High-skilled Aviation and Aerospace Cybersecurity Workforce Development

CAE in Cybersecurity Symposium
Seattle, WA, June 8-9, 2023

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Embry-Riddle Highlights

- World's largest, oldest, and most comprehensive institution specializing in aviation, aerospace, engineering, and related degree programs.
- Major research center, seeking solutions to real-world problems in partnership with the aerospace industry, other universities, and government agencies.
- Institution draws on cybersecurity principles, safety, certification and assurance experience to educate aviation professionals.

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Embry-Riddle Large Facilities and Resources

- John Mica Engineering and Aerospace Innovation Complex (MicaPlex) – the cornerstone building of the Embry-Riddle Research Park – serves as a unique, 50,000-square-foot, cutting-edge innovation hub.
- Center for Aerospace Resilience (CAR) coordinates research on cybersecurity engineering across the university, contributing to product development in collaboration with industry and federal agencies.
- The Florida NextGen Test Bed (FTB) is an FAA initiative to develop NextGen research and capability demonstrations at ERAU adjacent to the Daytona Beach International Airport (DAB).

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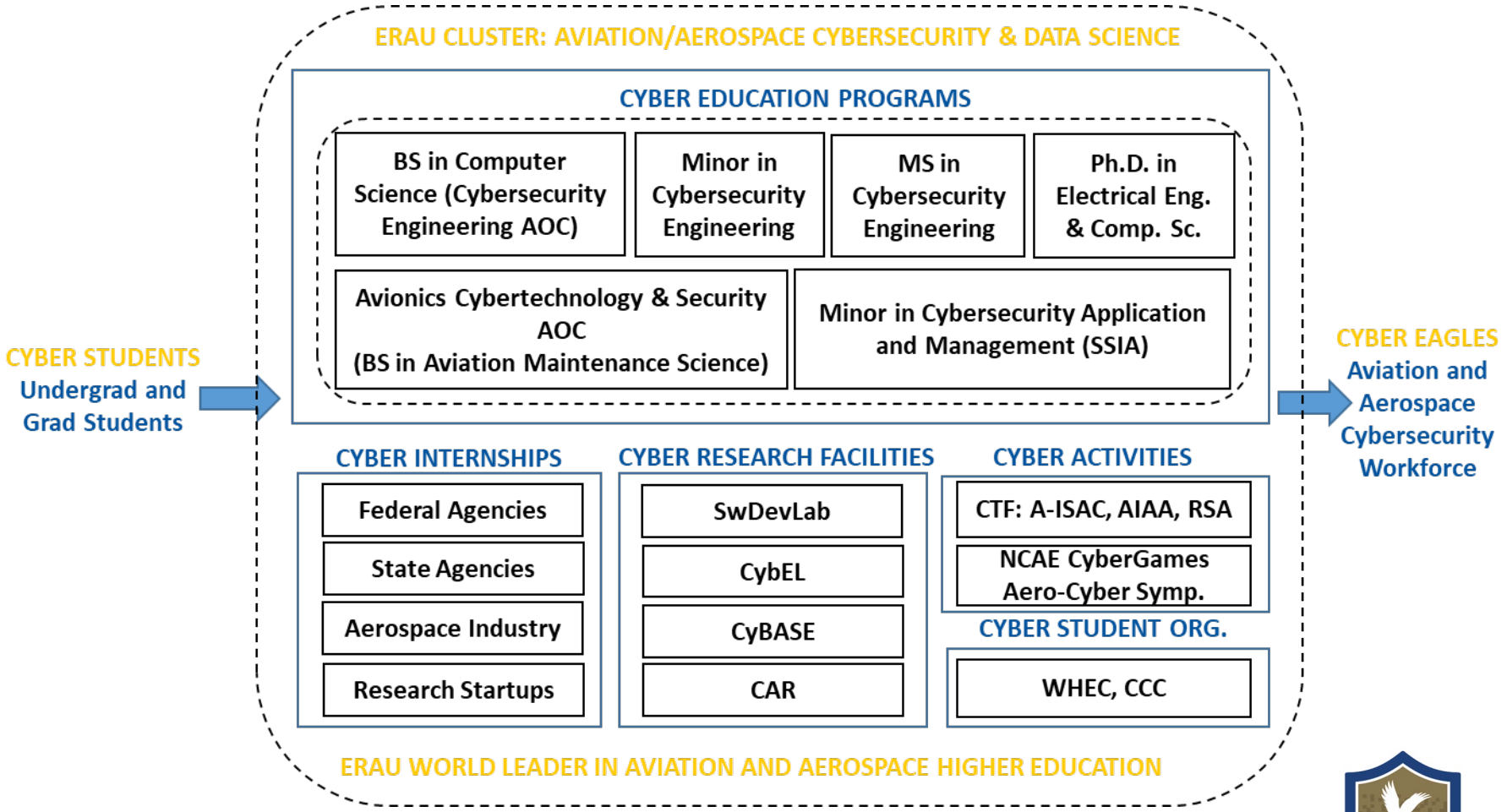
Cybersecurity Education and Extracurricular Activities



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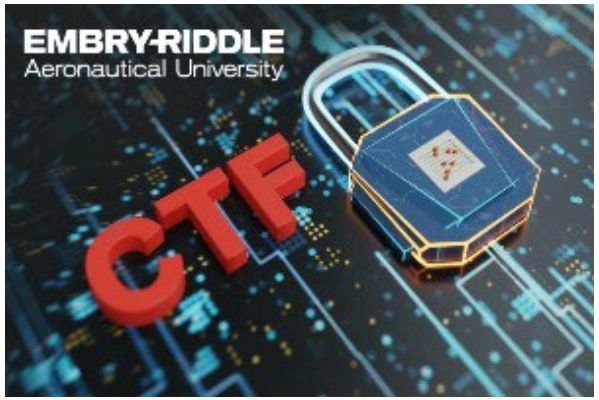
Cybersecurity Outreach

- Summer Camps
  - Basic
  - Advanced
- Capture the Flag (CTF)
  - A-ISAC
  - AIAA SCITECH Forum
  - RSA Conference
- NSF REU
  - UAV Cyber Research
- Sponsored Projects
  - Federal agencies and industry



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CyBASE Cybersecurity Center

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- Coordinates research activities in the field of cybersecurity and assured systems engineering across the university academic departments.
- Contributes to the research and product development while collaborating with industry as well as the scientific community.

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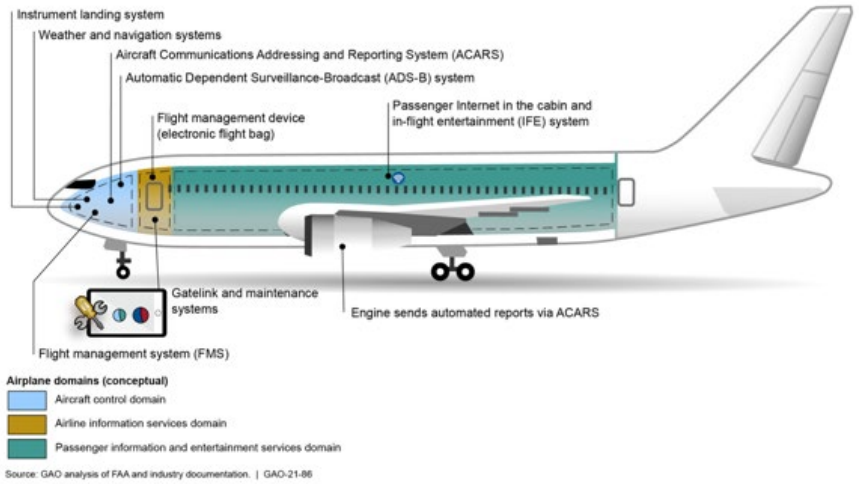
Aviation and Aerospace Cybersecurity Research



Aviation / Aerospace Cybersecurity Research

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GENERAL SECURITY	GROUND STATION	AVIATION	SPACE	ENGINEERING
Cybersecurity and Social Engineering	Ground Station Environment	Aviation Environment	Space Environment	Reverse Engineering
Cybersecurity Principles General Security for Aviation General Security for Space	Ground Station Security Network Security	Avionics Security Data-Link Communications Security	CubeSat Security Communications Security	Reverse Engineering Security

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Aviation and Aerospace Cybersecurity Research

- Aircraft-based detection of GPS spoofing.
- Trustworthiness models for aviation systems.
- Risk management for positioning, navigation, and timing services.
- Threat modeling and mitigation for avionics.
- Cyber resilience analysis of components and interdependencies.
- Rapid certification of software updates and aircraft certification support.
- Onboard expert systems to aid pilots in emergency decision-making.
- Cybersecurity risk management for trajectory-based operations.
- Counter-drone technology to bring down rogue drones safely.

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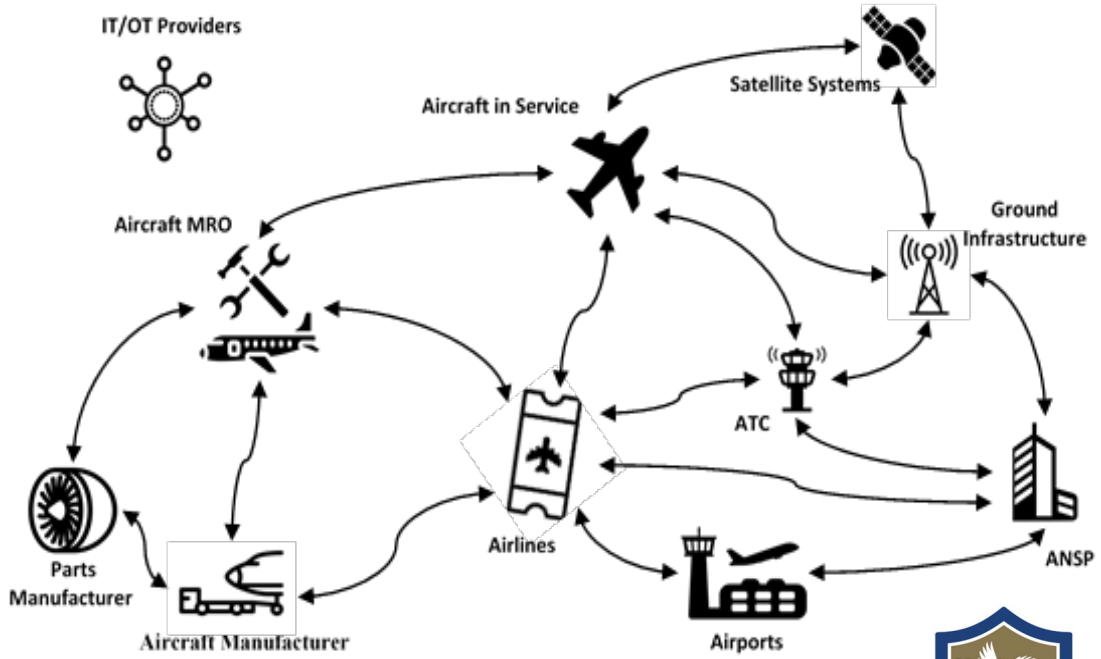
Aviation Ecosystem Highly Connected SoS

- Aircraft and component manufacturers
  - Design, development, testing
- Aircraft customization
  - Run additional software
- Airline services
  - Frequent flyer, etc.
- Airport exposure
  - Aircraft and services



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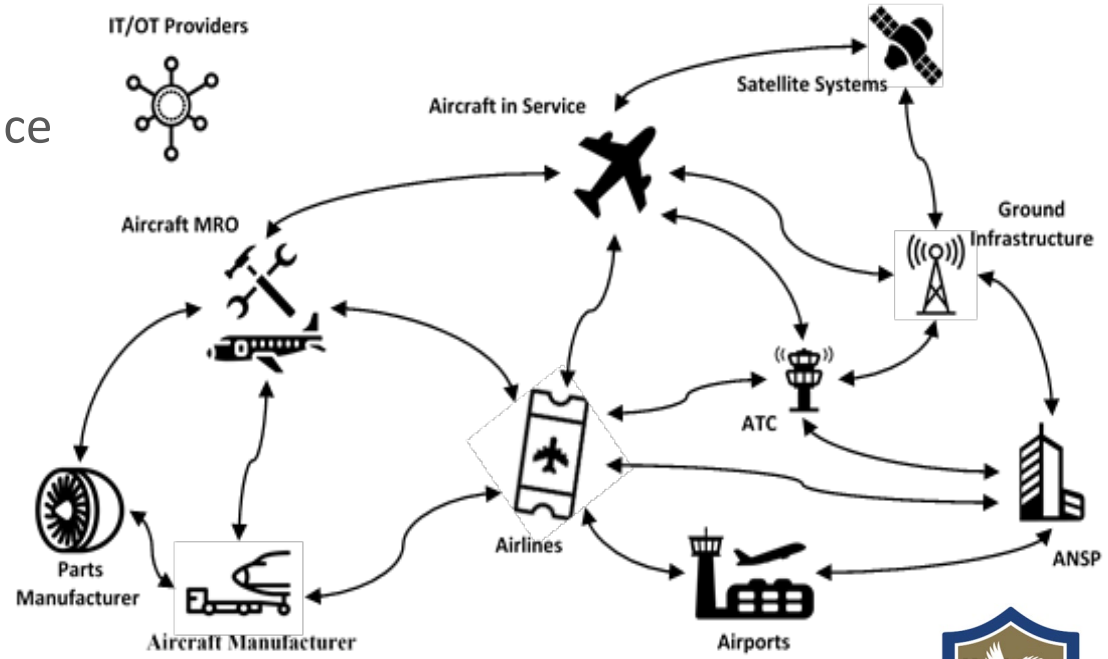
Aviation Ecosystem Highly Connected SoS

- On-board systems
  - EFB, FMS, avionics
- Datalink communications
  - Jamming, spoofing, interference, DOS
- Satellite communications
  - PNT services
- Aircraft airport maintenance and MRO
  - FLS, software updates
- Aircraft retirement



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Aviation Ecosystem Highly Connected SoS

- Aviation systems: are they protected because not too many access them?
  - Niche domain, proprietary systems, large cost.
  - Practice of safety/security first when building them.
- Moves slower than other domains because it is a very large system
  - Every airplane (including ones built 15-20 years ago) is an extension of a on-ground system.
- How do you engineer cybersecurity into aviation systems?
  - The lifetime for an airplane is around 25 years.
  - Would you, today, use a computer that is 25 years old?
  - How do you take a legacy system and assess its security?
  - How do you assure new software is not vulnerable?

Aviation Cybersecurity Environment

- Historically, security-by-obscurity…
- However, times changed…
  - Wide availability of cyberattack tools.
  - Access to industry-specific knowledge.
  - Connectivity growth and software-driven functionality.
  - Computing services across all aviation ecosystem.
- Emphasize cyber-safety and continuity of systems' operation.
  - Assess cyber threats according to their impact.
  - Pose system/component certification challenges.

Aviation Cybersecurity Environment

- Control Display Unit (CDU) or Multi-function CDU (MCDU)
  - Provides primary human-machine interface for data entry and information display.
  - Primary interface between pilot and Flight Management Computer (FMC).
  - LCD display, alphanumeric characters keyboard, other function-specific keys.

Aviation Cybersecurity Environment

- Aviation Enthusiasts
  - Availability of passive data collection (aircraft position, ADS-B messages) through flight trackers.
  - FlightRadar24
  - OpenSky Network
  - FlightAware
  - PlaneFinder
  - ADS-B Exchange
  - PlaneFlightTracker

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Ahead… Research and Education

- Current Environment and Issues
  - Cybersecurity as a discipline grows faster and more complex every day.
  - Availability of SDR, open-source software for radio tech, COTS components.
  - Availability of live traffic data and large datasets.
  - Communication attacks such as jamming, spoofing, and message injection may become common once they start to be profitable from an economic perspective.
  - Some cases of jamming (GPS) have closed-down airports for several minutes.
- Way Forward
  - Bring awareness of aviation cybersecurity.
  - Invest/increase aviation cybersecurity educational programs.
  - Update course offerings with latest state-of-the-art knowledge.