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Enhanced Surveillance Program Overview

Regan Stinnett and Robert Bernstein

U.S. DEPARTMENT OF ENERGY | NNSA

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SNL Enhanced Surveillance Program Structure and Integration with Core

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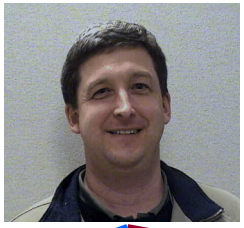

DSW Stockpile Systems / C8 Deputy Director
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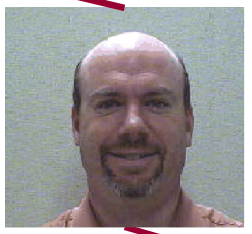
Tim Gipe, NA 124
NNSA ES FPM

Enhanced Surveillance/C8 Sub-Program Manager
Regan Stinnett, 1836

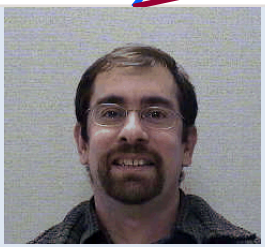
Integrated Stockpile Evaluation and Core Surveillance Sr. Manager
Corey Cruz, 2950

ISE Planning Manager
Bernie Gomez



ISE Components Manager
Dan Sherman

Component surveillance engineers



Materials MTE Lead
Robert Bernstein

Components MTE Lead
Lynn Fugelso

Systems MTE Lead
Dan Garcia

Program Support
Suzanne Chavez

Technical Advisory Team for Enhanced and Core Surveillance

Historical Mission of Enhanced Surveillance
(from NNSAs 2009 Program Implementation Plan)

"Because nuclear weapons are being retained for timeframes beyond our experience and their design life, ES pursues a fundamental scientific understanding of stockpile aging and develops the models and technologies needed for early identification and assessment of stockpile aging concerns.

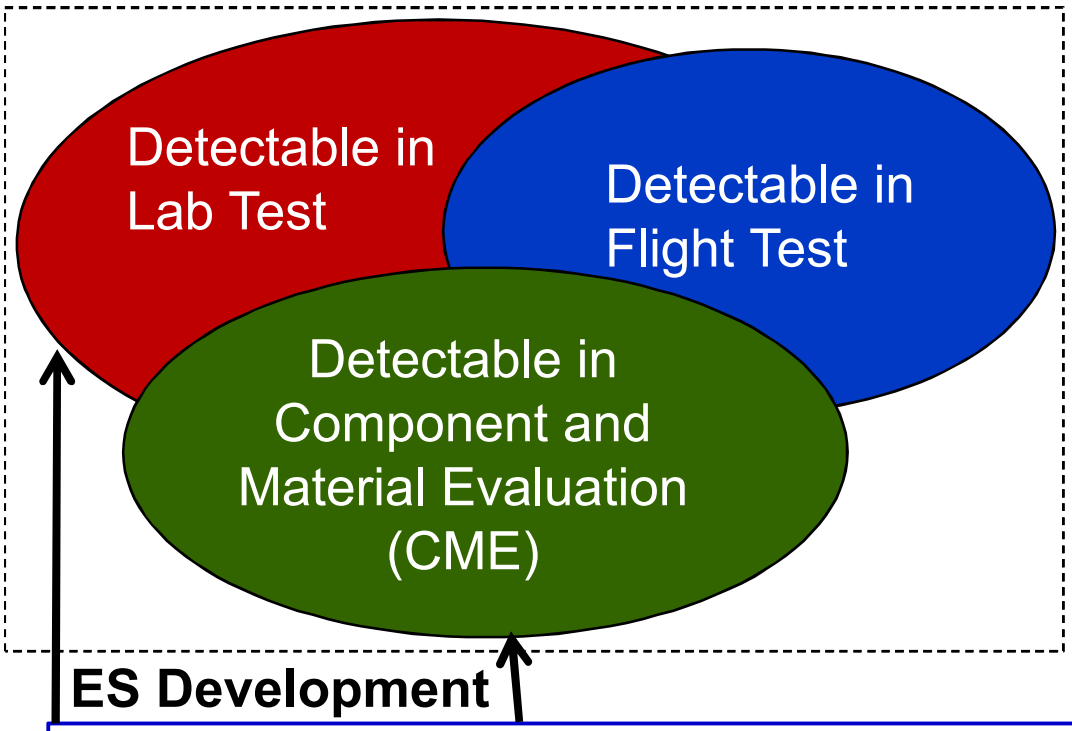
The vision is to ensure a responsive capability by identifying aging issues with sufficient lead-time to ensure that NNSA has the necessary infrastructure capability and capacity in place when required.

ES also provides assessments on the reused and new materials to be used in refurbished or replacement weapons to support age-aware design, manufacturing, and certification to increase longevity for a more sustainable stockpile.

ES delivers new diagnostics and methods, including non-destructive techniques, to the Directed Stockpile Work (DSW) program for transforming surveillance to be more predictive in finding defects in weapons sampled from the stockpile."

Where does Enhanced Surveillance Fit in Stockpile Evaluation Activities?

Each Activity Area involves both Core and Development work



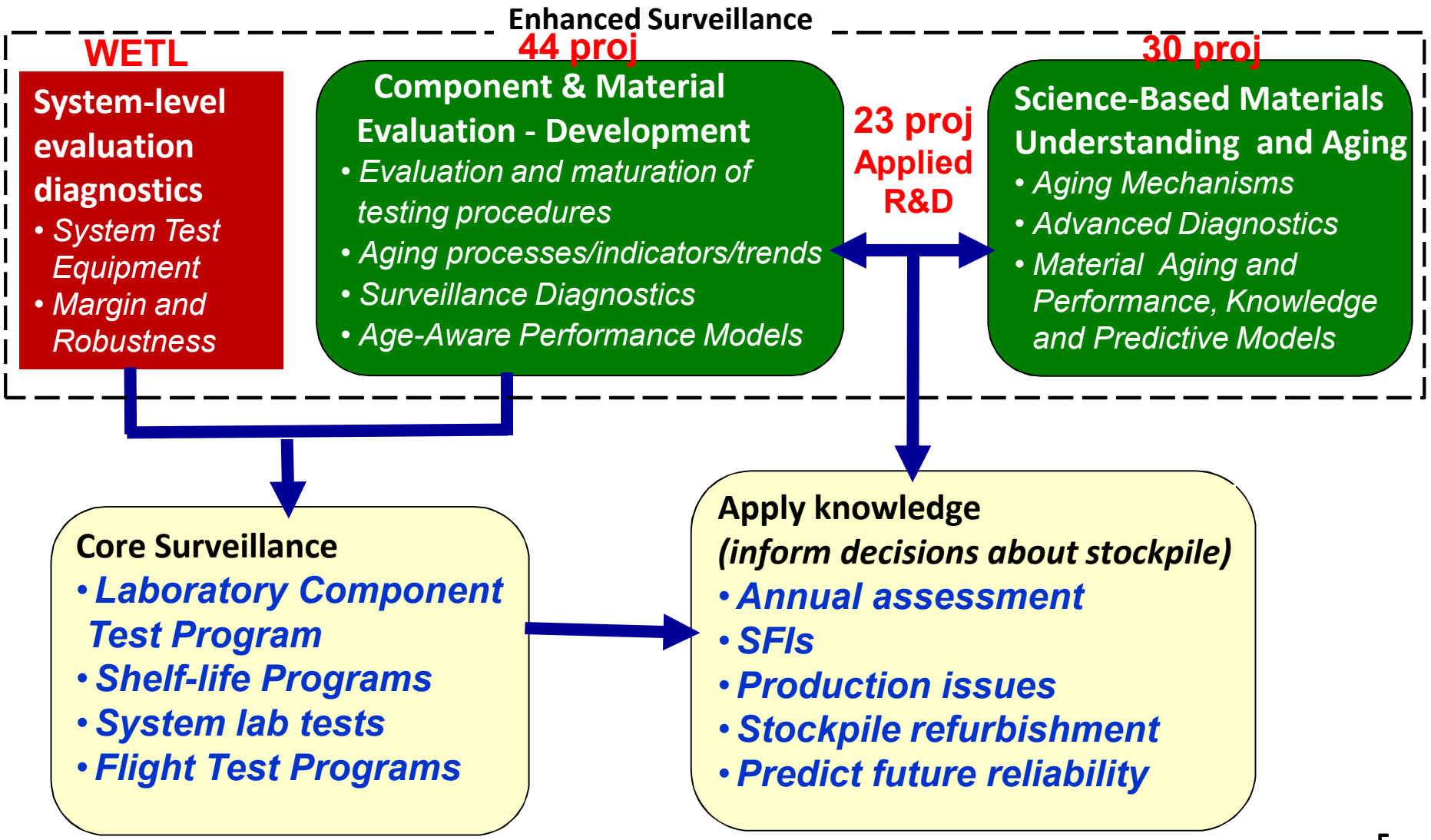
Flight Testing: System Tests, Mission like, limited control of mission environments, minimal diagnostics

Lab Testing: System and subsystem testing, Replicates some aspects of Mission, more control of environments, more diagnostics

CME: Component and Materials Evaluation, derived mission environments, more control of environments, extensive diagnostics

Enhanced Surveillance provides the knowledge and test capabilities needed to enable the surveillance program to better detect, assess and predict aging effects at the system, component and material levels.

Enhanced Surveillance develops the knowledge and capabilities needed to effectively assess an aging and evolving stockpile



Working Groups Have Been Established for 14 Component Families

- Energetics	- Capacitors
- Electro-Mechanical Components	- Lightning Arrestor Connectors
- Neutron Generators	- Gas Transfer Systems
- Firing Sets	- Parachutes
- Cables and Connectors	- Radar
- Thermal Batteries	- Use Control
- Electrical Components	- Impact Fuse

These groups plan and prioritize CME activities in their areas based on integrated guidance from surveillance, systems, components, and materials SMEs.

ES Non-Nuclear Materials provides materials performance and aging capabilities to the NW program in ten cross-cutting materials areas

- Corrosion
- Solder
- Organic Materials
- Tribology, Surfaces, and Lubrication
- Films and Coatings
- Structural Materials
- Brittle Materials, Ceramics, Glass, Glass-To-Metal Seals
- Materials Characterization, and Diagnostics
- Gas Analysis
- Chemical Analysis

The science-based understanding and capabilities developed in these areas enables direct support for a wide range of materials issues in the component working groups, support of SFIs, and predictive capabilities based on understanding of materials degradation processes.

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NNM MTE Lead Roles and Responsibilities

Non-Nuclear Mateials (NNM) Major Technical Effort (MTE)

--Portfolio of ~50 projects

--Implements ES NNM priorities, budgets and plans

--Accountable for NNM performance and deliverables, manage agreements with staff, reporting requirements, and schedules

NNSA ES program objectives*

- **Aging Analysis and Lifetime Assessments**
  - **Understand and predict aging behaviors**
  - **Provide improved predictive models and lifetime assessments**
  - **Inform stockpile decisions on Annual Assessment and LEPs**
- **Diagnostics**
  - **Develop new cost effective capabilities, tools, diagnostics, and methods**

Specific applications of the ES advancements include:

- Science-based tools/models to predict effects of aging phenomena and/or detect the precursors of age-related defects
- Advanced diagnostic techniques to validate these models easier and less expensive to obtain.
- Engineering and physics-based estimates of component or system lifetimes
- Lifetime and compatibility assessments on material/component reuse and/or new materials options in support of weapon refurbishment or life extension.

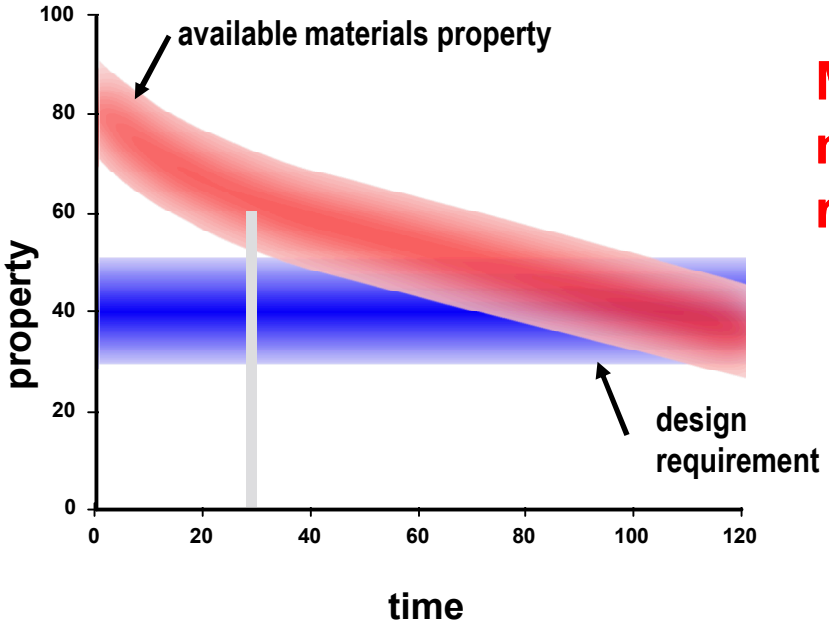
* *From FY2013 NNSA Program Implementation Plan (pages D1 & D2)*

Materials are What Age

Reliability is the "probability" of functioning properly (both *margin* and *uncertainty* are established).

Engineered materials are metastable and their properties can change with time.

Change and rate of change depend on the microstructure, chemistry, and physics of the constituent materials and their environments.



Materials aging knowledge is mandatory to determine component/ reliability

Principles for ES Prioritization

Highest priorities are to support…

- foundational scientific capabilities and understanding needed to address Sandia's stockpile issues
- new capabilities needed for early identification, assessment, and prediction of stockpile aging concerns
- new capabilities for cost and hardware-effective surveillance
- predictive and modernization capabilities
- cross-cutting issues involving multiple systems

Specific factors influencing portfolio selection

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- NNSA Enhanced Surveillance Sub-program requirements
  - Program priorities
  - Multi-year, multi-site milestones
  - Near-term / long term balance
- System cross-cutting materials issues
  - Observed risk (consequence – likelihood assessments)
  - Knowledge and capabilities over a broad range of age-related vulnerabilities must be developed and maintained (ref: SAND2010-4895)
  - The materials organizations are the integrator of historical materials issues in the stockpile (are in the best position to understand gaps)
- Systems and Components: knowledge gaps

ES materials thrusts

- Develop advanced materials diagnostics
  - detect early signatures of aging
  - identify materials aging mechanisms
- Understand mechanisms of materials aging and device-level failure
  - establish basic knowledge of how materials age that is useful for addressing surveillance issues
  - provide physical basis necessary for an effective long-term predictive capability
  - identify how manufacturing processes can introduce latent defects that may be manifested as an aging concern in the long term
- Predict materials changes
  - quantify the effect of material property changes on performance, safety, reliability,
  - provide a part of the basis for re-use and life-extension decisions

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The Materials MTE is managed to maintain a healthy balance between "engineering" and "science" activities

- **Engineering projects focus on using current capabilities to assess weapon aging effects and expected lifetime. (*Customer: Components*)**
- **Science projects are aimed at *advancing our capabilities* to detect, understand, and predict aging and reliability. (*Customer: Materials Engineer and Components*)**

This balance between "engineering" and "science" work is required to address both near term and future needs

Future Goals/Work NNM MTE Lead

- Improve “line of sight” understanding of the role and contribution of each NNM task
- Improve communication between NNM PIs with component and system PIs, Weapons System Leads, and System Managers
- Prioritize overall work scope to permit the focusing of the future NNM portfolio given reduced funding and expanding requirements

End of Talk

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