



Merlin Labs Civil & Military Certification Programs

Agenda

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Introduction

Who is this guy talking at the end of the day and will he hurry up...?

- Tim Trank
- Merlin Sr. Certification Manager
- FAA Certification Engineer/Manager for last 22 years
- FAA S&E DER, STC ODA Administrator for L3Harris/Thales JV & Honeywell
- Managed avionics upgrades/retrofits with most major OEMs and Airlines (1000's of STCs and TSOs)

New Zealand just seems more relaxed than the USA



Merlin Labs

Merlin is developing the world's
most capable Pilot;
enabling current and future aircraft to fly with
reduced crew, and eventually autonomously.

Merlin Locations



Boston

HQ

Civil and Military: System Integration and Test Labs, Certified System Development, Advanced Capability Development



Denver

Civil: Certified System Development, Advanced Capability Development



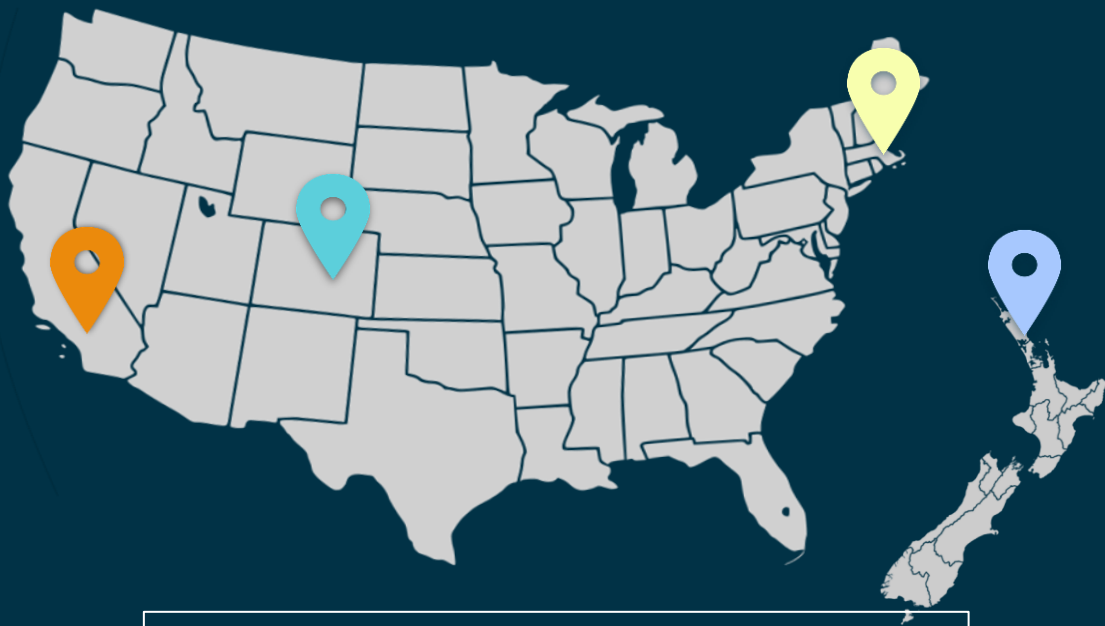
Mojave

Civil: Hangar Facility, Flight Test, Aircraft Integration



Kerikeri, NZ

Civil: Hangar Facility, Flight Test, Aircraft Integration, Certified System Development



150+ Employees and growing



Part 23 Murray STC Program

- Textron 208B - Caravan
- New Zealand STC - CB is Part 23 Amdt 23-64
- Concurrent FAA STC Validation
- Merlin Advanced Autopilot and Communication System
 - Conventional flight controls and surfaces are maintained
 - Automated Pitch, Roll, Yaw and Pitch Trim
 - Automated Takeoff to Touchdown
 - Automated Throttles
 - Automated Navigation
 - Automated Communication System
- SOI Process underway
- STC Issuance Planned for Q4 2025

Murray STC: Aircraft Automation

Automatic Pitch
Trim Control

Takeoff Config
Check - Flaps

Autopilot Gain
Scheduling

Flap Position
Sensors

Elevator Trim
Servo Installation

Automatic Yaw
Axis Control

Automatic Pitch
Axis Control

Elevator and Rudder
Servo Installation

Aileron Trim
Position Sensor

Takeoff Config Check
Aileron Trim

Power Lever
Servo Installation

Automatic Power
Control

Rudder Trim
Position Sensor

Takeoff Config Check
Rudder Trim

Aileron Servo
Installation

Automatic Roll
Axis Control

Automation
Configuration
Monitor





KC-135 Tanker Airworthiness Program

The United States Air Force has entered a Cooperative Research and Development Agreement (CRADA) with Merlin to demonstrate reduced crew automation on Air Mobility Command's KC-135 military aircraft.

Program includes Merlin's
Advanced Autopilot and
Automated Communication
System



IN THE AIR FORCE



GAS STATIONS COME TO YOU

KC-135 Tanker Airworthiness Program

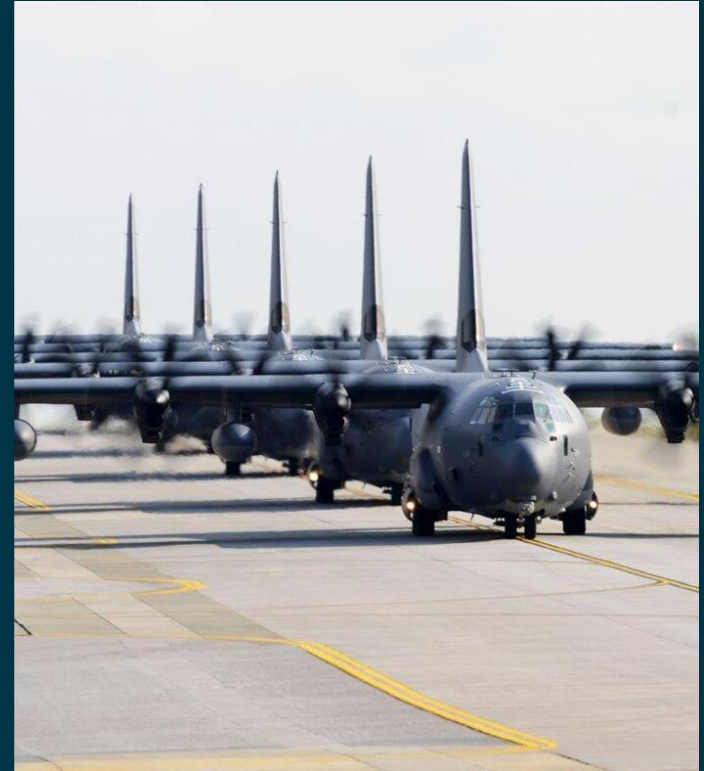
In 2023 Merlin signed on to demonstrate our reduced crew autonomous flight system on the Air Mobility Command KC-135.

- The system will utilize the **Core Merlin Pilot system developed for Civil and Military applications**
- Custom tailored to the KC-135 platform and USAF Mission Requirements
- Airworthiness Plan and Compliance Package for survey flights approved Q2 2024
- Aircraft survey flights were completed in Q2 2024
- Demonstration **Airworthiness Plan Approved** by TAA October 2024
- *“Non-Standard Airworthiness Assessment”* (NSAA) - more on this later
- Currently in the Design phase
- Demonstration flights scheduled **Q4 2025**

C-130J Airworthiness Program

The United States Air Force has signed a \$100+ million USD contract with Merlin to evolve piloting the next generation of Special Operations Command's C-130J aircraft.

Program includes Merlin's Takeoff to Touchdown Advanced Autopilot and Automated Communication System





C-130J Airworthiness Program

Merlin is in the early phases of a contract to deliver a reduced crew autonomous flight operations system on the C-130J.

- Program phases:
 - Design Up To CDR
 - Demonstration
 - Full Production System
- The system will utilize the **Core Merlin Pilot system developed for Civil and Military applications**
- Custom tailored to the C-130J platform and USAF Mission Requirements
- Currently in the Design phase
- Airworthiness Plan (AWP) for Survey Flights submitted and in TAA review
- Demonstration flights scheduled **Q3 2025**

Civil Certification vs Military Airworthiness

- FAA “*Certification*” Definition
 - Certification is how the FAA manages risk through safety assurance. It provides the FAA confidence that a proposed product or operation will **meet FAA safety expectations to protect the public**. Certification affirms that FAA requirements have been met.
 - Certification is broken into three types: Type Certification, Production Certification and Airworthiness Certification.
- USAF “*Airworthiness*” Definition:
 - The property of an air system configuration to **safely attain, sustain, and complete flight** in accordance with approved usage limits
 - Airworthiness is a system characteristic relating to its safety in operation
 - Reflects our best engineering efforts and knowledge of the selected technologies
 - Recognizes mission and cost constraints that must be balanced with safety



“PSCP” - “AWP”... What’s the difference??

PSCP - Project Specific Certification Plan (*civil*)

AWP - Airworthiness Plan (*military*)

CM - Compliance Matrix (*both*)

Why different names? Isn’t aircraft certification just aircraft certification?

- Looking down from FL300... Yes, pretty much
- As you dig down... No, not at all!
- Rules / Regulations are different (CFR vs MIL-HDBK-516)
- Operations are different (Part 91/121/135 vs Military Flight Release)
- So much more

Why?

Military vs Civil Certification Approaches (cont.)

- Vested into two organizations:
 - US Department of Defense (DoD)
 - US Department of Transportation (DoT)
 - Similar functions and both operate under legal authority
- Why are they separate?
 - FAA's responsibility is to promote aviation and oversee industry as an independent authority to keep the public safe
 - US Armed Services' responsibility is to approve flight operation of air system configuration and conditions of that operation to perform military missions
- Both systems ensure safety utilizing differing processes & procedures tailored to the needs of those they support:
 - FAA is for the general public and covers a much wider spectrum of operations
 - Military is mission specific, tailorable and must support unique situations quickly
 - Military uses SMEs and Civil often relies on external designees for expertise



Baseline Policy

Civil

Everything is rule based (Federal law)

- Part 21
 - Procedures regulations
 - Manufacturing regulations
- Parts 23, 25, 27, 29, 33, etc.
 - Design regulations
- Part 43
 - Maintenance regulations
- Parts 91, 121, 125, 135, etc.
 - Operating regulations
- Certification flexibility is limited by rules and requires limitations



FAA CERTIFIED

Military

- Design regulations
 - MIL-HDBK-516C
 - Airworthiness Cert Criteria, Standards and MOC for ALL Air Systems
- Airworthiness approval is mission operation specific and can be tailored thus reducing the level of certification
- Military TC or Flight Release issued



Non-Standard Airworthiness Assessment (NSAA)

Risk based approach to Airworthiness

- Planning
 - AWP based on AWB-110 and 245
 - Hazard Assessment based on AWB-150 and MIL-STD-882
 - *Applicable 516C sections and Hazards/Risks identified (no Certification Basis required)*
 - NSAA review (determine if non-standard is acceptable)
- Review of Approach
 - Rationale for use of NSAA
 - Review of Hazard/Risk Classification
 - *Evaluation of risk in lieu of CB*
 - Often used for Science/Technology programs
- PDR Held with sponsoring branch

Non-Standard Airworthiness Assessment (NSAA) *cont*

- Assessment (Approval Cycle)
 - Review of:
 - System design
 - Hazard/Risk identification, rationale, mitigation, restrictions, etc.
 - All required Substantiation data (516C) IAW AWP
- TAA issues AW Approval (Special Military Flight Release)
 - Aircraft modification is completed by the military
 - Conformity is managed by installing base personnel
 - Vendor supports modification, testing and operation as applicable
- Other Notes
 - Hazard/Risk/Safety References
 - MIL-STD-882E, Department of Defense Standard Practice - System Safety
 - AWB 150, USAF AW Risk Assessment and Acceptance
 - Software References
 - MIL-STD-882

Takeaway - Key Differences

- **Civil Certification strictly follows federal rules** and requirements
 - Operations are well established in the public airspace
 - Focus is on safety of people on the ground and in the air
- **Mil Airworthiness has flexibility to accept non-compliance based on risk** acceptance
 - Missions differ and change quickly so the system allows adaptation for specific needs
 - Focus is safety within a narrow use
- FAA delegates a majority of compliance finding to non-government, industry expert designees. Military do not go outside their ranks.
- Requirements and guidance material differ based on the end goal Cert/AW
- Program logistics follow similar approaches but approvals differ greatly
- **Devil is in the details.** Cert is Airworthiness, Airworthiness is Cert but the processes, requirements and personnel are different.

Thank you for welcoming me to your beautiful country!



Questions?



Let's ascend
to new heights.