2020-04-27

Architecture-Based Security for UxVs

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Acquisition Research Program:
Creating Synergy for Informed Change

Architecture-Based Security for UxVs

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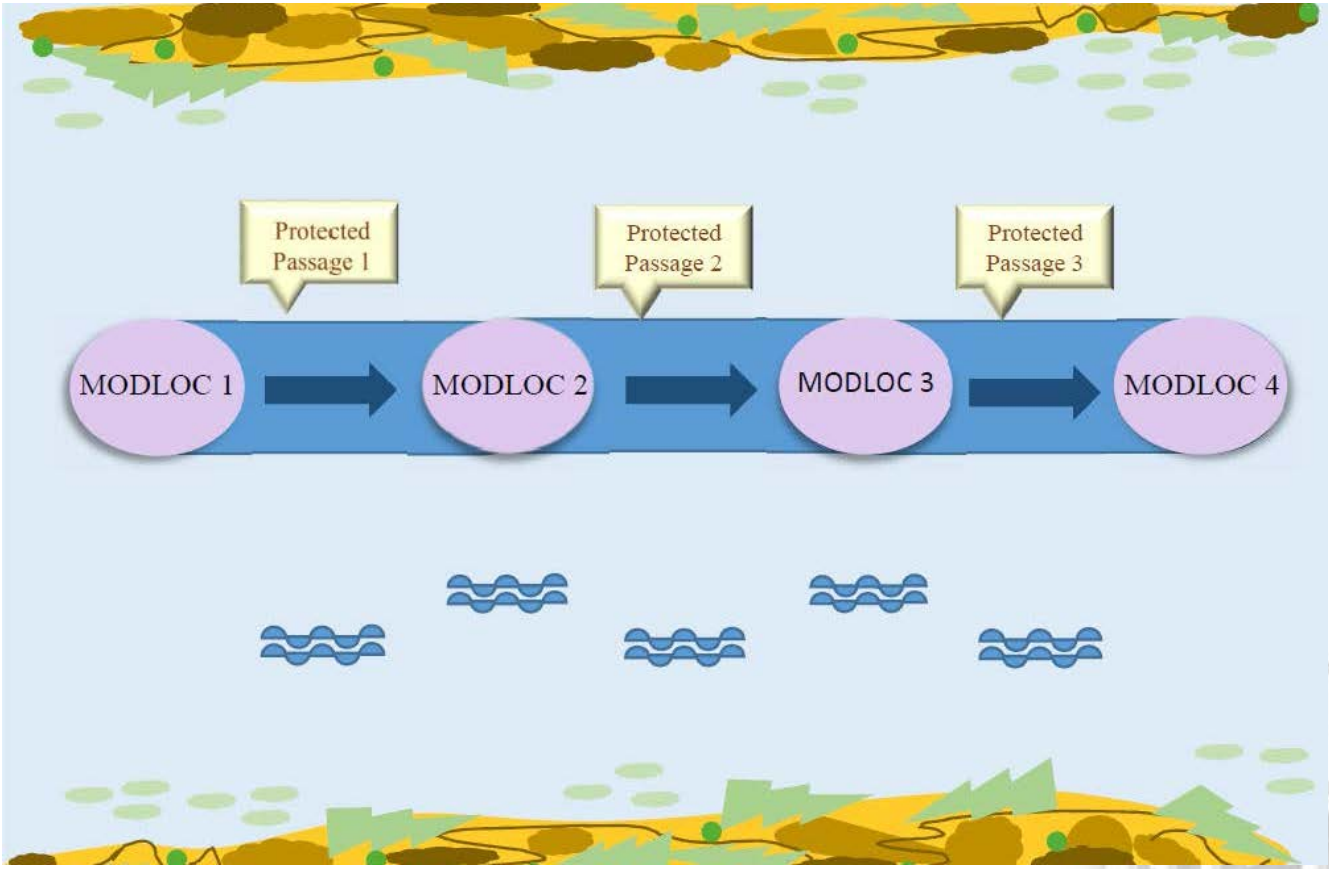
The views presented is this paper are those of the author
and do not necessarily represent the views of DoD or its Components.

UxV Security Challenges

- Security is key for Unmanned Vehicles (UxVs)
  - Worst case: adversary could take control and use them and the information they contain against us
- UxV security has unique concerns
  - Physical security cannot be guaranteed
  - Weak deterrence: retaliation for captured UxV unlikely
  - UxVs may not have defensive weapons
- UxVs are cyber-physical systems
  - Integrated software, physical parts, & communications
  - Need special certification methods
  - Claim: also need special acquisition methods

Case Study: USVs for ASW

- USVs as submarine detection pickets



Mitigations for Physical Intrusions

- Limit the sensitive information contained in UxVs to the bare minimum needed.
- Encrypt all sensitive information held in non-volatile memory.
- Protect the encryption keys with multiple redundant methods for defense in depth.
- Use multiple methods for sensing intrusions and erase sensitive data if intrusions are detected.

Acquisition Implications

- Mitigations apply to all kinds of UxVs
- Make them reusable requirements parts
  - Incorporate by reference into all contracts for unmanned military systems.
- Professional adversaries will eventually find ways to compromise barriers
  - Expect an arms race in developing counter-measures, counter-counter-measures, etc.
  - Make them replaceable parts in architecture/TRF

Conclusions

- Security of UxVs is a dynamic process strongly affected by changing circumstances

- UxV requirements and architectures should be organized around standardized, modular parts
- Each part should have multiple variants matching likely future circumstances.

- Want rapid reconfiguration by component swapping, matching capabilities to current situations using a plug-and-fight concept

Recommendations

- Develop a Technical Reference Framework (TRF) for UxVs that defines fragments of system and software architecture for mitigating security threats.
  - Needed to support interchangeable components that adapt capabilities in a plug-and-fight mode
- Establish a Navy/Joint organization for developing and managing improvements to the TRF recommended above
  - Provide it with the resources needed to support an ongoing effort to keep TRF mitigations effective.

Recommendations

- UxVs are supposed to be expendable
- Don’t put sensitive information on them

https://www.heartland.org/news-opinion/news/the-real-reasons-africa-has-another-locust-plague

Thank you