Cybersecurity of Ground Systems

GVSETS GROUND VEHICLE SYSTEMS ENGINEERING & TECHNOLOGY SYMPOSIUM
& ADVANCED PLANNING BRIEFING FOR INDUSTRY

NDIA Michigan

Secure Rapid Prototyping of Unmanned Systems

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4/4/2023

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Unmanned Systems Cybersecurity – Evolving Policy

- Cybersecurity is a growing concern in Unmanned Systems
- As developmental systems/capabilities transition to operational use, many will need significant cybersecurity updates slowing deployment
- While air applications have been the most affected to date by security processes/required certifications, other domains will likely be "catching up" soon
- **How do we accelerate the design process to keep up with the rapid evolution of unmanned systems without leaving cybersecurity behind?**

National Defense Authorization Act-NDAA

FY2020 NDAA SEC. 848. PROHIBITION ON OPERATION OR PROCUREMENT OF FOREIGN-MADE UNMANNED AIRCRAFT SYSTEMS.

(a) PROHIBITION ON AGENCY OPERATION OR PROCUREMENT.— The Secretary of Defense may not operate or enter into or renew a contract for the procurement of—

(1) a covered unmanned aircraft system that—

- (A) is manufactured in a covered foreign country or by an entity domiciled in a covered foreign country;
- (B) uses flight controllers, radios, data transmission devices, cameras, or gimbals manufactured in a covered foreign country or by an entity domiciled in a covered foreign country;
- (C) uses a ground control system or operating software developed in a covered foreign country or by an entity domiciled in a covered foreign country; or
- (D) uses network connectivity or data storage located in or administered by an entity domiciled in a covered foreign country

SecMUAS – Secure Modular Unmanned Aerial Systems

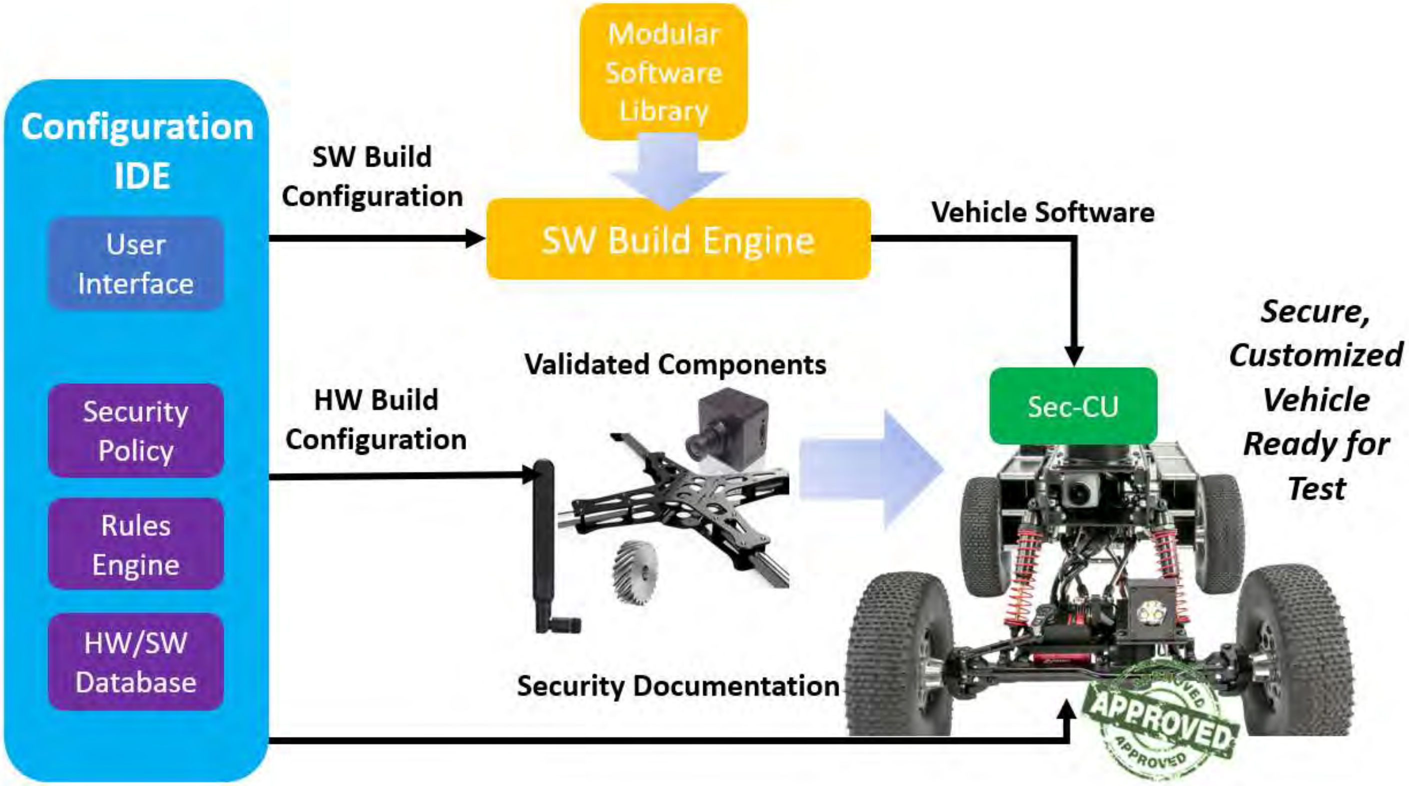
- Goal: The goal of the SecMUAS program is to enable the rapid, modular, security-enhanced unmanned systems design process
- Customer: Office of Naval Research. Code 351, Air Warfare and Weapons.
- ONR TPOC: Dr. David Gonzalez (david.r.gonzalez@navy.mil)
- Contract: Phase II SBIR

While SecMUAS initial demonstration target is air systems, the system is being designed to handle ground, surface, underwater, and space applications

What makes SecMUAS Unique?

- Assist unmanned system designers to build in cybersecurity early in the design process
- How?
  - Automate security policy enforcement. Designer does not need to be a cybersecurity expert to develop a system than meets security policy requirements.
  - Provides a selection of hardware and software components with known pedigrees that can be re-used
  - Security architecture enforcing strong isolation, multiple radio/crypto options, and other cybersecurity functionality supporting cybersecurity in contested environments
- Automated document generation on cybersecurity controls implemented to enforce security policy assisting in approval process.

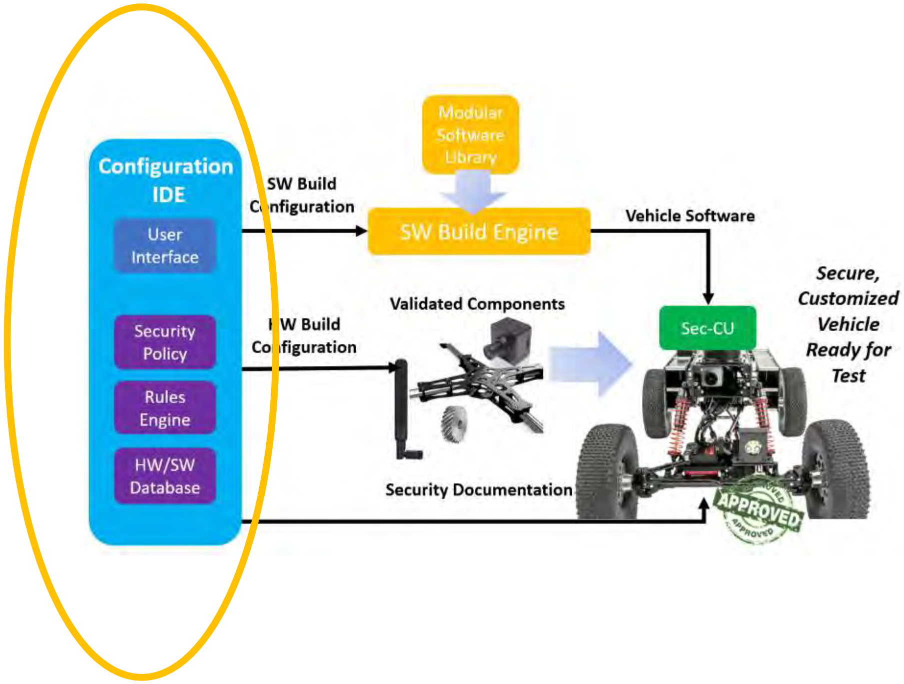
SecMUAS Overview



SecMUAS "bakes-in" security to modular unmanned systems enabling rapid transition to the warfighter

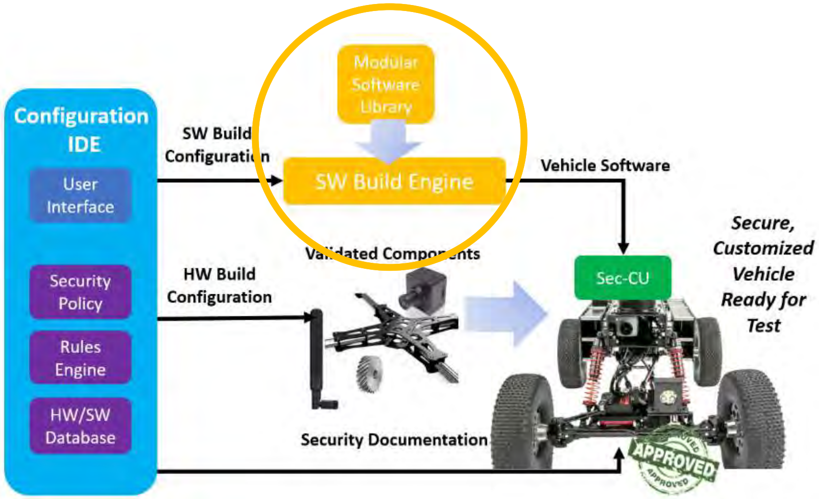
Configuration IDE

- Primary interface to designer
- Enables selection, connection, and configuration of components
- Enforces security policy in design
- NOT an engineering design tool (e.g. MATLAB/Simulink)



Software Build System

- Takes system configuration defined in Configuration IDE and automates software build
- Uses components from Modular Software Library (MSL)
- MSL can be extended through use of defined templates
- Designed to work with components from Simulink Code generation and other resources (e.g. ROS) with minimal modifications



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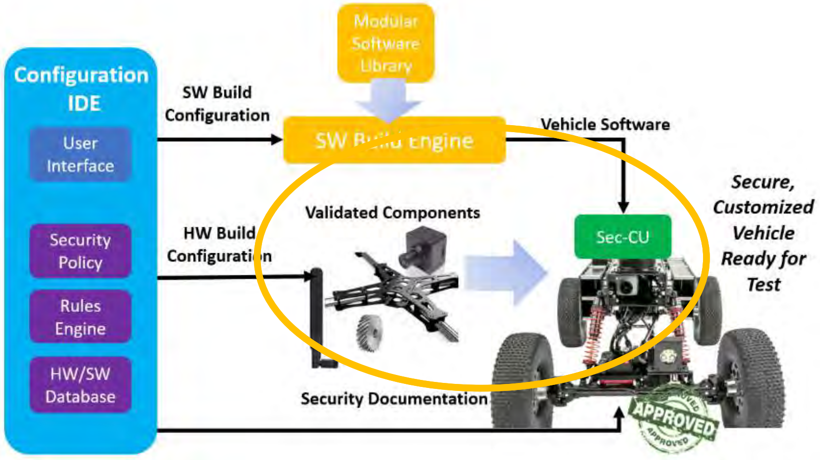
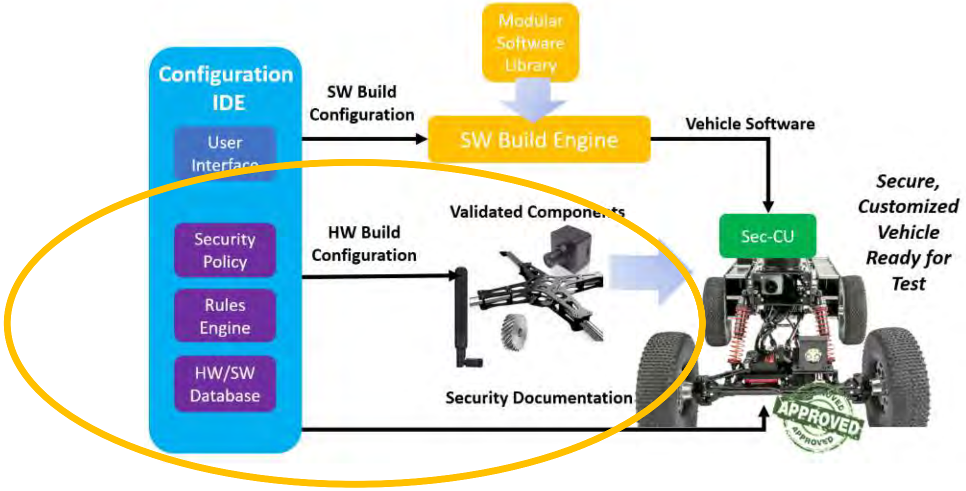
Secure Supply Chain

- Supply chain is an important cybersecurity risk for unmanned systems
- SecMUAS uses Sec-CU, a US designed controller with a secure supply chain, as a Root of Trust for SecMUAS
- Hardware component library with options from verified vendors



Document Generation/Security Approval

- Security documentation can be a “long-pole” in obtaining required certifications/approvals
- SecMUAS knows the security policy (e.g. certification requirements) and security controls selected to enforce the policy
- Security documentation is automatically generated to documents the as-built security design of the system



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Ground Systems Relevance

- SecMUAS adapts the modular component concepts from the ROS software framework. The vehicle control stack consists of a collection of nodes.
- Support for nodes allows researchers and developers, such as the ROS-M community, for fast integration into the SecMUAS ecosystem.
- The selection, arrangement, and interconnection of these nodes are responsible for unmanned system behavior. SecMUAS uses Data Distribution Service (DDS) as its middleware for components interactions.

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Way Forward/Conclusion

- Development Schedule
  - Q1FY22 – Initial SecMUAS release
    - Early feedback/evaluation
    - Simulation support only
  - Q4FY22 – Second SecMUAS release
    - Initial capability to support unmanned system development
    - Demonstration quad-copter developed using SecMUAS in flight and security testing
- Looking for “early adopters” in all application domains including ground

DevSecOps for Next-Generation Unmanned Systems