Architecture-Based Security for UxVs

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https://hdl.handle.net/10945/64794

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The views presented in 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

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Thank you