STPA Standards, Certification, and Accreditation

John Thomas

William “Dollar” Young

Email: JThomas@mit.edu wyoung@mit.edu

STPA in Industry Standards (2023)

- ISO/PAS 21448: SOTIF: Safety of the Intended Functionality
  - STPA used assess safety of automotive systems
- ASTM WK60748
  - “Standard Guide for Application of STPA to Aircraft”
- SAE AIR6913
  - “Using STPA during Development and Safety Assessment of Civil Aircraft”
- RTCA DO-356A
  - “Airworthiness Security Methods and Considerations”
  - STPA-sec used for cybersecurity of digital systems
- IEC 63187
  - “Functional safety - Framework for safety critical E/E/PE systems for defence industry applications”
- SAE J3187
  - “Recommended Practice for STPA in Automotive Safety Critical Systems”
- SAE J3187A
  - STPA Recommended Practice for Safety-Critical Evaluations in Any Industry”
- EPRI 3002016698 & 3002018387
  - STPA for digital I&C in nuclear power
- NIST SP800-160 Vol2
  - “Developing Cyber Resilient Systems: A Systems Security Engineering Approach”
  - “Attack scenarios can be represented as part of a model-based engineering effort […] based on identification of loss scenarios from System-Theoretic Process Analysis (STPA).
- IET 978-1-83953-318-1
  - “Code of Practice: Cyber Security and Safety”
  - Recommends use of STPA for Safety & Security
- NEI 20-07 Rev D
  - “Guidance for Addressing Common Cause Failure in High Safety-Significant Safety-Related Digital I&C Systems”
  - Outlines STPA process for digital technology at nuclear power stations
- UL 2800-1:2022: Standard for Medical Device Interoperability
  - Explicitly mentions STPA for performing system-level hazard analysis and control loop analysis

The International Center for
STAMP Certification and Accreditation (SCA)

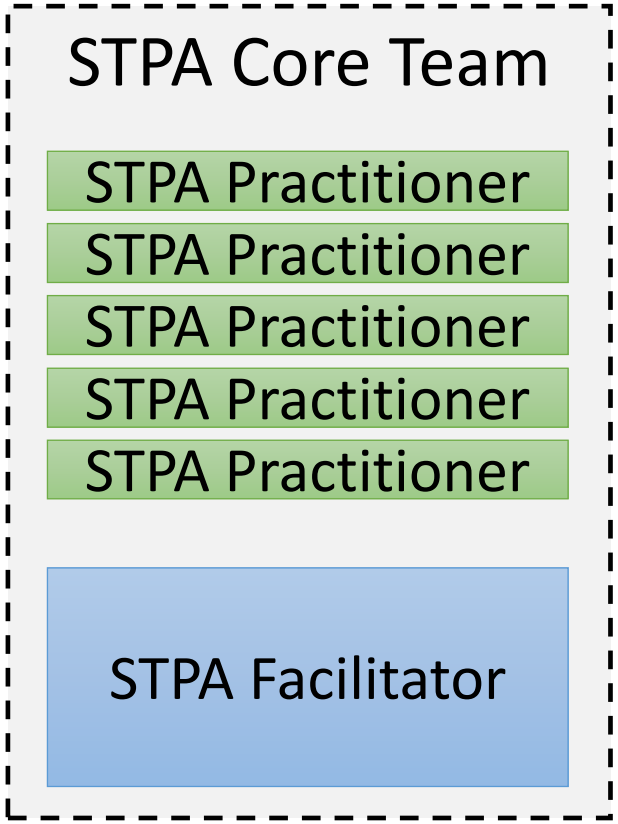
Certification

Why a certification?

- Standardization to accelerate useful adoption
  - Gain scale without sacrificing quality
  - Provide an organized support community for practitioners
- Need a way to recognize qualified & skilled STPA practitioners vs. a basic familiarity
- Help practitioners understand what is needed to perform STPA correctly
- Help management & leadership recognize the qualifications to perform STPA correctly
- Provide a way for you to verify your credentials when offering STPA support on projects
- Establishes an international board of experienced experts to help scale STAMP/STPA/CAST
  - Globally
  - Responsibly

Standardization, Structure, and Rigor Benefits the Entire Community!

Typical STPA Team Participants



Practitioners

- Perform majority of STPA work
- Interdisciplinary team
- Must have STPA training and basic understanding of STPA, but may not be experts

Facilitator

- The STPA expert
- Provide STPA method guidance (and other responsibilities)

SMEs

- Provide specialized domain knowledge as needed by team
- May have little or no STPA familiarity
- May not be actively involved in STPA, but must be accessible by team

STPA Practitioner Certification Criteria (Proposed)

- Skill
  - Basic STPA skill & ability on real project (see next slide)
- Knowledge
  - Knowledge of the strengths and limitations of STPA
  - Knowledge of differences between STPA and other HA methods used in their industry
  - Knowledge of how STPA relates to industry objectives (e.g., SOTIF, etc.)

Practitioners must demonstrate Skill and Knowledge

STPA Practitioner Certification Criteria (Proposed)

Must demonstrate skill on STPA project:

- STPA Step 1
  - Ability to identify stakeholder losses
  - Ability to identify system-level hazards
  - Ability to identify system-level safety constraints
  - Ability to establish traceability between losses, hazards, safety constraints
  - Ability to identify and correct common mistakes in losses, hazards, and safety constraints
- STPA Step 2
  - Ability to model a control structure
  - Ability to distinguish controllers, controlled processes, control actions, and feedback
  - Ability to use abstraction effectively in a control structure
  - Ability to define relevant controller responsibilities and process models
  - Ability to identify and correct common mistakes in control structure modeling
- STPA Step 3
  - Ability to identify Unsafe Control Actions (UCAs)
  - Ability to properly construct a UCA
  - Ability to identify effective UCA contexts
  - Ability to identify requirements and safety constraints for each UCA
  - Ability to establish traceability between UCAs and Hazards, requirements, and safety constraints
  - Ability to distinguish between UCAs and Hazards
  - Ability to identify and correct common mistakes in UCAs
- STPA Step 4
  - Ability to identify scenarios
  - Ability to properly construct the four scenario types defined in the STPA handbook
  - Ability to evaluate scenario coverage, including component failure and component interaction scenarios
  - Ability to establish scenario traceability
  - Ability to identify and evaluate effective solutions to address scenarios
  - Ability to identify and correct common mistakes in scenarios

Practitioner Rollout

- Standardized foundational curriculum
  - Familiarization Track – No evaluation for certificate (reduced cost)
  - Practitioner Track – Course plus evaluation
  - Emphasizes theory and proven best practices
- Testing
  - Board certifies criteria and samples of behavior

November 2023 is planned rollout for beta course

Summary

- Certification will support community-wide need to recognize qualified individuals
- Designing for community-wide impact
- Scale STAMP/STPA/CAST as fast as responsibly possible

Survey to collect comments & ideas about certification

Mission: To enable high-quality STAMP-related work products by recognizing qualified practitioners and defining a uniform standard for education and facilitation.