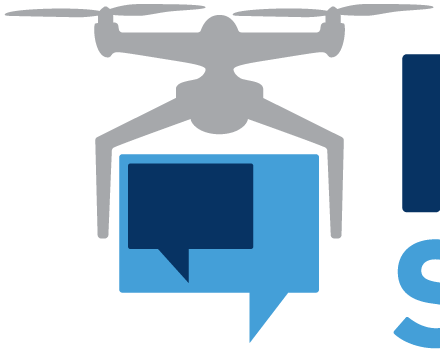


FAA UAS SYMPOSIUM

# Cybersecurity and Mitigations

**Susan J. M. Cabler**

Manager , Design, Manufacturing and Airworthiness Division, AIR-100

FAA Aircraft Certification

Federal Aviation Administration

AUVSI

#UAS2017

# Workshop 2: Cybersecurity

FAA UAS SYMPOSIUM

- **Lead: Susan Cabler,** Assistant Manager, Aircraft Certification Design, Manufacturing and Airworthiness Division, FAA Aircraft Certification Service
- **Wes Ryan,** Manager, Programs and Procedures (Advanced Technology), FAA Small Airplane Directorate
- **Richard Morgan,** Director, National Airspace Security and Enterprise Operations, FAA Technical Operations Services
- **Tim Shaver,** Manager, Aircraft Maintenance Division, FAA Flight Standards Service
- **Greg Rice**, Senior Engineering Manager for Cyber Systems, Rockwell Collins

# Goals & Expectations

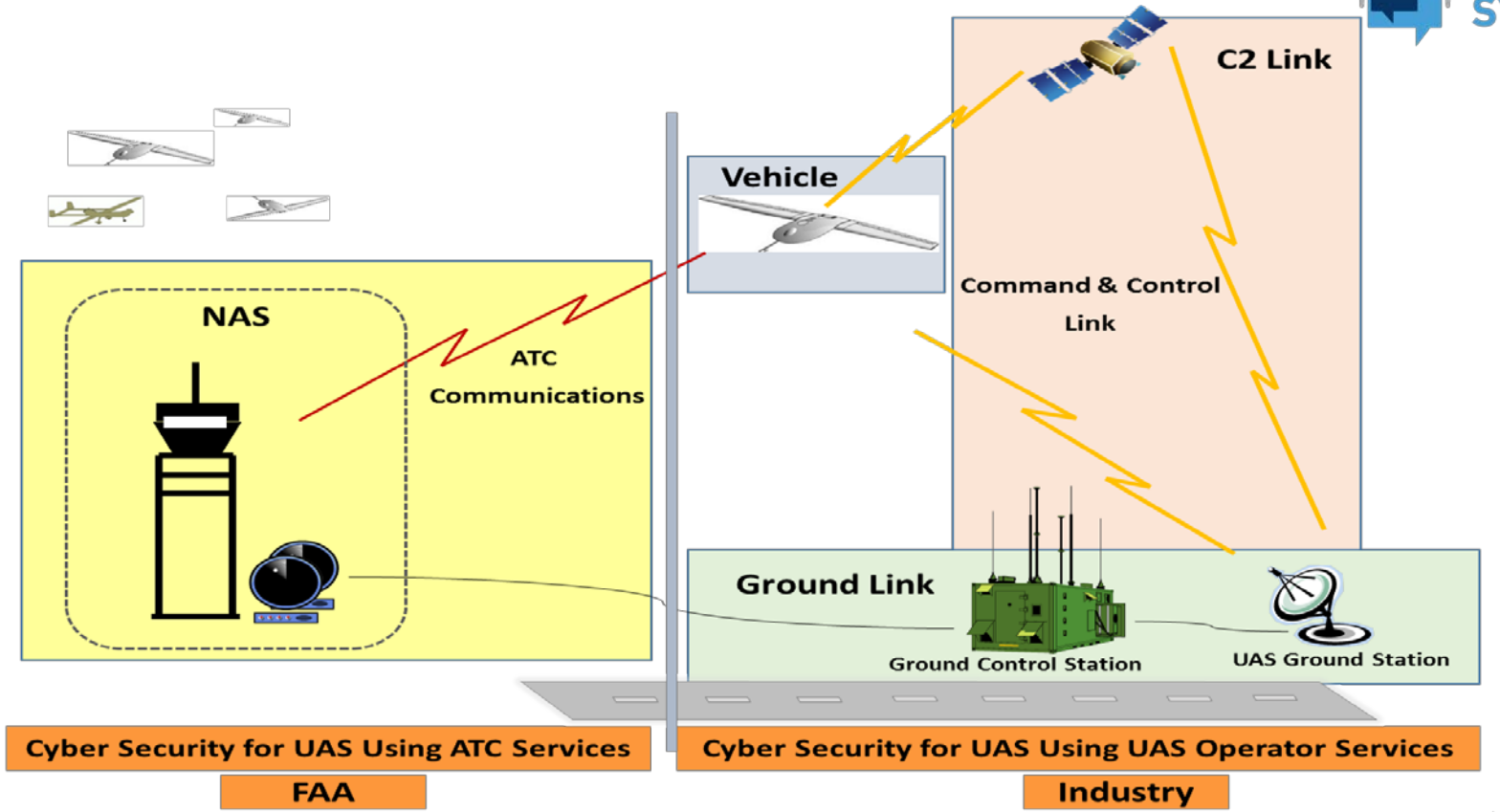
Expectations:

- An open dialogue regarding cyber threats and specific mitigations for UAS.
- Discuss scalable, risk-based Requirements, based on “exposure.”

Goal:

- Robust, fault-tolerant UAS designs that respond to cyber threats, but keep functioning.

# Components of UAS Security



# Risk-Based & Performance-Based

FAA UAS SYMPOSIUM

- Considerations for requirements: aircraft, intended use, area of operation.

- One size does not fit all -- current FAA policy is scalable for manned aircraft.
  - Special conditions driven by Policy PS-AIR-21.16-02
  - FAA's expected level of safety

- Risk exposure must drive safety expectations.

# Non-Government Services

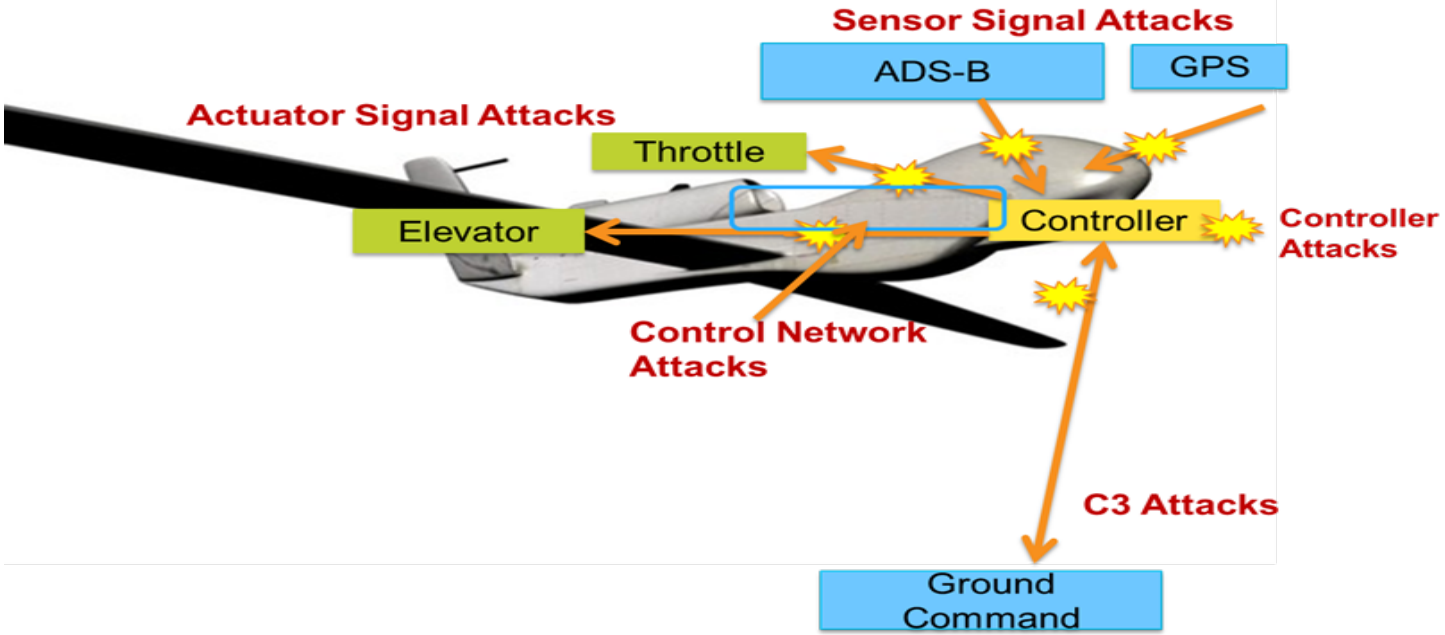
- Examples of non-government services
  - Airline Networks (Airline Operations Centers)
  - Commercial Systems (e.g. Internet, Cellular Network)
  - Data Loaders (e.g. Maps, Flight Plans and Databases)
  - Wireless Aircraft Sensors and Sensor Networks
  - Ground Support Equipment
  - Command and Control System

# Specific UAS Threat Considerations


- How can cyber vulnerabilities impact your UAS's capability to aviate, navigate, and communicate?
  - GPS vulnerability & spoofing
  - Command and Control link integrity
  - FLS during maintenance - could corrupt programming or introduce malware
  - Single and multi-aircraft considerations

- Evolving threats, aftermarket mods & COS considerations = current UAS designs will have different vulnerabilities than future designs.

# UAS Vulnerability Overview




- Diverse attack vectors – from intercepting communications to firmware exploits

# Workshop 2: Cybersecurity

FAA UAS SYMPOSIUM

- **Lead: Susan Cabler,** Assistant Manager, Aircraft Certification Design, Manufacturing and Airworthiness Division, FAA Aircraft Certification Service
- **Wes Ryan,** Manager, Programs and Procedures (Advanced Technology), FAA Small Airplane Directorate
- **Richard Morgan,** Director, National Airspace Security and Enterprise Operations, FAA Technical Operations Services
- **Tim Shaver,** Manager, Aircraft Maintenance Division, FAA Flight Standards Service
- **Greg Rice**, Senior Engineering Manager for Cyber Systems, Rockwell Collins

# **Susan J. M. Cabler,** Assistant Manager, Aircraft Certification Division, FAA Aircraft Certification Service

Susan Cabler is currently serving as the Acting Manager of the Design, Manufacturing and Airworthiness Division of the Federal Aviation Administration (FAA) Aircraft Certification Service. Ms. Cabler previously served as the Assistant Manager of the Design, Manufacturing and Airworthiness Division and has held this position since 2003.

As the national policy office governing requirements for all aircraft certification programs, the Design, Manufacturing and Airworthiness Division is responsible for: the engineering and design aspects of 14 CFR Part 21, Certification Procedures for Products and Parts; Individual and Organizational Designee and Delegation Programs; development of technical standards, policy, guidance and regulations for NextGen communication, navigation and surveillance technologies; leadership of the Aircraft Certification Safety Management System; and the introduction of risked-based decision tools for the FAA certification workforce.

Prior to joining the FAA, Ms. Cabler had a 14-year career as a pilot in the United States Air Force. The bulk of her time was as an instructor aircraft commander in the Lockheed C 141, flying strategic and tactical airlift mission to over 60 countries. In the early 90s, she flew over 600 hours in direct support of Operations Desert Shield and Desert Storm. She has a degree in aeronautical and astronautical engineering from Purdue University.

# **Wes Ryan,** Manager, Programs and Procedures (Advanced Technology), FAA Aircraft Certification Service

Wes Ryan has been with the Federal Aviation Administration (FAA) for 15 years and manages the Technology Programs & Procedures Branch in the Small Airplane Directorate in Kansas City. He has helped lead emerging technology initiatives for the FAA in avionics, light sport aircraft, electric propulsion, and unmanned aircraft, and was instrumental in bringing safety enhancing glass displays, GPS moving maps, and envelope protection autopilot technology into light GA aircraft.

Mr. Ryan is currently the certification policy lead for the Aircraft Certification service for UAS design requirements and the type certification process. His goal is to see the safe integration of UAS into the NAS, and to leverage UAS technology to improve safety of manned GA aircraft through transformational flight concepts in the next decade.

# **Richard Morgan,** Director, National Airspace Security and Enterprise Operations, FAA Technical Operations Services

Richard Morgan was named the Director for the National Enterprise Operations (NEO) Directorate within the Federal Aviation Administration (FAA) in October 2013. NEO provides collaborative operational management and coordination of NAS infrastructure events at the National level. In October 2016, all ATO cybersecurity specialists accepted the engineers into NEO. This realignment along with establishing a resiliency team and three Enterprise Control Centers in support of NEXTGEN services resulted in the retirement of NEO and the National Airspace Security and Enterprise Operations (NASEO) Directorate was established. Mr. Morgan is currently the acting Director for NASEO as of October 16, 2016. As Director of NASEO, Mr. Morgan is responsible in providing executive level direction and managerial oversight to approximately 425 employees, both federal and contractor support. He is responsible for the management, direction, planning, and operational concerns that impact NAS performance crucial to the accomplishment of the agency's goals and objectives.

Mr. Morgan joined the FAA in July 1987 as a Navigation and Communication Technician at Jacksonville, FL. In August 1991, he was selected as a Technician at the National Airspace Data Interchange Network (NADIN) in Hampton, GA., where he held multiple positions ranging from Technician, Specialist, and Unit Supervisor during his 15 years in the facility.

# **Tim Shaver,** Manager, Aircraft Maintenance Division, FAA Flight Standards Service

Tim Shaver serves as the Manager of the Federal Aviation Administration's (FAA) Aircraft Maintenance Division, AFS-300, in Aviation Safety's Flight Standards Service (AFS). AFS-300 consists of six branches staffed by 65 aviation safety professionals, including aviation safety inspectors, aviation safety engineers, program managers, technical writers, analysts and other support staff. Under Mr. Shaver's leadership, the division's work activities directly affect certificate oversight, surveillance, and technical support of our stakeholders by developing and implementing policy, guidance and regulations for aviation safety inspectors and industry operations.

Additionally, the division ensures the airworthiness of civil aircraft through a proactive approach and keen awareness to innovative changes affecting regulations, performance standards and maintenance practices, as well as national policy governing the certification, inspection, and surveillance of the various maintenance entities and practices.  His areas of responsibility include general aviation, air carrier, and commercial operators, airmen (mechanics, repairmen, designees, and parachute riggers), avionics, and air agencies (aviation maintenance technician schools and repair stations).

# **Greg Rice**, Senior Engineering Manager for Cyber Systems, Rockwell Collins

Greg Rice is Engineering Manager for the Cyber Systems research team in the Advanced Technology Center at Rockwell Collins. In 2006, Mr. Rice co-founded True Security, where he led design work on secure, ad-hoc sensor networks for embedded systems and new penetration testing services. Today his primary research interests include intrusion detection, application security, attack methodologies, and building fundamentally secure embedded systems.

Mr. Rice's holds multiple patents in network security mechanisms and intrusion detection and has led the DIACAP accreditation of embedded systems. His work on the security of embedded avionics systems has been well recognized; he has served as a subject matter expert on avionics security for the Government Accountability Office. Mr. Rice has previously served as PI for the DARPA RAPID and Longbow programs and now leads a team of research engineers focused on the development of new embedded security technologies applied to airborne systems.

# THANK YOU TO
# AUVSI'S SPONSORSHIP PARTNERS


AIRMAP

QUALCOMM


#UAS2017