Joint Science and Technology Office (JSTO) Filtration Initiatives

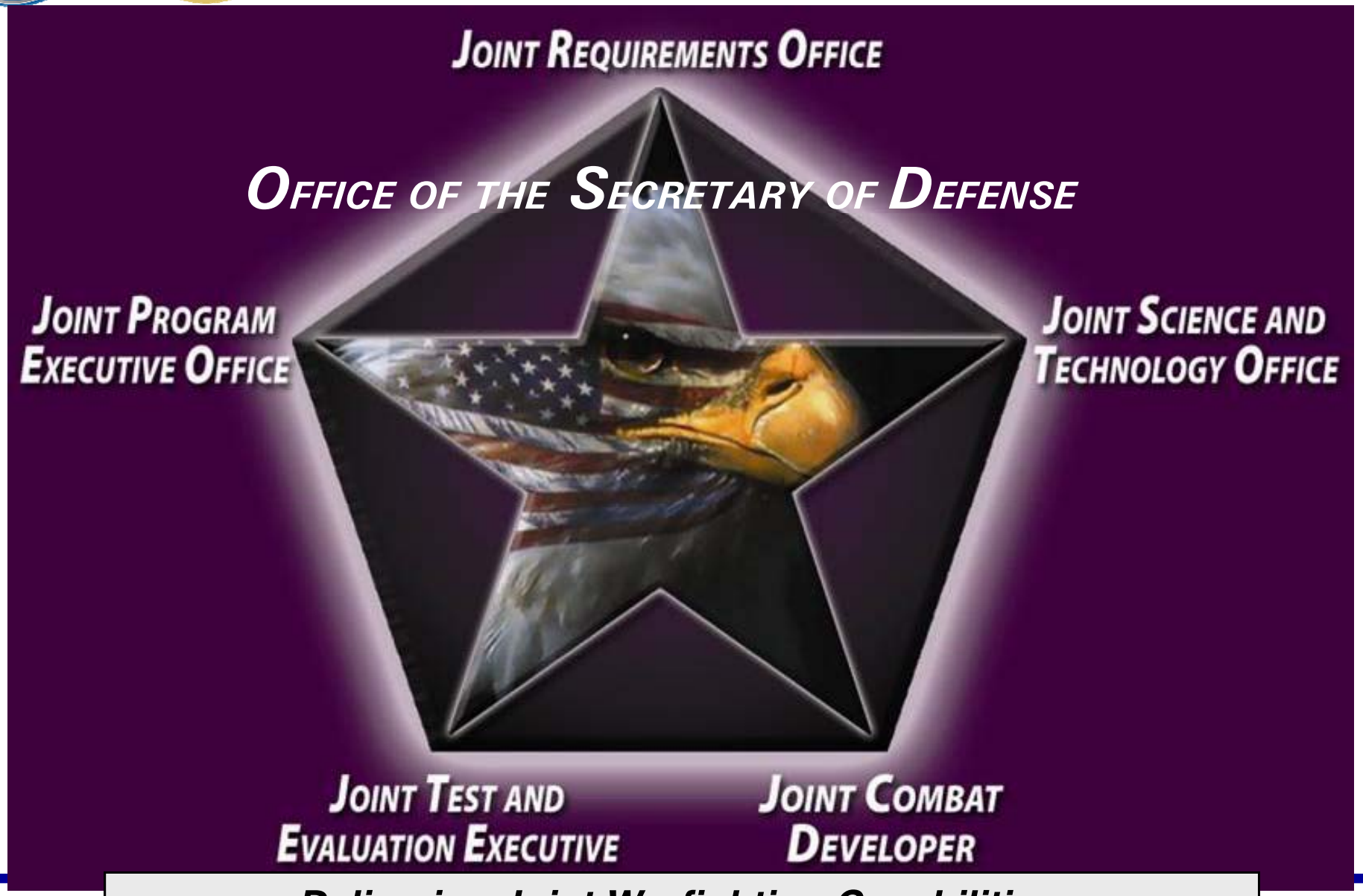
Joint Project Manager for Individual Protection and Collective Protection Industry Day

July 22, 2008

Agenda

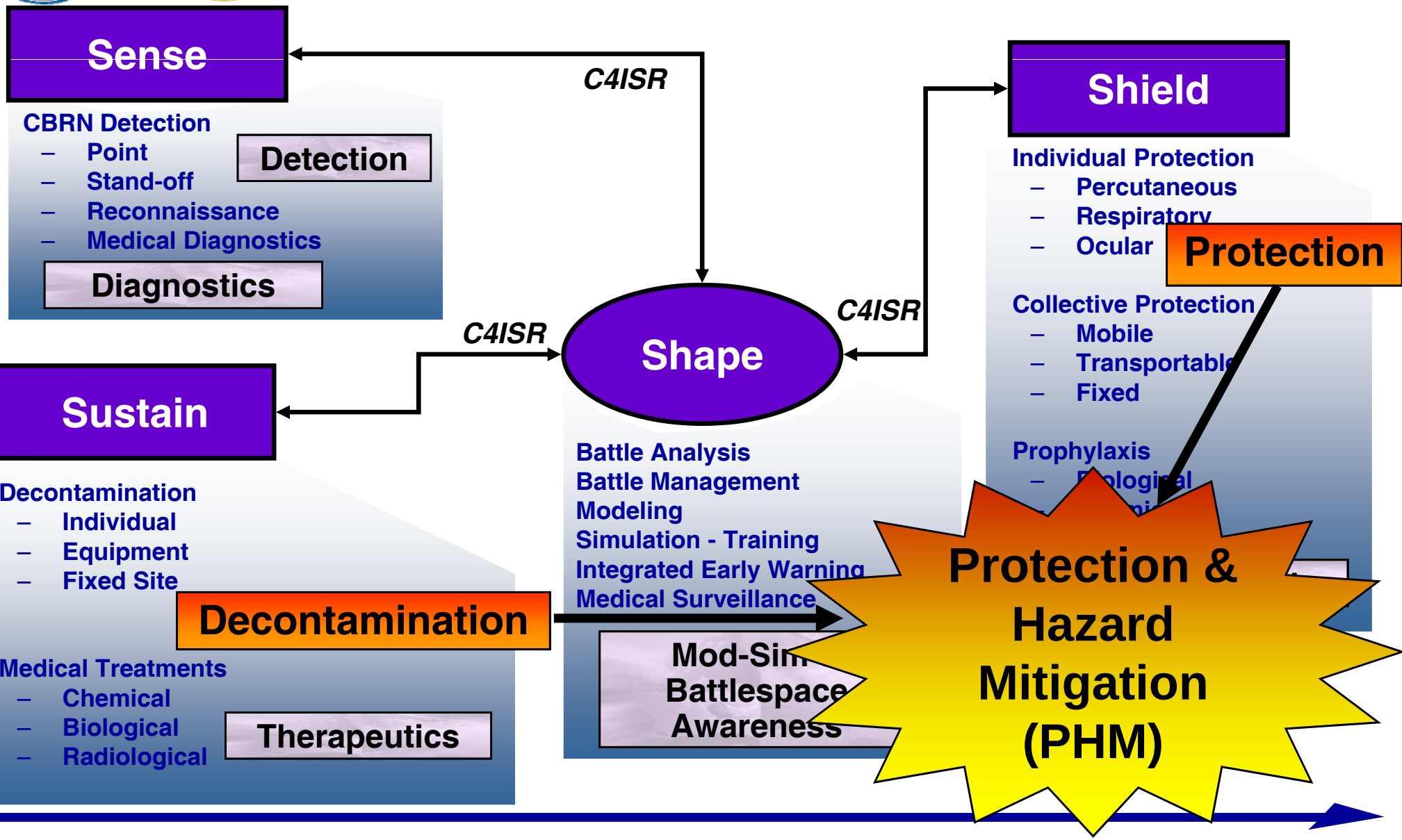
- Joint Science and Technology Overview
- General Technology Development Approach
- Air Purification Technologies
  - Sorptive Media
  - Particulate Removal Media
  - Oxidative
  - Regenerative
  - Hybrid and other Media-less approaches
  - Residual Life Indication
- Funding Summary

CB Defense Program



Delivering Joint Warfighting Capabilities

CBRN Doctrinal Elements



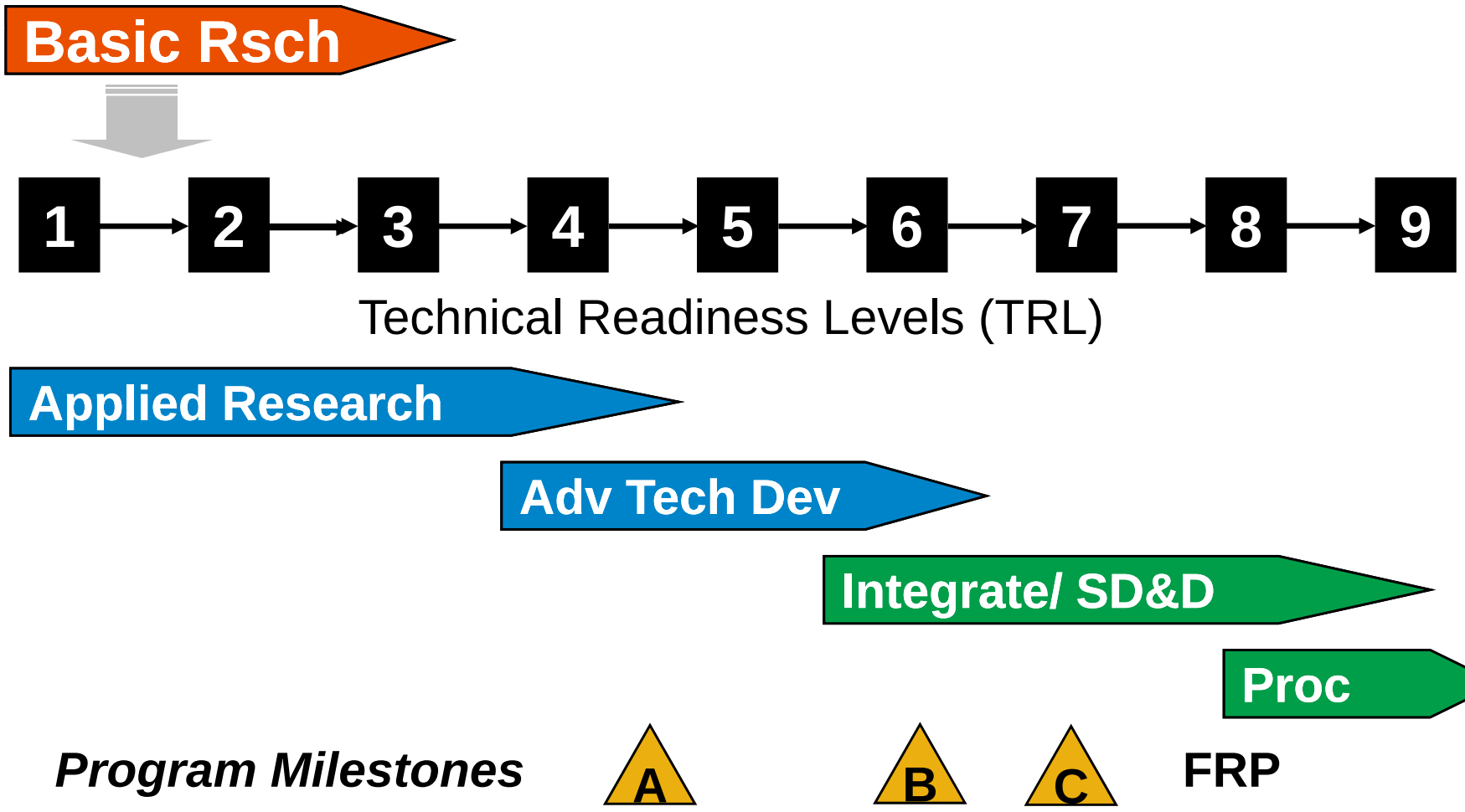
The Low-Burden Imperative

Like Improvised Explosive Devices (IEDs), future threat use of CB weapons will likely be immediate, intense, and local. Thus, to have its greatest impact, protective and hazard mitigation measures must be constantly available. This necessitates low-burden equipment.

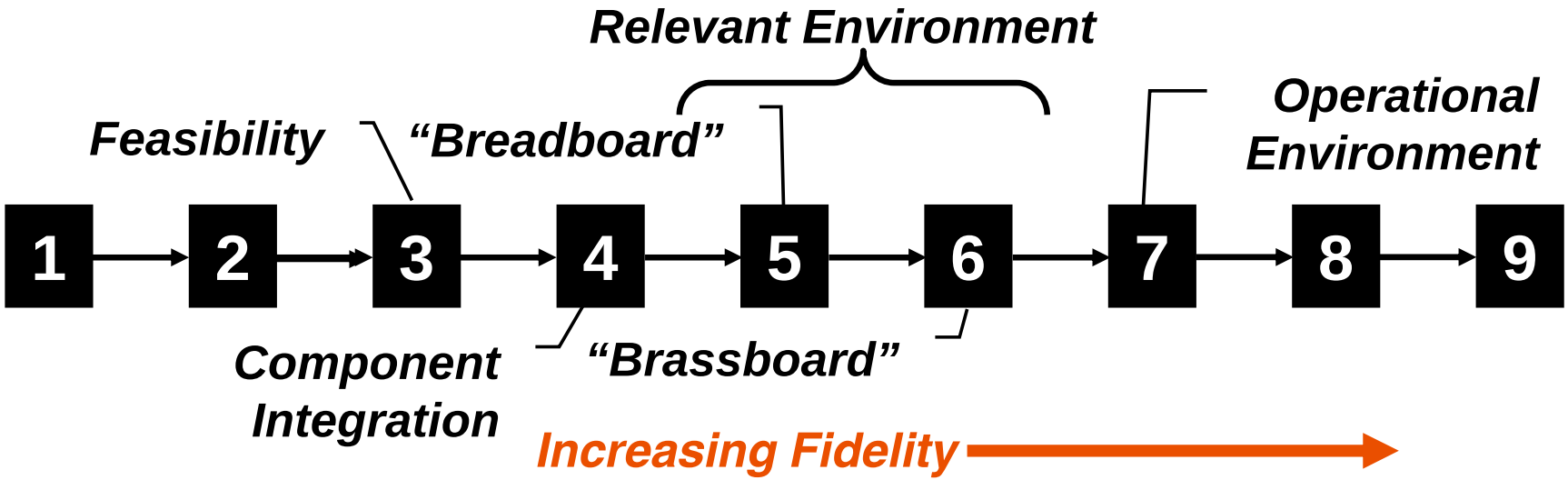
Sources of Burden:

- **Physiological**
- **Cognitive**
- **Logistical**
- **Operational**

Technology Development Process



Technology Development Process



Increasing Fidelity

Effectiveness (Agent & Simulant Work)

Scalability Factors

Materials Compatibility

Environmental Safety / Occupational Health

Additional “ilities”

- Maintainability
- Supportability
- Transportability
- Sustainability
- Packaging, Handling, and Storage
- Additional equipment required to support system
- Affordability
- Training and Training Support (e.g. training aids, training systems, etc.)
- Technical Data
- Survivability
- Reliability
- Human Factors
- Facilities
- Producibility

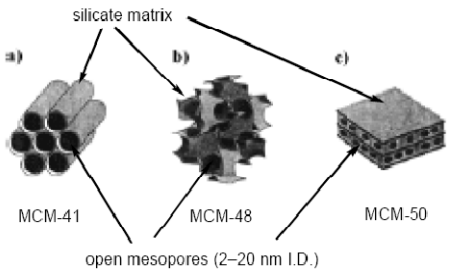
Technology Readiness Assessments

- Informal internal assessments to confirm TRLs 3 & 4, and a formal and/or independent assessment to confirm TRL 6 at Milestone “B” for transition to an acquisition program
- Expect TRL maturity “step” to provide ‘proof’ of completion
- Data must be objective, robust, and statistically significant supporting the performance of a technology for its intended application
- Correlation of data to the intended operational environment is critical

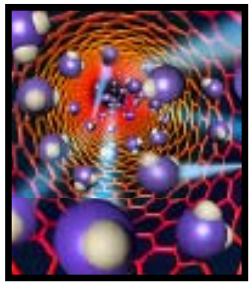
Air Purification Technologies

Sorbtive Media

- **Performance Objectives**
  - Increased TIC Capacity
  - Lower resistance
  - Smaller size volume/lower profile
- **Technical Objectives**
  - Increase retention of high volatility substances by increasing affinity/reactivity
  - Increase capacity of media

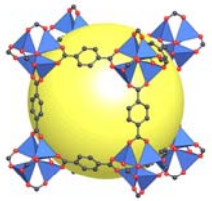


Meso-Porous Structures

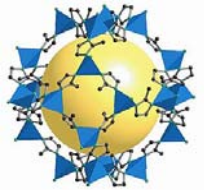


CNTs/CNFs

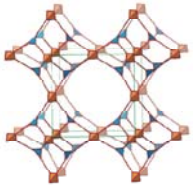
Reticular Chemistry



MOFs



ZIFs



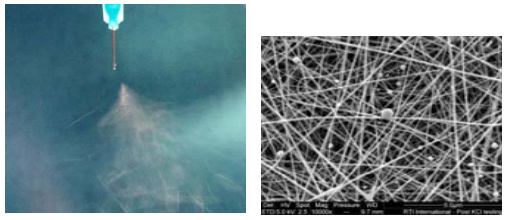
COFs

- **Output**
  - Well characterized novel sorptive materials
  - Validated novel bed designs
  - Design equations/parameters
- **Focus**
  - Near – TIC optimized M98 size filter
  - Mid – Low-profile/Low-burden optimized IP filters for demo (FY11)
  - Far – Smart Materials

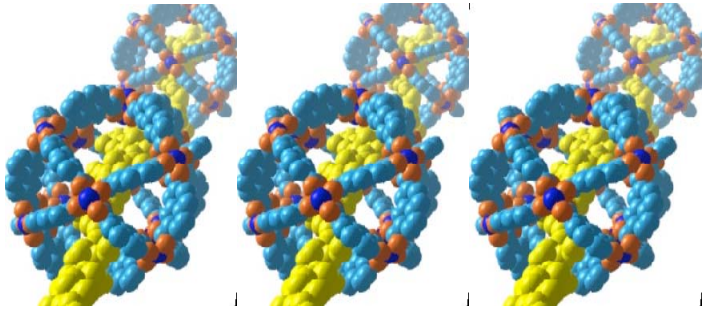
Current efforts at UCLA, Northwestern University, Kansas State University, University of South Florida, Indiana University, University of Colorado, Vanderbilt University and Naval Research Laboratory; IP Integration at Edgewood Chemical and Biological Center; CP Filter Integration at 3M and New World Associates

Particulate Removal Media

- **Performance Objectives**
  - Lower resistance
  - Lower profile
- **Technical Objectives**
  - Significantly increase Figure of Merit (FoM)
  - Increase robustness of new media to meet durability and loading requirements



Nano-Fibers

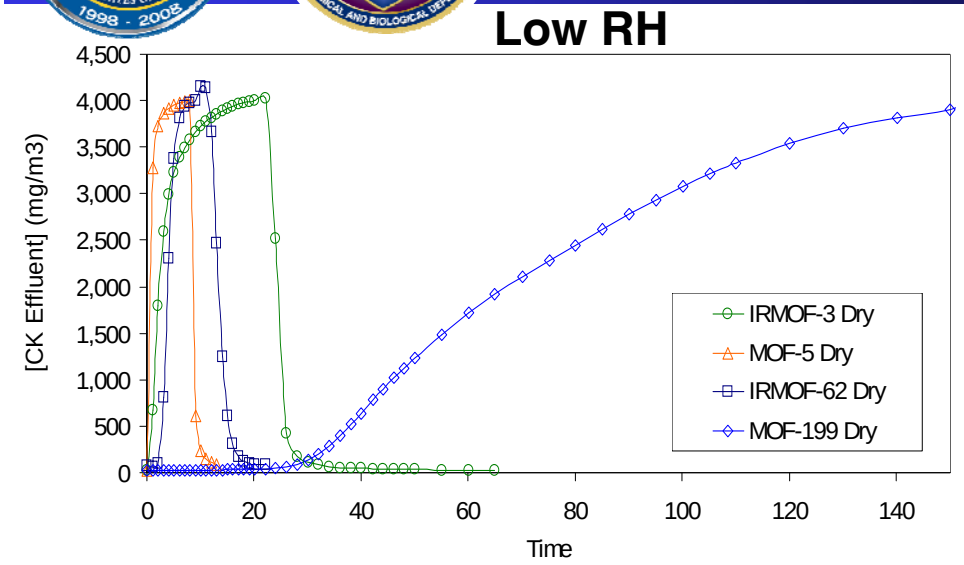


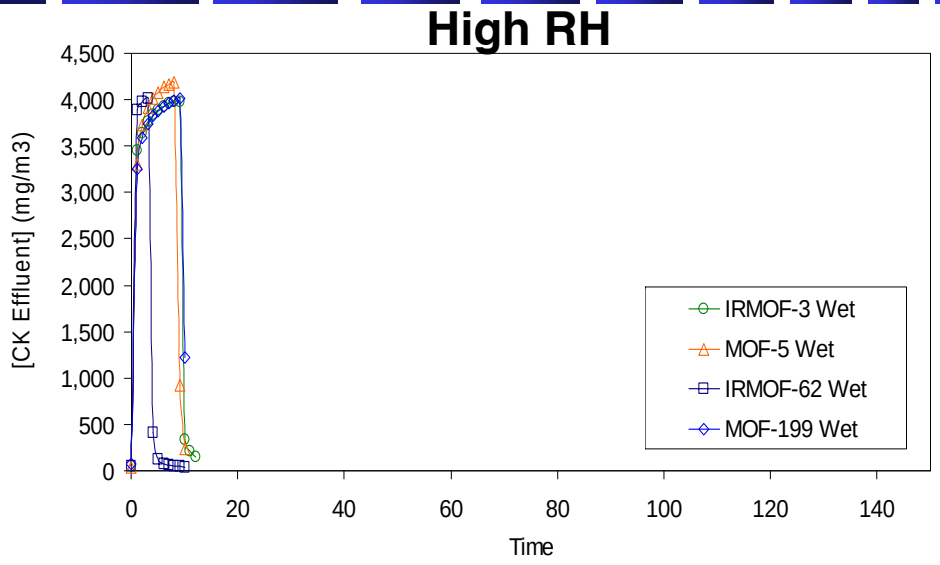
Sorbent Integrated Nano-Fibers

- **Output**
  - Well characterized novel materials
  - Validated designs
  - Design equations/parameters
- **Focus**
  - Near – Irregular cross-section fibers
  - Mid – Nano-fiber HEPA Media (FY11)
  - Far – Functionalized nano-fibers

Current efforts at Research Triangle Institute, Air Force Research Laboratory, Argonide, UCLA and Cornell University; Integration at Edgewood Chemical and Biological Center

Challenges





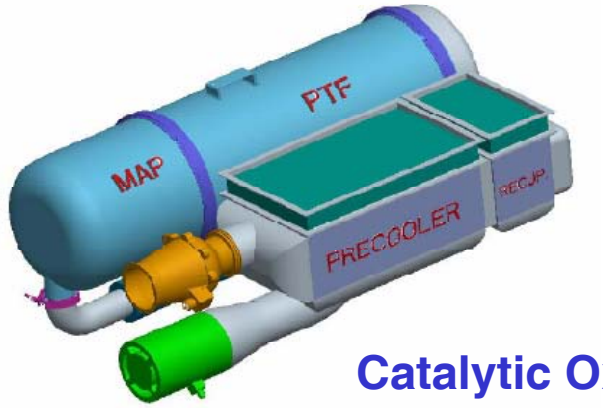
Example: CK Break-Through of Material Samples

Performance Varies With Conditions!

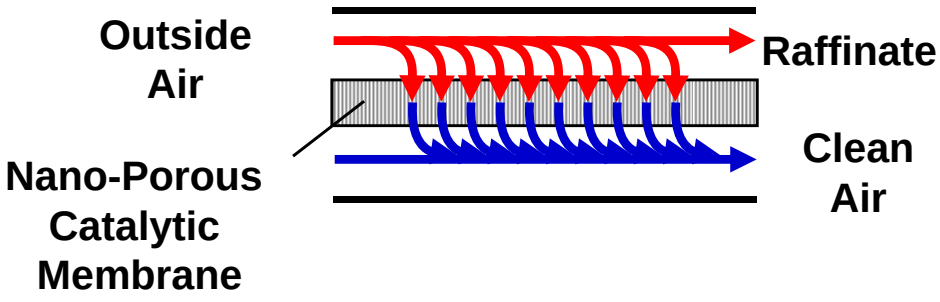
- Specific Issues and Challenges:
  - How can these materials be improved to meet performance requirements over the range of environmental conditions and optimized against targeted TICs?
  - How to design robust nano-materials that perform in the intended environment?
  - How to design around potential health effects of nano-materials?
  - How are these new materials scaled to commercialization?

Oxidative Filtration

- **Performance Objectives**
  - Size, weight and power reduction
  - Broad Threat Spectrum
  - Reduce O&M costs
- **Technical Objectives**
  - Decrease required rxn temperature
  - Increase robustness of catalyst
  - Reduce size of post treatment



Catalytic Oxidation

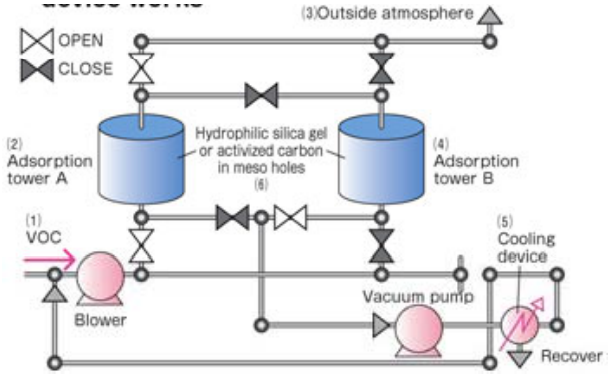


Reactive Membrane

- **Output**
  - Validated prototypes
  - Design equations and parameters
- **Focus**
  - Near – CATOX demonstrator (FY09 – FY11)
  - Mid/Far – Low-temperature combustion / Membrane reactor

Regenerative Filtration

- **Performance Objectives**
  - Size, weight and power reduction
  - Broad Threat Spectrum
  - Smaller size volume/lower profile
- **Technical Objectives**
  - Improved broad spectrum media
  - Better engineered heat transfer
  - Design simplicity

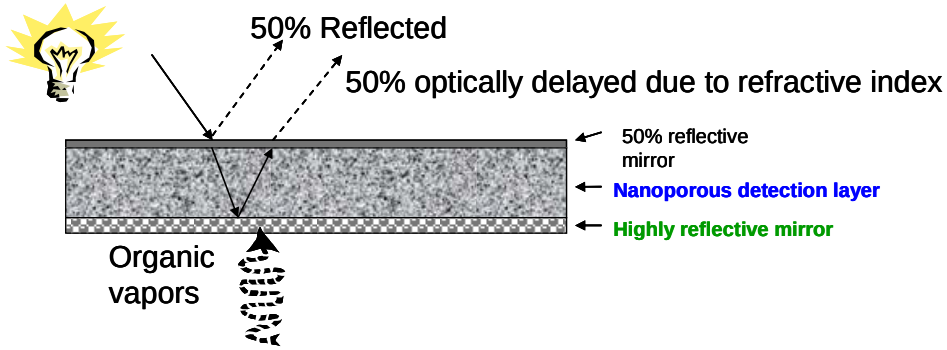


Swing Adsorption

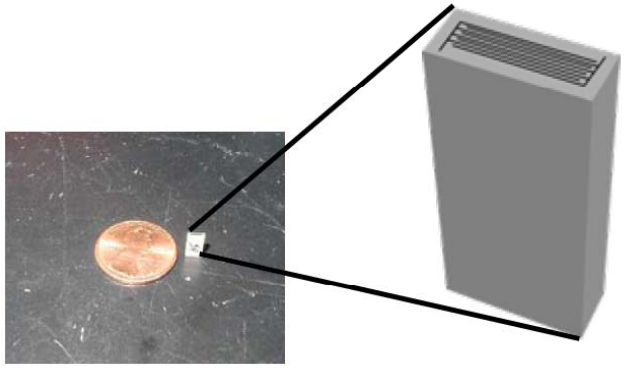
- **Output**
  - Validated prototypes
  - Design equations and parameters
- **Focus**
  - Near – Hunter Manufacturing demonstration
  - Mid/Far – Tech watch for novel and effective approaches

Residual Life Indicator (RLI)

- **Performance Objectives**
  - Indicate remaining service life (normal O&M)
  - Warn user of impending failure
- **Technical Objective**
  - Broad range indicators
  - Direct interrogation of the media



Refractive Capacity Indicator



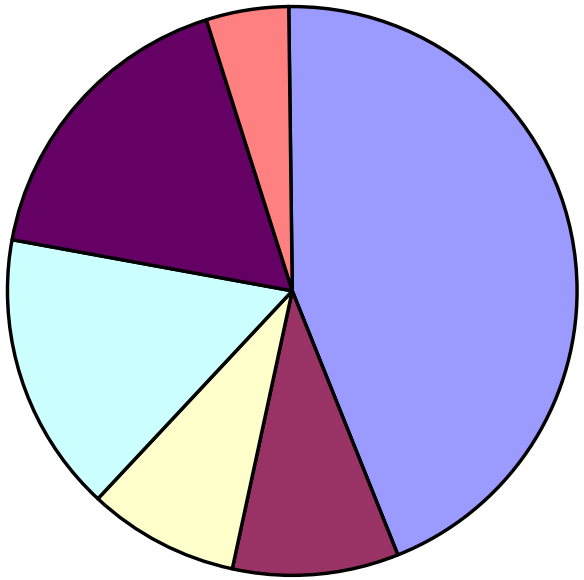
Elector Impedance Spectroscopy

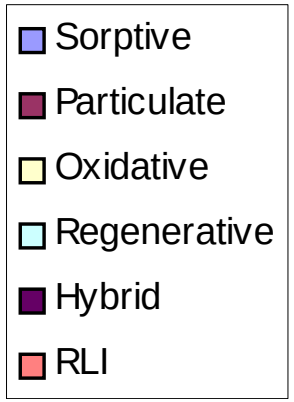
- **Output**
  - Agent indicators
  - Validated broad-spectrum process
- **Focus**
  - Near (transitioned) – Colorimetric acid gas indictors
  - Mid/Far – Direct interrogation sensor technologies

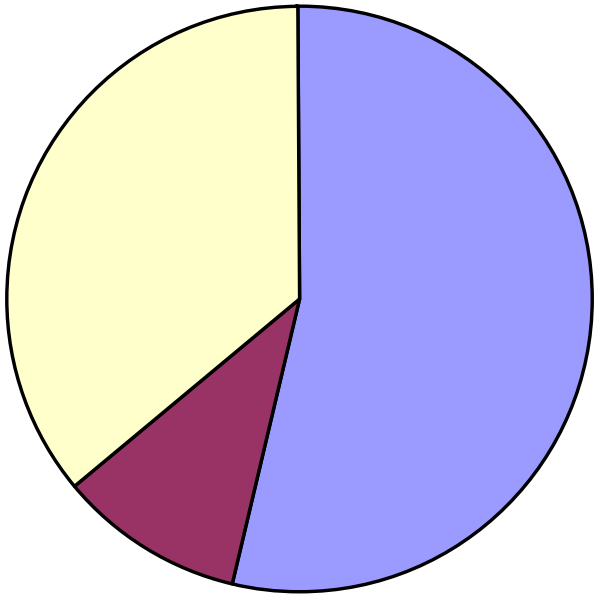
RLI: Interrogate vs. Detection

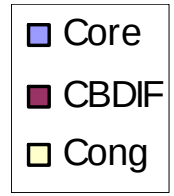
Seeking methods that directly interrogate the residual capacity of the filter bed. Additional work on detectors for specific chemicals (e.g. colorimetric strips) is not desired.

Current Filtration Investments









PHM Core S&T Funding ($M)

YEAR/ RTDE	FY08	FY09	FY10	FY11	FY12	FY13	TOTAL FY08-13
BA2	24.3	28.2	29.0	27.8	24.7	22.6	156.6
BA3	5.0	5.0	3.3	2.9	2.9	2.9	22.0
TOTAL BUDGET	29.3	33.2	32.3	30.7	27.6	25.5	178.6

Total PHM S&T Funds includes Individual and Collective Protection, and Hazard Mitigation

Questions?