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# Study of Security Primitives for the Robot Operating System (ROS) of UAV Swarms

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(Adapted From Hartmann, Steup Figure 4 pg. 6)
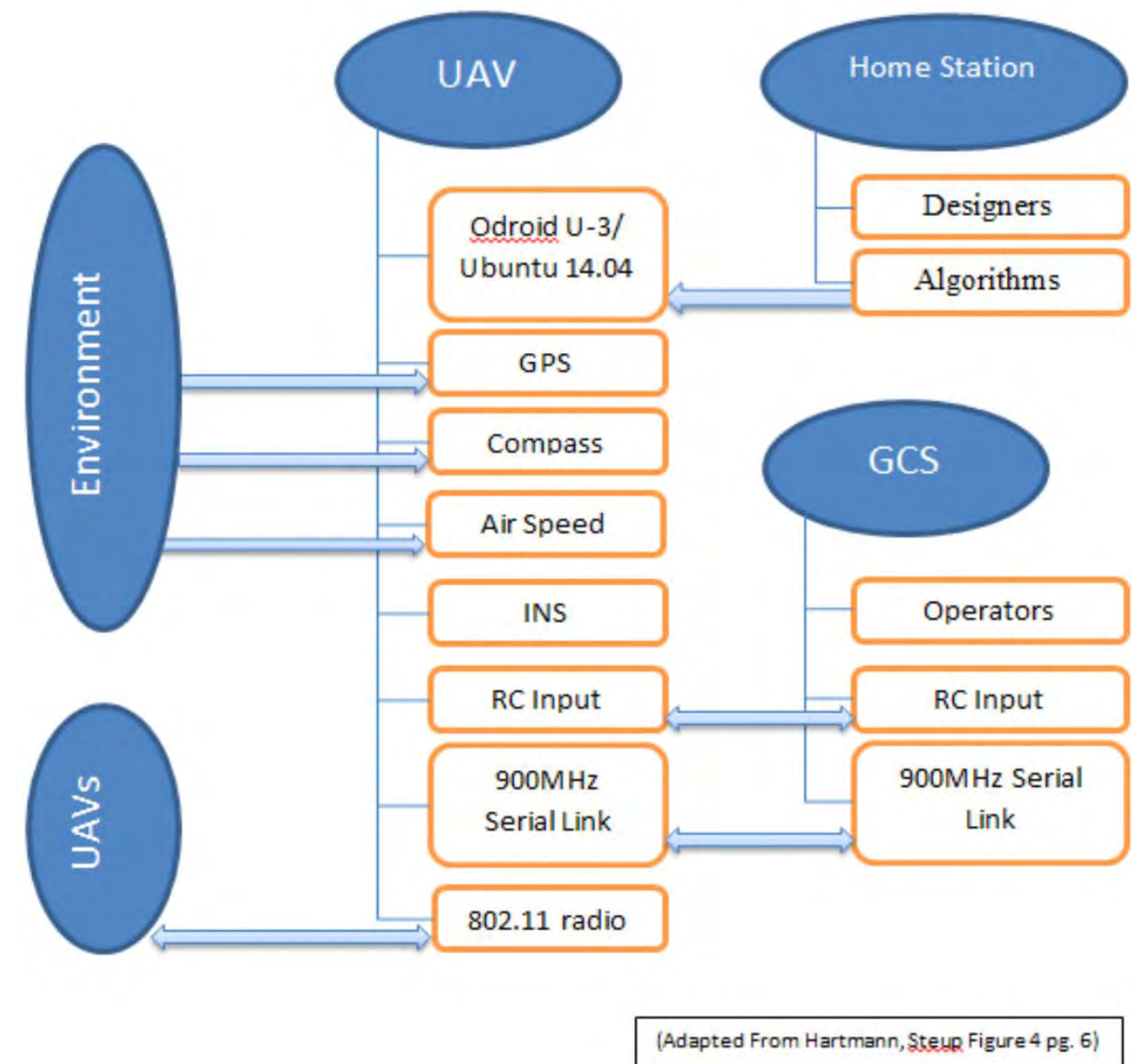
*Representation of the UAV architecture and the various vulnerable entry points into the system*

- 1) Begin with a comprehensive survey on ROS and its internal dynamics
- 2) Test and experiment with the ROS implementation and management on the Odroid of the UAV
- 3) Implement security primitives in the ROS environment
  - Study the implementation of Message Authentication Codes (MAC) for ROS message authentication
  - Study the implementation of the Advanced Encryption Standard (AES) for dealing with plain text ROS messages
  - Study the impact of security primitives on various threat models, specifically man-in-the-middle (MITM)

- Highlight ROS vulnerabilities and study its use and management in the UAV swarm, including how messages are sent, received, and processed
- Study the implementation of security primitives (authentication, authorization, and encryption) for the ROS used in UAVs
- Quantify the performance change (if any) that these security primitives incur on ROS and the UAV system as a whole
- This is a continuation of work stated in FY16 in which security for the UAV communication link was studied
- We take the baseline security algorithms studied in FY16 and apply them to the other major vulnerability of a UAV-the ROS

- To develop additional security enhancements to the UAV swarm
- To continue to develop a comprehensive security architecture for the UAV swarm
- The proposed research is operationally relevant and will contribute to relevant thesis study for NPS students
- Cybersecurity is an important research and curricular component at NPS and thus furthers the mission of the school, Navy and DoD.

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**FY17 Call for Proposals**

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