- **The goal is to provide the Warfighter with an innovative IPE solution that will:**
  - Be fully integrated into the combat uniforms and helmets
  - Reduce physiological burden
  - Lighten the individual Warfighter's load
  - Reduce the logistical burden for the unit
  - Be fully interoperable with communications, weapons systems, and life support equipment
  - Be relevant in catastrophic and disruptive as well as traditional CBRN threat environments

The vision is to provide an Individual Protection modular family of systems solution that maintains the Warfighters' ability to shoot, move, fly and communicate, while protecting against a wide range of CB threats.

Agenda

- Current Capability
- Future Capabilities
- Challenges
- Path to Combat Uniform Integration
- Test Methods
- Evaluation Protocols
- Summary

JSLIST – Joint Service Lightweight Integrated Suit Technology

- CB protective garment
- Provides percutaneous protection against all know CWAs
- Two piece, two layer construction with spherical carbon beads
- 24 hours of protection after 45 days of wear and 6 launderings
- Donned over duty uniform
- Used by Army, Navy, Air Force & Marine Corps

JPACE – Joint Protective Aircrew Ensemble

- Flame resistant CB protective garment
- For use by all aviators & air crew for fixed and rotor winged personnel
- Integrates fully with fielded masks, boots, gloves and the Army's Air Warrior System
- Used by the Navy, Army, Marines & Special Operations Command

JSGPM – Joint Service General Purpose Mask

- Provides face, eye & respiratory protection from Chem/Bio agents & toxic materials
- 24 hour above the neck protection
- 80% overall field of view
- Used & compatible with current CB garments
- Lighter & lower breathing resistance than previous models
- Used by Army, Navy, Air Force & Marine Corps

JSAM – Joint Service Aircrew Mask

- Provides head, eye & respiratory CB protection for fixed/rotary wing personnel
- Don and doff while in flight
- Designed to replace 6 existing aircrew masks
- Incorporates positive breathing for high performance aircraft (Gs)
- Integrates well with various aircraft and life support equipment
- Used by the Army, Navy, Air Force & Marines

Capabilities Discussion

- Paradigm is beginning to shift from historical challenge level requirements to a capabilities-based view with intelligent decisions used to bound tradespace.
- Recently completed and ongoing studies into operationally relevant challenge levels
  - Joint Requirements Office (JRO)/Institute for Defense Analyses (IDA) “Chemical Challenge Study”
  - JPM-IP/RAND Corp “Chemical Challenge Level Analysis”
  - JRO/IDA “Operational Chemical Challenge Study”

Challenges

- Creating a mission-tailored, spiral development approach
- Integration/synchronization up front with service specific mission and life support equipment and air/ground platform programs
- Maturing technologies to transition into program of record

Warfighter Mission Areas

GROUND

AVIATION

LAND-BASED & SHIPBOARD C2

INFANTRY MECH SpecOps

- Amphibious Ops
- Reconnaissance
- Ground Fires
- Heavy Mech.
- Light Mech
- Air Defense
- Combat Engineering
- MOOTW
- Maintenance
- Supply
- Health Services
- AT/FP
- Transportation
- Deliberate Engineering
- Services

FIXED WING + ROTARY WING

- Strike/Interdiction
- Air-to-Air
- Close Air Support
- Maritime Patrol
- Air Reconnaissance
- Airborne Early Warning (AEW)
- Electronic Warfare (EW)
- Anti-Surface Warfare (ASU)
- Anti-Submarine (ASW)
- Search and Rescue (SAR)
- Transport
- Medical Evac
- Assault Support

Warfighter Mission Areas

TRADITIONAL APPROACH

LAND-BASED &

INFANTRY **MEC** **ecOps**

- Amp
- Rec
- Grou
- Hea
- Ligh Mech
- Air Defense
- Combat Engineering
- MOOTW

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SHIPBOARD C2

FIXED WING + **Y WING**

- Strik
- Air-t
- Clos rt
- Mar trol
- Air Reconnaissance
- Airborne Early Warning (AEW)
- Electronic Warfare (EW)
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- Anti-Submarine (ASW)
- Search and Rescue (SAR)

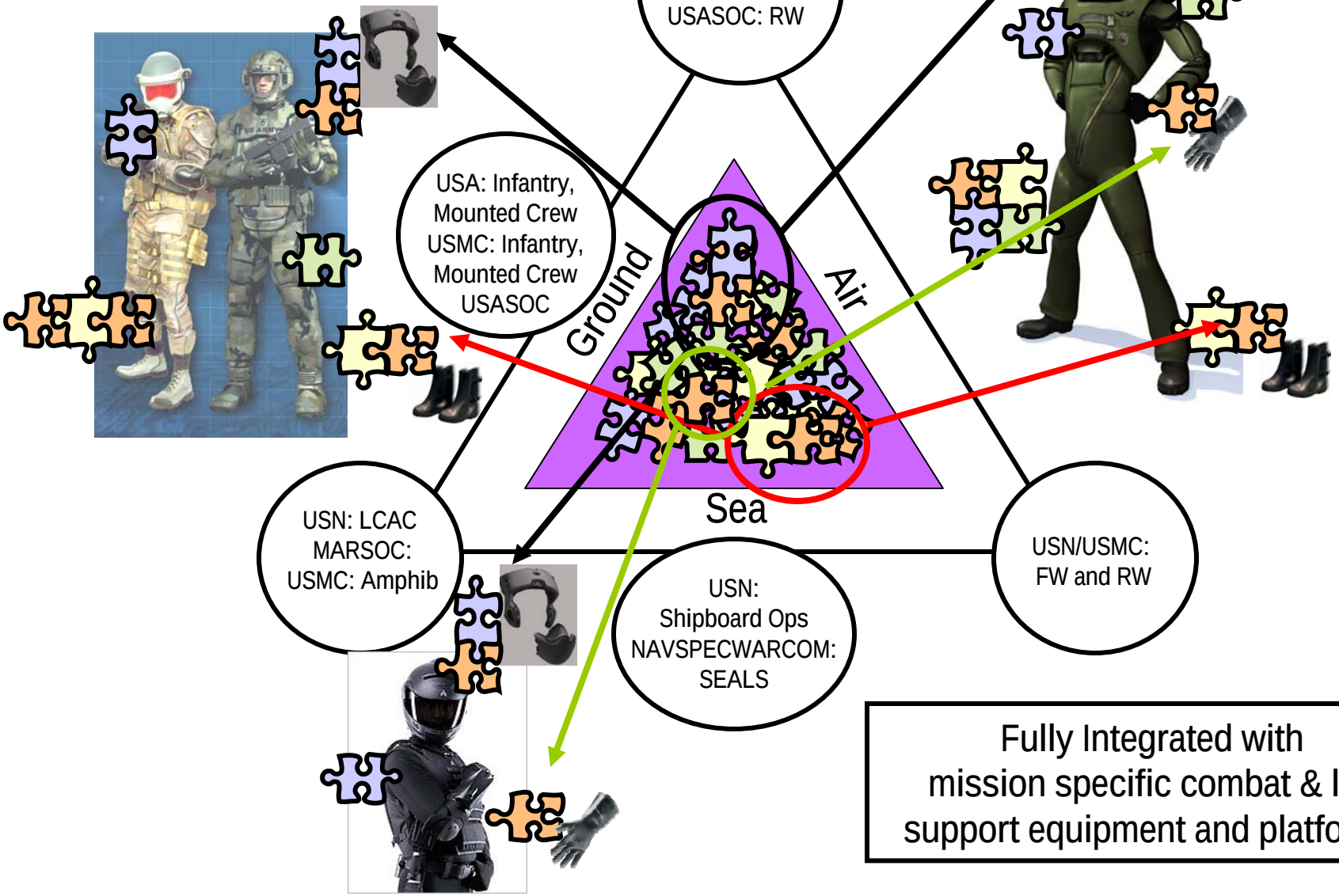
port
- Medical Evac
- Assault Support

ISLIST-JSGPM

JPACE-JSAM

JCE - A Family of Systems

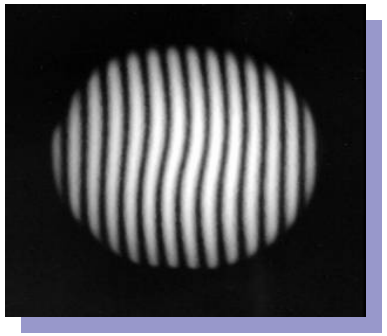
Built from Common & Unique
Advanced Components, Modules
& Sub-systems



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

Path to Combat Uniform Integration

Integration Issues
Joint Service Aircrew Mask (JSAM)



- **Head Mobility**
  - Interference with body armor and flotation collar
  - Limited range of motion
- **Night Vision Goggle (NVG) Integration**
  - Not rated safe to fly at night due to limited head mobility
  - NVG displacement caused by helmet / hoodring interface

Bottom Line: JSAM met all requisite Key Performance Parameters, but then was not rated "safe-to-fly".

Integrated Helmet Concepts

Modular Helmet Concept

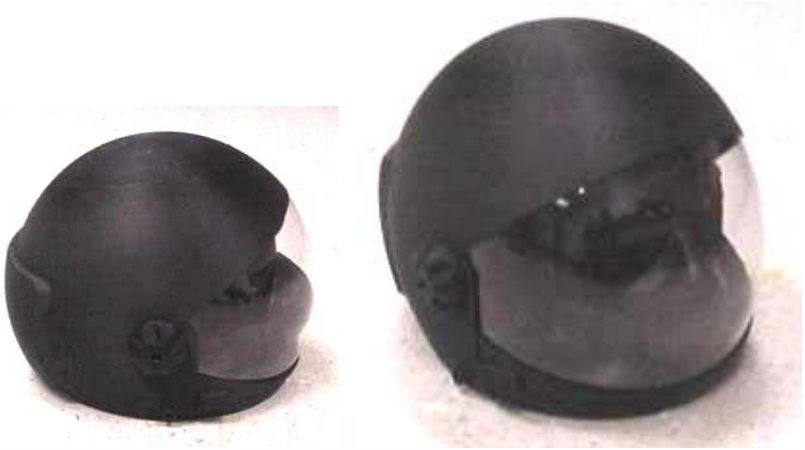
Features

- **Vehicle or aircrew focus**
- **Modular design**
- **Integrated filters/seals**

Potential Advantages

- Minimizes body mounted equipment
- Improved helmet compatibility and comfort
- Reduced breathing resistance
- Improved visual field-of-view
- Improved communications interface
- Option for improved in-flight donning

Integrated Helmet Concept



Features

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- **Integrated filters/seals**

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

Making an Inroad

- **Lightweight Chemical/Biological Protective Garment**
  - Light weight, lower bulk
  - No laundering
  - Worn 2 to 4 days
  - Reduced challenge level
  - Reduced volume/package size
  - Decreased thermal burden

Making an Inroad

- **Integrated Aircrew Ensemble**
  - Cold water survival, anti-G, integrated breathing support, CB protection and ballistic protection
  - Chemical protection requirements: 1 g/m^2 liquid, 500 mg-min/m^3 vapor (measured over a 12-hour period)
  - The flight suit will minimize heat stress and fatigue
  - Capability development document has completed Stage I staffing

F-16 Pilot w/Combat Edge

Making an Inroad

- **JPACE Increment II**
  - Addresses unmet requirements
    - Heat stress
    - High wind-driven agents
    - Anti-exposure/maritime compatible solution
  - Will provide avenue for early fielding of improved aviation below-the-neck components prior to JCE
  - Capability Development Document in review
  - Funding requirements to be included in POM-10 build

Making an Inroad

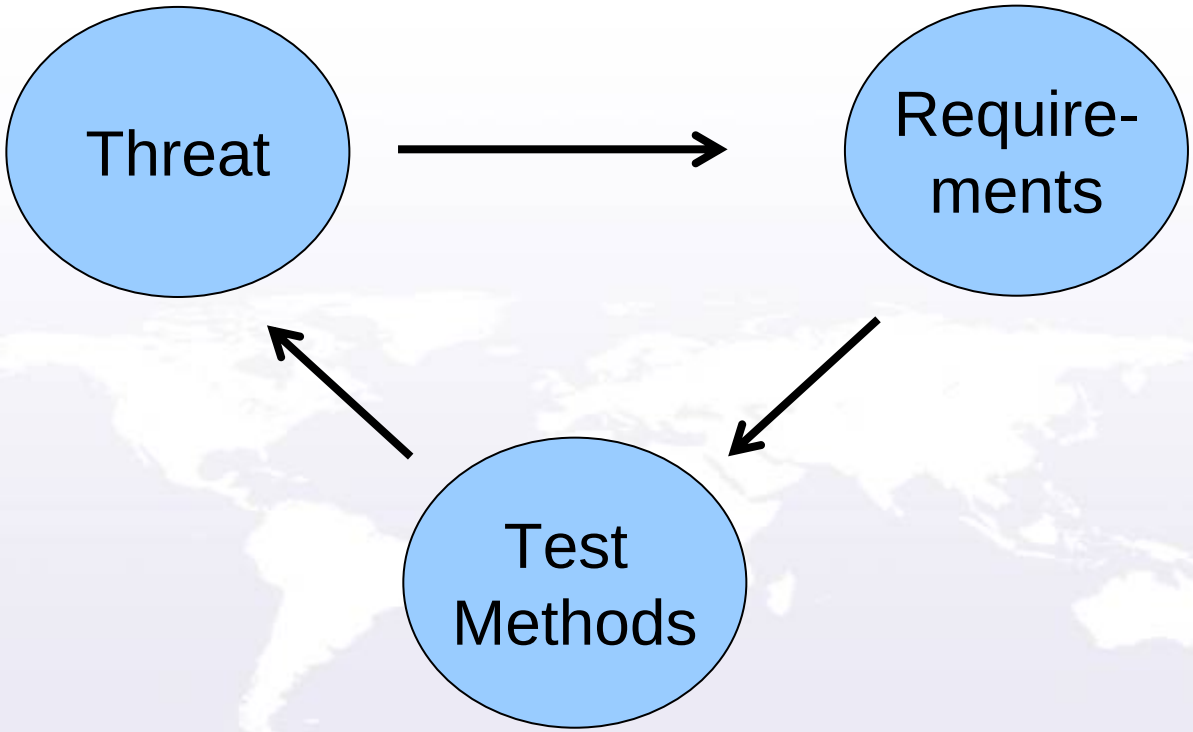
- **JCE Initial Capability Document**
  - Will allow materiel developers to look at all tradespace independent of challenge levels
  - Allows for optimized solution
  - In draft…anticipate staffing by Nov 07

Continuing Integration Efforts

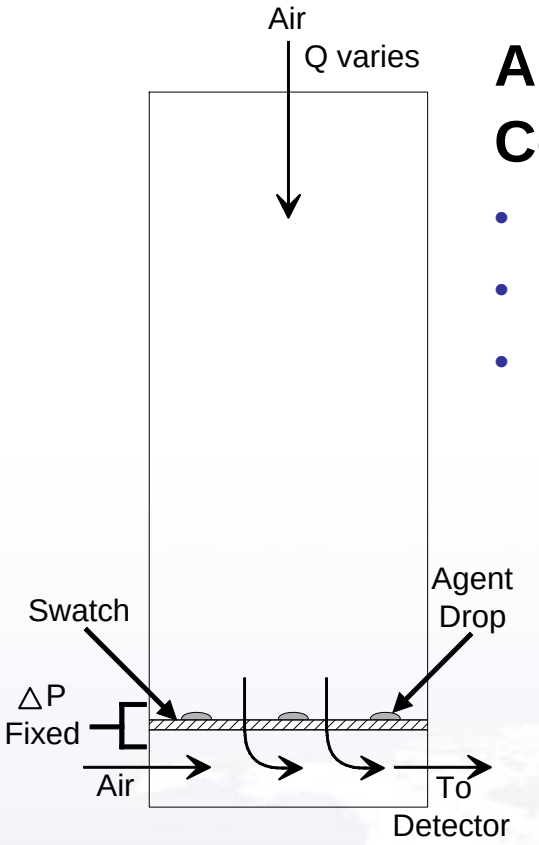
- **Soldier-as-a-System Ground Technology Demonstration**
  - Demonstrate novel and integrative protection technologies
  - Transfer technologies for further development
  - Key Players
    - Natick Soldier RDE Center
    - JPM-IP and JPEO-CBD
    - Joint Science and Technology Office
    - PEO Soldier

Test Methods

- Need to reflect operationally relevant conditions
  - Unrealistic tests leads to poor systems engineering
  - Realistic battlefield condition tests needed to characterize material in order to perform tradeoff analysis



Current Swatch Test Methods

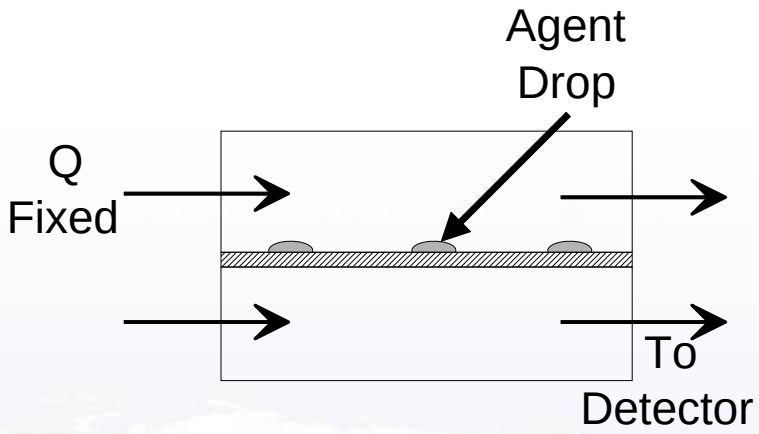


Air-permeable: Convective

- **Flow through sample**
- **Fixed ΔP**
- **Flow varies with permeability**

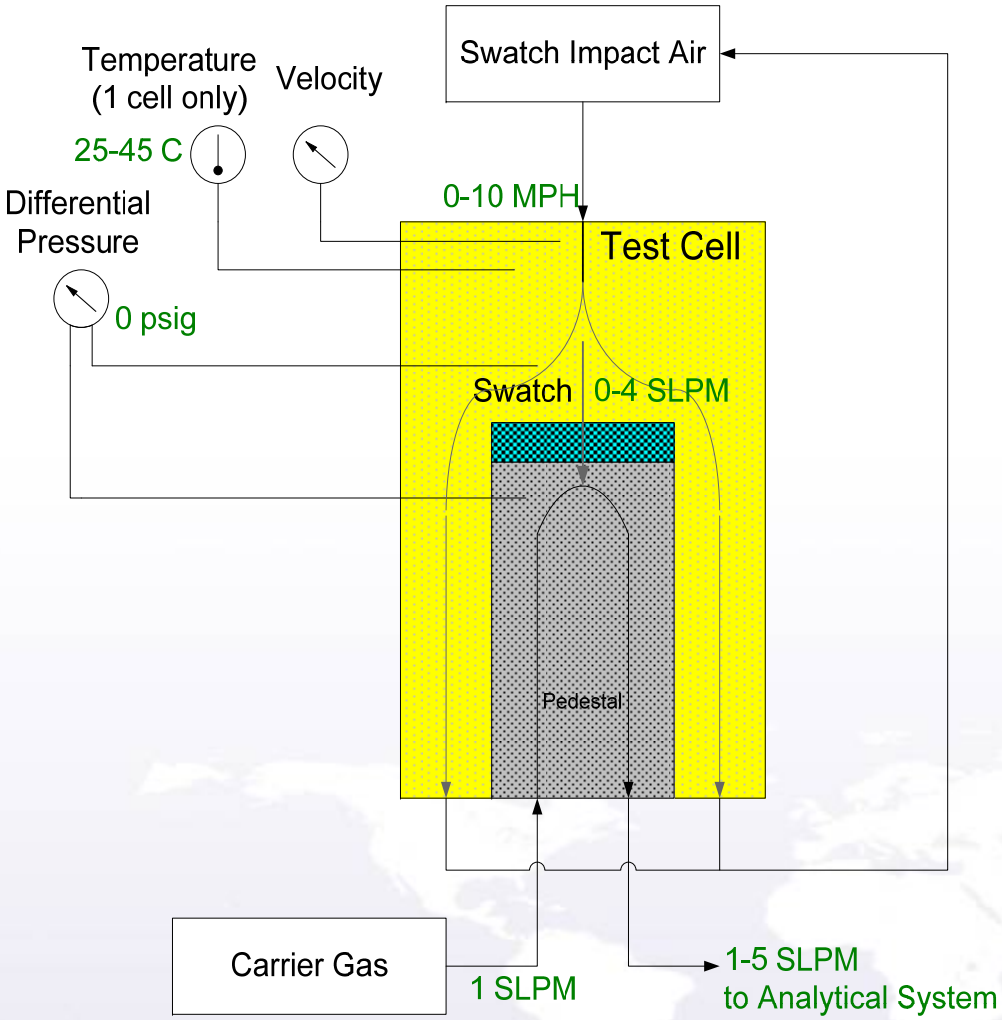
Air-impermeable: Dual flow

- **Flow bypasses sample**
- **Fixed flow rate**



- **Currently: test conditions depend on material properties**
- **Goal: make test independent of properties**

Next Generation Swatch Test



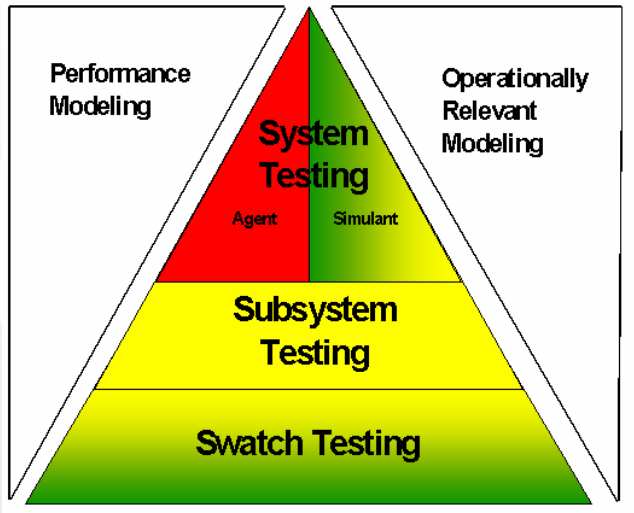
- Liquid, vapor or aerosol challenge
- Wind impacting perpendicular to material
- Pressure equalized across swatch surface
- Evaporated agent filtered out during liquid test
- Operationally relevant
- All material types tested under similar conditions
- Pumping effect not tested

Decision Support Tools

- Program Managers need improved tools to perform better tradeoff analysis of fabric, filter, mask, and ensemble designs
  - How do we determine the optimal balance of heat stress, chemical protection, size and weight?
- Swatch testing example
  - 10g/m^2 challenge
  - Pass/fail criteria not correlated to medical effects

Chemical Testing Evaluation Protocols

- Man In Simulant Testing Evaluation Protocol Update
  - HD toxicological assessment being updated by ECBC via JSTO funding
  - Needed to know how much protection is needed
- No method to evaluate swatch, component, and system chemical testing data
  - Creare IPE airflow mapping model
  - Efforts underway to standardize analytical measurements in tests



Cost Benefit Analysis

- With medical endpoints established, can develop a cost/benefit analysis for protective equipment
  - Can optimize heat stress, cost, and chemical performance
- Can deliver warfighters the right balance of chem/bio protection with minimized heat stress and cost

Summary

- Integrate basic CBRN protection into combat uniform and helmet
- Enhance overall warfighter survivability by optimizing CBRN individual protection
- Tailored solutions based on mission set
- Integration strategy
  - Reach out to service combat uniform material developers early
  - CBRN Integration Impact minimal
- New test methods and evaluation strategies needed to perform tradeoff analysis
- Funding in place, POM10 build underway