Standards Development Process-ASTM Response Robot Case Study

Exoskeleton Standards Technical Interchange Meeting – 26 January 2017

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Overview

- Not exactly case study, more program overview, history and lessons learned
- Comparison of standards development models
- Lessons learned and observations
- Items for consideration going forward

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History of Program

- 2005 DHS Science & Technology Directorate (S&T) engaged in multi-year partnership with NIST to develop response robot test methods
- Initial focus robots for search and rescue, met with representatives from FEMA Urban Search and Rescue Teams to identify requirements
- Identified Standards Development Organization (SDO) through which to promulgate standards – ASTM E54 Committee on Homeland Security Applications
- Developed test methods to characterize key performance parameters of response robots – did not develop robot performance standards

History Continued

- Conducted tests, exercises, and operational exercises based on test methods to characterize robots in terms of what they could do as opposed to what the should do
- Other events had impact on program
  - 2010 Times Square bombing attempt
  - 2011 tsunami and Fukushima Daiichi nuclear disaster response and recovery
- Broader applications of robot testing program

Technical Approach

- Provide emergency responders a way to quantitatively measure whether robots are capable and reliable enough to perform operational tasks
- Develop standard test methods to measure robot maneuvering, mobility, sensors, energy, radio communications, dexterity, durability, reliability, logistics, safety, autonomy and operator proficiency
- Use standard test methods to:
  - Communicate operational needs to robot developers
  - Enable users to understand emerging robot capabilities
  - Guide robot procurement and deployment decisions base on objective data
  - Focus training and measure operator proficiency

Standards Development Processes

- ANSI model standards development process
- Performance standards development model
- Test method characterization model
- Security standards spiral development model

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ANSI Model

- Multi-domain expertise to ensure considerations for both technical and business effects and impacts of the standard
- Participation and coordination across the homeland security enterprise
- Openness, balance, due process, appeals process, and consensus
- Technical studies and/or expertise to provide the technical and scientific foundation
- Oversight and tailoring of the voluntary consensus process to ensure verification and validation (note all SDOs follow the same steps)

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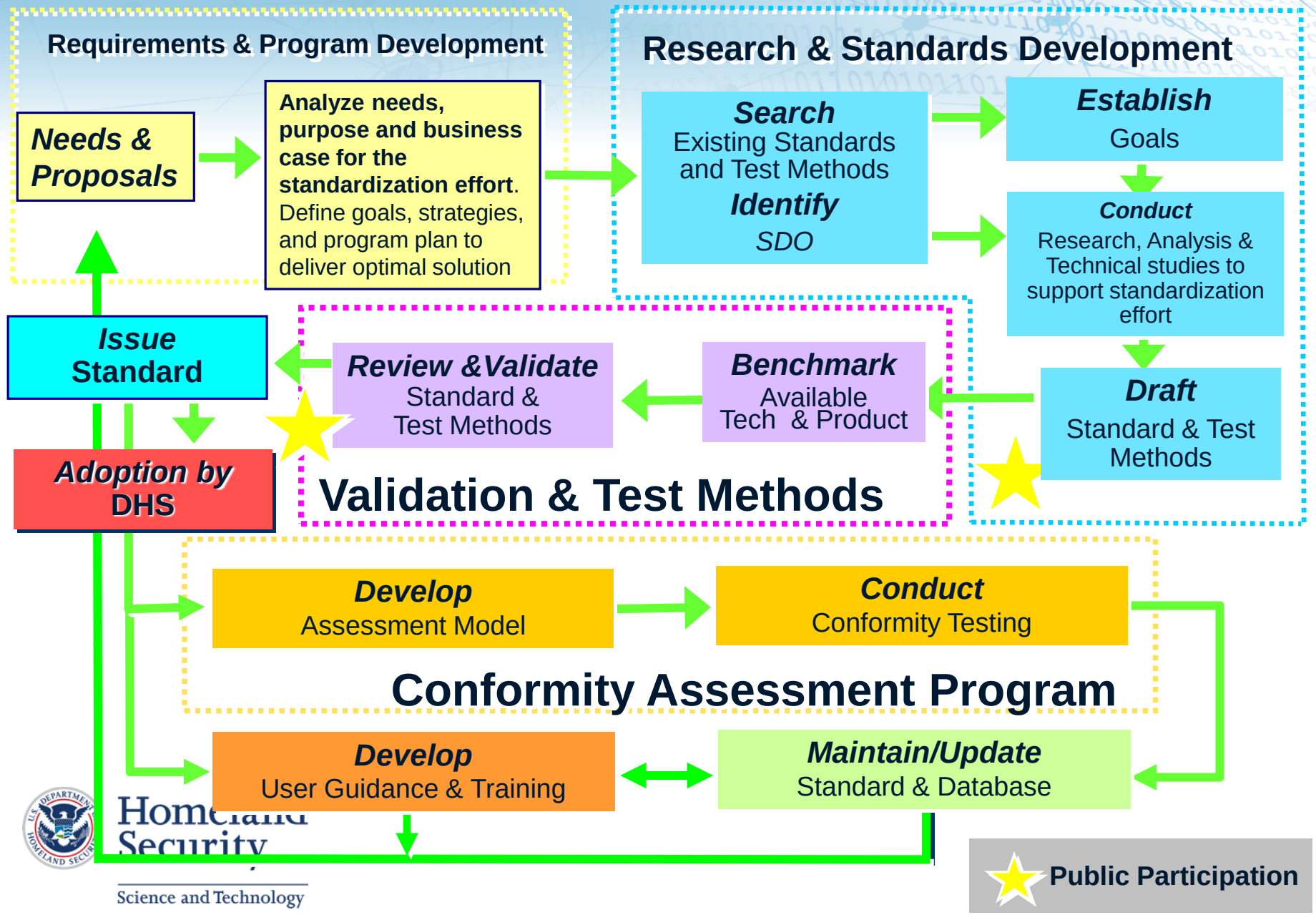
Performance Standards Development

Works well with:

- Mature technology
- Knowledge of
  - operational environment,
  - CONOPS
  - Threat
- Performance limits/requirements understood
- Conformance Assessment infrastructure in place or could be developed
- Examples: respiratory protection equipment, body armor, etc.

Performance Standards Development Process



Test Method Characterization Process

Better suited where:

- Technology rapidly evolving
- Not fully defined or evolving
  - operational environment
  - CONOPS
  - Threat
- Performance limits/requirements not fully defined or evolving
- Generates data/test results, but how to apply information
- Hard performance limits could hamper innovation

The response robot test method program uses this model

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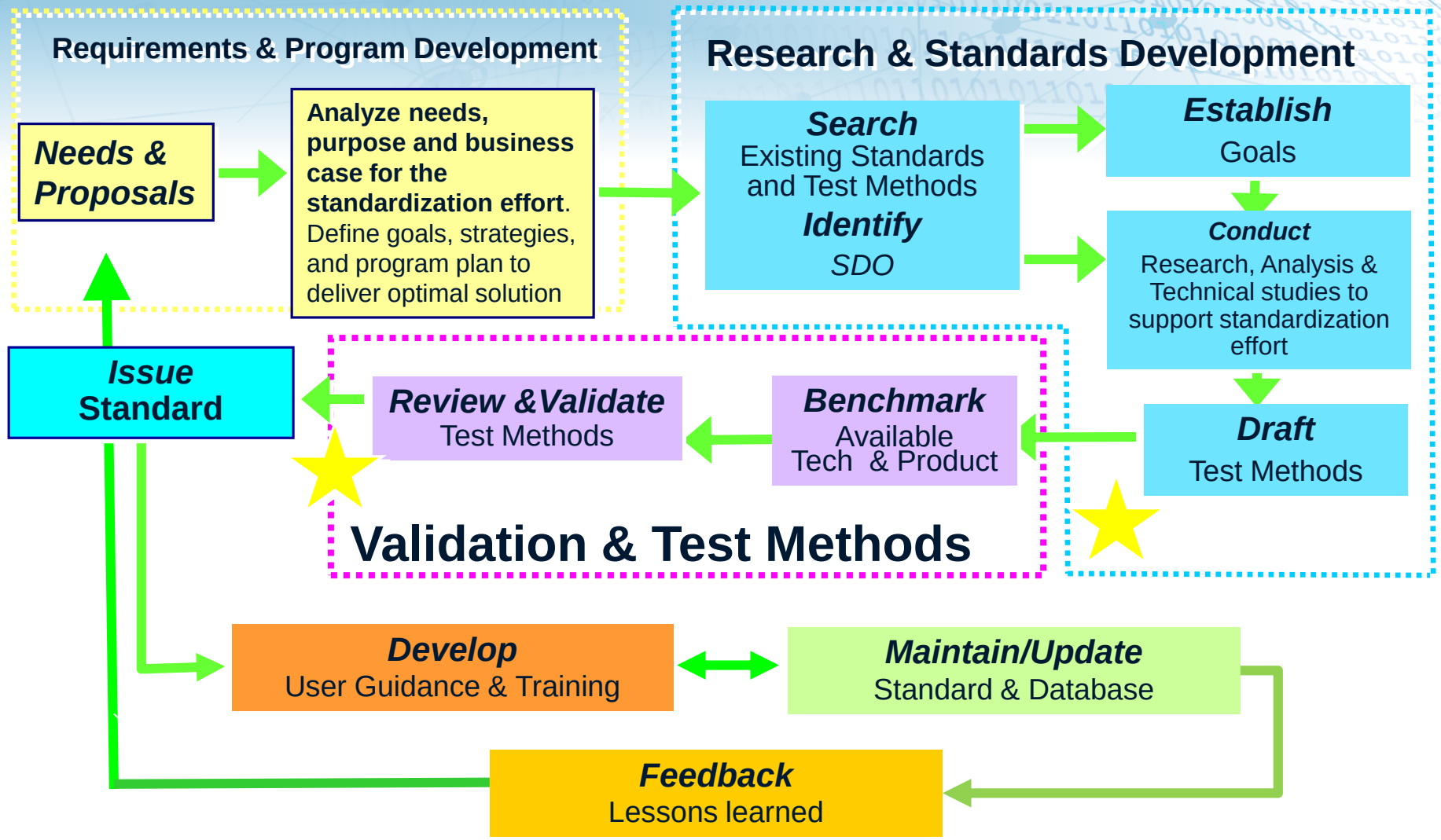
Test Method Characterization Process



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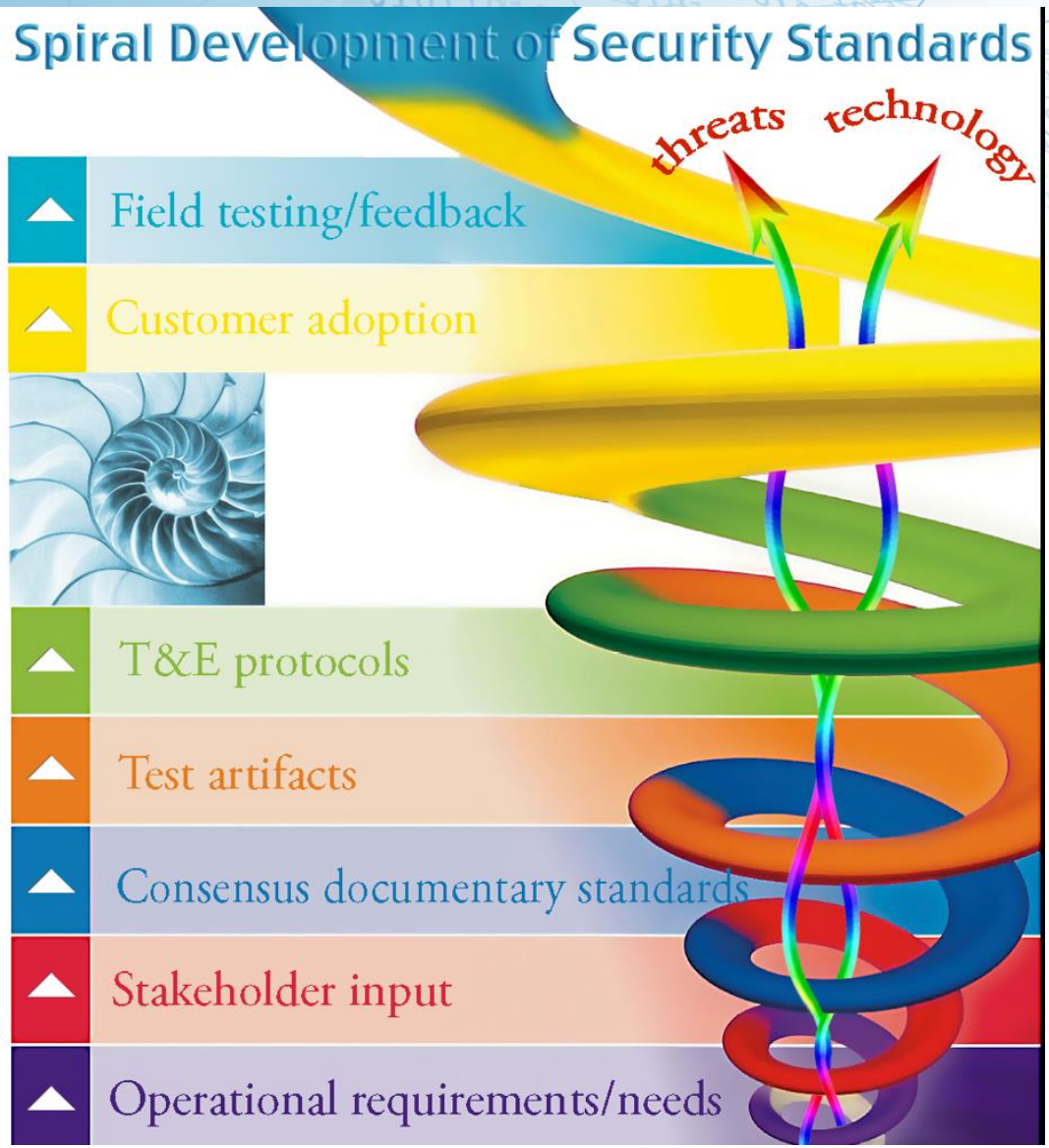
Public Participation

Spiral Development of Security Standards

- Addresses
  - Changes in threat
  - Advances in technology
- Also
  - Provides timely feedback to existing standards and test methods
  - Requires high levels of engagement from stakeholder community
  - Could drive standards development timeline
  - Flexible and adaptable to needs

Technical Approach



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Response Robot Program Outcomes

- Developing test methods and characterizing ground, aquatic and aerial robot platforms
- Test methods informed procurement of over $75 million worth of robots by multiple agencies
- Test methods promulgated around the world with facilitates in U.S., Germany, Japan, Afghanistan, Poland, South Korea and Australia
- Test methods developed at request of bomb squad community for Vehicle Borne Improvised Explosive Device (VBIED) response robots
- “Standard Test Methods in a Box” deployed around the country to support bomb squad robot operator training and over seas
- Test methods adopted by Japan so support Fukushima Daiichi decommissioning and decontamination

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Outcomes Continued

- Test methods and testing stimulate the development of technology in directions of interest to user community
- The stage is set for establishing performance thresholds for categories of response robots
- Standardized test methods allow for reproducible test results at different locations

Same Test Methods Help Different Users

- Robot Developers
  - Understand missions through tangible, reproducible test apparatuses
  - Practice and refine robot designs, optimize trade-offs
  - Highlight “Best-in-Class” capabilities
- Responders and other users
  - Compare robots with objective data, not marketing
  - Specify procurements based on existing combinations of capabilities
  - Align expectations with deployment considerations
- Program Managers
  - Describe objectives with a set of tangible tasks
  - Challenge conventional approaches and stimulate innovation
  - Measure baseline capabilities and document progress

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Considerations Going Forward

- Consider a similar approach – develop quantifiable test methods to measure and evaluate key performance parameters
- Identify the key missions to be performed by exoskeleton technology
  - Tactical military enhancements
  - Reduce repetitive motion stress and injury
  - Logistics support – materiel handling and transport
  - Levels of autonomy desired
- Determine what needs to be measured and how
- Human systems integration considerations – may make measurements more challenging
- Validate reproducibility of results of test methods and testing conducted at different sites

Considerations Continued

- Team with engineers and standards professionals to transition requirements to reproducible, verifiable test methods
- Determine how to interpret, distribute and use data to support decisions
- Voluntary Consensus Standards Development Organizations
  - It's the law
  - FACA issues – use the SDO's process
  - Connection to larger pool of experts
- Situational awareness
  - Multiple players & organizations
  - Leverage/synchronize with concurrent activities
- Be flexible – you will discover much as you embark on this effort

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