FLY UTAH

UTAH AERONAUTICS CONFERENCE
2023

Preparing for Tomorrow's Technician Workforce

Stephen Ley, Josh Nattress, Jaime Horning, Randy Chesley, and Shaun Anderson

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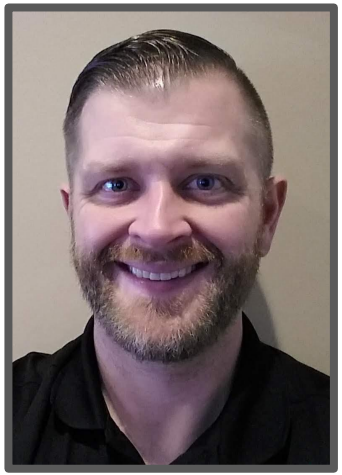
AXIOM AVIATION

Speakers

Stephen Ley



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PREPARING FOR TOMORROW'S TECHNICIAN WORKFORCE –

ADVANCED AIR MOBILITY & E-AIRCRAFT INTEGRATION IN UTAH

UTAH ADVANCED AVIATION MAINTENANCE PLANNING(UAAMP)

WORKING GROUP

FLY UTAH

UTAH AERONAUTICS CONFERENCE

2023

ADVANCED AIR MOBILITY – A VIEW OF EMERGING AVIATION TECHNOLOGIES

Advance Air mobility (FAA)

- Advanced Air Mobility (AAM) is an umbrella term for aircraft that are likely **highly automated and electric**. These aircraft are often referred to as air taxis or electric Vertical Takeoff and Landing (eVTOL) aircraft.

- AAM aircraft could also be used to transport cargo and passengers, help with firefighting, and provide search and rescue operations. It also has the potential to connect underserved and rural communities.

ICE vehicle evolution

Ford Model T – (1908 – 1927) 15 million built

1958 Firebird -

Turbine powered
Joystick control

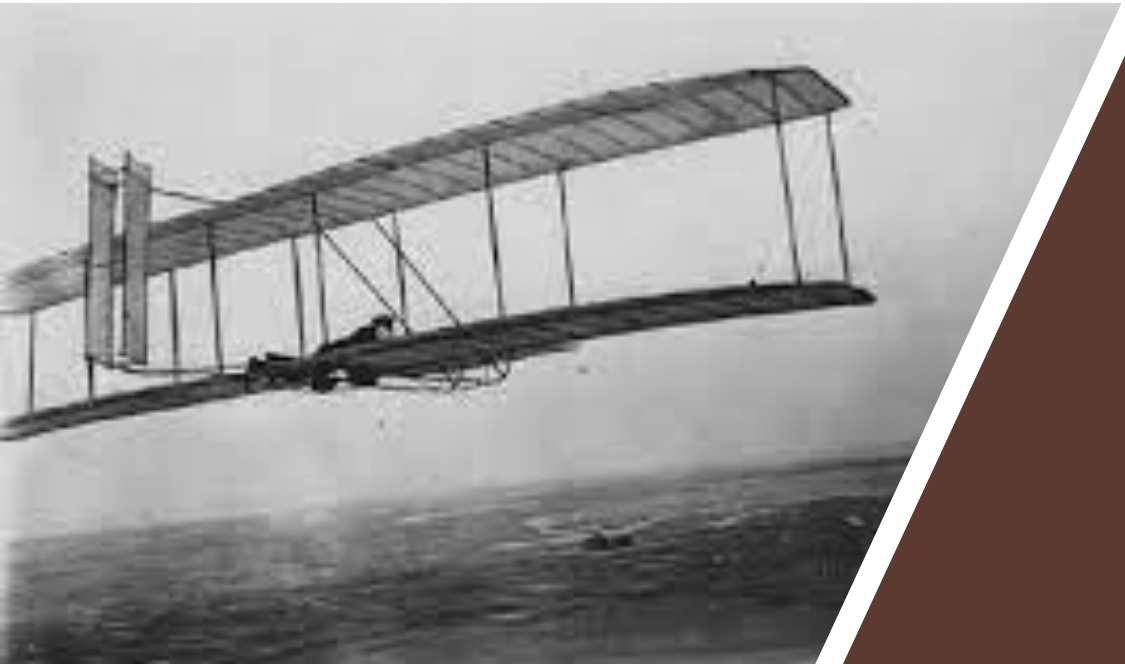
Bugatti Veyron – 2005

Ford Model T

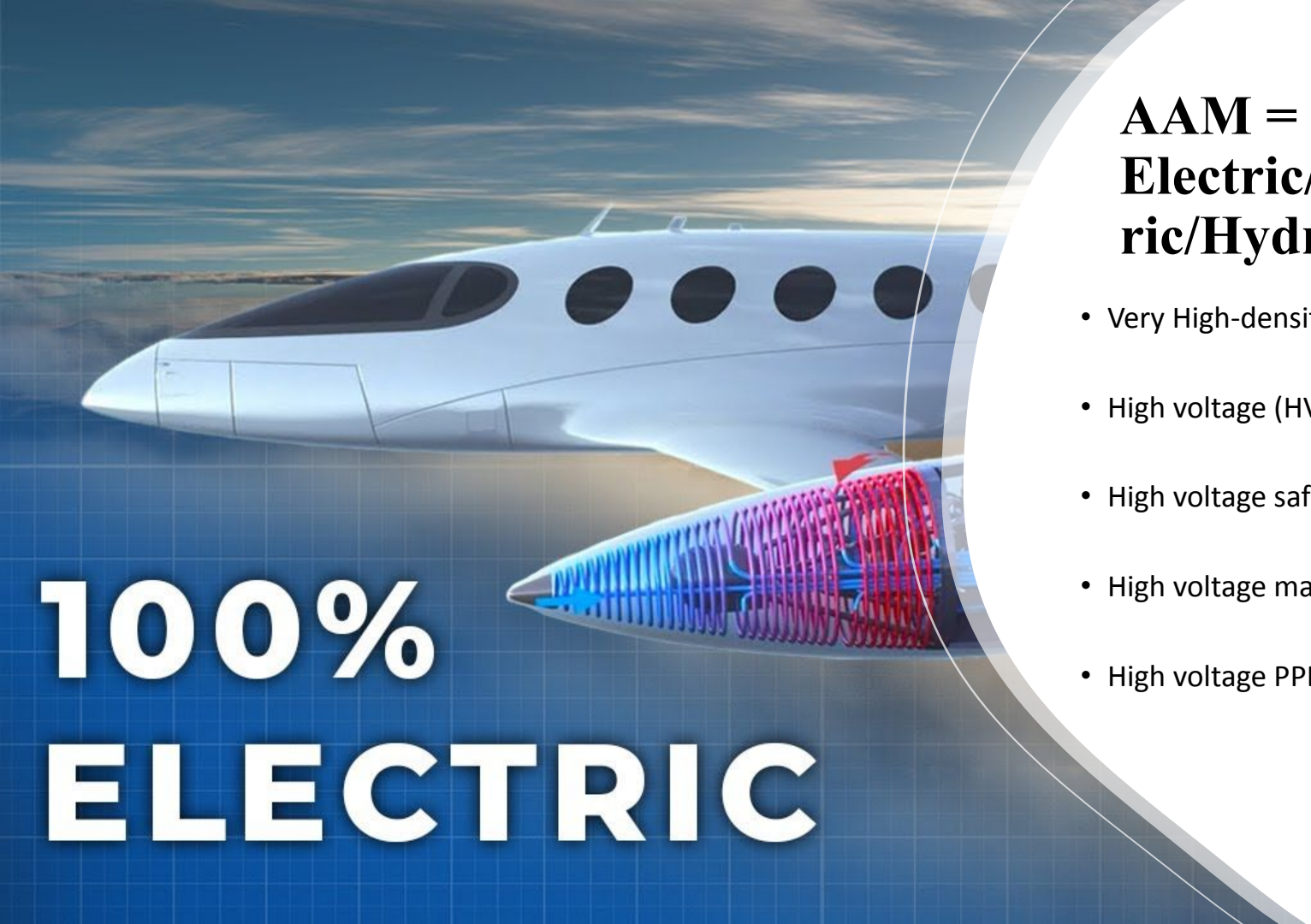
Duesenberg

Tesla Model S

Electric Vehicle e-volution



Electric Aircraft Evolution



AAM = Electric/Hybrid-electric/Hydro-electric

- Very High-density power battery banks
- High voltage (HV) systems (400 – 800v)
- High voltage safety systems
- High voltage maintenance procedures
- High voltage PPE

eVTOL vs eCTOL

- electric Vertical TakeOff Landing
- electric Conventional TakeOff Landing

Electric Vehicle Maintenance

- Proven technician standards and maintenance procedures exist for ground vehicles

National Institute for AUTOMOTIVE SERVICE EXCELLENCE

Electrified Transportation Pro+
Training & Certification Program
EV Transportation Technologies Service Professionals

- No current technician standards for electric aircraft

Utah **A**dvanced **A**viation **M**aintenance **T**raining (UAAMP)

Collaboratively working to draw from current ground EV standards and develop standards-based maintenance training curriculum for anticipated electric aircraft

Partners

- EP Systems
- Utah State University
- Weber State University
- Salt Lake Community College
- Utah Valley University
- Southern Utah University
- Utah Division of Aeronautics
- Industry
- NCAT
- Aspire

OPPORTUNITIES & CHALLENGES – AAM INTEGRATION & DEPLOYMENT

Workforce Requirements for Emerging Technologies

Outlook:

- Market for Advanced Air Mobility
  - 110 billion dollars by 2035 (Allied Market Research)
  - Projected $1.0 tn market by 2040; $9.0 tn by 2050 (Morgan Stanley)
- Expanding technologies in aerospace already outpace existing technician standards
- Current CFR Part 147 technician standards are insufficient to sustain these new technologies in the field.
- New standards must be developed and integrated into training curricula to ensure a highly qualified technician workforce is ready for the challenge.

MARCH 23, 2023 | UNITED AIRLINES AND ARCHER ANNOUNCE FIRST COMMERCIAL ELECTRIC AIR TAXI ROUTE IN CHICAGO

Details

- 100 acft order
- 2025 EIS
- ORD to Vertiport Chicago
- 10 minute flight, Cost of an Uber (National)

Source:
https://www.archer.com/news/united-airlines-and-archer-announce-first-commercial-electric-air-taxi-route-in-chicago
https://www.abc4.com/news/national/chicago-to-debut-first-commercial-electric-air-taxi-route/

NASA & FAA WORKING TOGETHER ON AAM/UAM

NASA RESEARCH FINDINGS

- Near-market segments – "commercially viable market for last-mile parcel delivery and air metro could be in place by 2030" (NASA, 2018)
- Likely market constraints – "limited potential market for air taxis in concentrated areas of high net worth individuals and businesses in 2030" (NASA)
- Key challenges – "For UAM to be viable, it is necessary to address the technical, physical, operational, and integration challenges of a highly interdependent system-of-systems" (NASA)
- Market viability depends on the following:
  - Safety & security
  - Economics
  - Transportation demand
  - Regulation
  - Market substitutes (ex. Autonomous delivery and transportation)
  - Public acceptance (NASA)

Joby Aviation S4 – Autonomous Flight Test

Source: https://www.aopa.org/news-and-media/all-news/2023/april/pilot/joby-s4-coming-to-you-in-2025

ADDITIONAL CHALLENGES RELATED TO SUPPORT OF UAM EQUIPMENT IN THE FIELD

- Current Federal Aviation Regulations (FARs) not ready for emerging technologies
  - Certification criteria for hybrid propulsion and transitional lift systems
    - FAA proposes SFAR to incorporate 'Powered-Lift' aircraft category for eVTOL Ops (NPRM); impacts aircraft certification 14 CFR Part 21.17(b) (Trock, 2022)
    - Impacts maintenance and inspection criteria – Technician standards, TBD
  - Advanced integrated technologies and systems within air vehicles is beyond the scope of current FAR Part 147 Aircraft Maintenance Technician standards
    - Industry, education & training and FAA collaboration essential
    - Need new standards and industry to provide information & training aids

ADDITIONAL CHALLENGES RELATED TO SUPPORT OF UAM EQUIPMENT IN THE FIELD, CONT.

- **Current aftermarket support services, and MRO facilities are strategically centralized within regional boundaries**
  - customers fly aircraft to service centers
  - Demographics of operations dramatically changes the type and location of in-service support footprint.
    - Limited ranges of eVTOL will require <u>decentralization</u> of support placed close to the area of operations
    - Increased demand for technicians, logistics & supply chain, facilities, & zoning for air operations close metropolitan areas
- **Current aircraft OEMs, operators, and 3rd party service providers are knowledgeable and experienced**
- **Most of the UAM designs under development are from start up companies that are <u>NOT traditional OEMs</u>**
  - Best solution is for new start-ups to leverage service support agreements with established FAR Part 145 Repair Stations (short term)

THE ROADMAP TO NEW STANDARDS DEVELOPMENT FOR AEROSPACE TECHNICIANS

EMERGING TECHNOLOGIES – CONTEXT IS IMPORTANT

Advanced Traditional Fixed & Rotary Wing Aircraft

Spacecraft

Hybrid-Electric/ Hydrogen Fueled

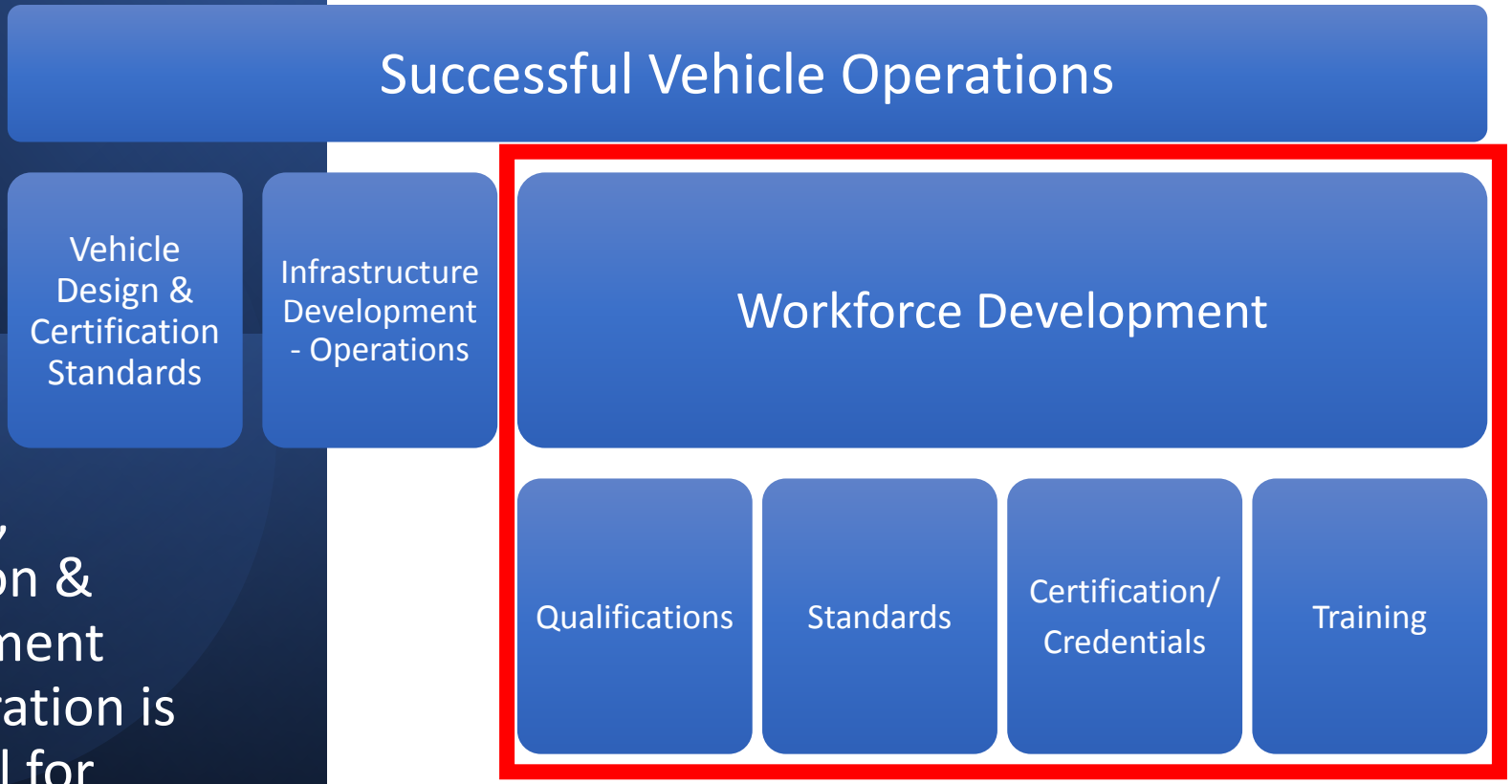
Supersonic Aircraft

AAM
UAM – eVTOL

AAM
Thin Haul/GA- eCTOL

AAM
UAS – Small/BVLOS

AAM
UAS - LUCA



Industry, Education & Government Collaboration is Essential for Successful Operations

"Important to focus on technician requirements now"

NASA
- AAM Infrastructure

FAA
- Advanced Aircraft Advisory Committee

GAO
- Workforce Requirements

OEMs

GAMA
- EPIC

NBAA
- Emerging Technologies Committee

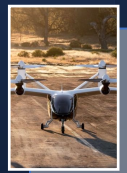
ATEC/AEA
- Part 147 & Avionics Technician School Advocacy

ASTM
- (F46/AC377/AC433)

CertTEC/SpaceTEC
- Credentialling

Vertical Flight Society
- Advocacy, Resources, Community

Utah Advanced Aircraft Maintenance Planning (UAAMP)



Advanced Air Mobility Working Groups
- State Infrastructure Initiatives

Organizations engaged in emerging technologies

“Many involved, few coordinated to create qualified technicians for new technology (Stove piped)”

(SAMPLE – Not All Inclusive)

Qualified Technician - Integrated and collaborative process workflows (Desired state)

Phase 1

New Technology Identification

- Organizations collaboration via committee, working groups

Phase 2

Impact Analysis

- Evaluation & assessment
- Gap analysis to existing standards
- Recommendations

Phase 3

Standards Development

- Review recommendations, adopt/reject
- Develop & Publish

Phase 4

Credential Development

- Impact analysis, create/revise
- Publish & test

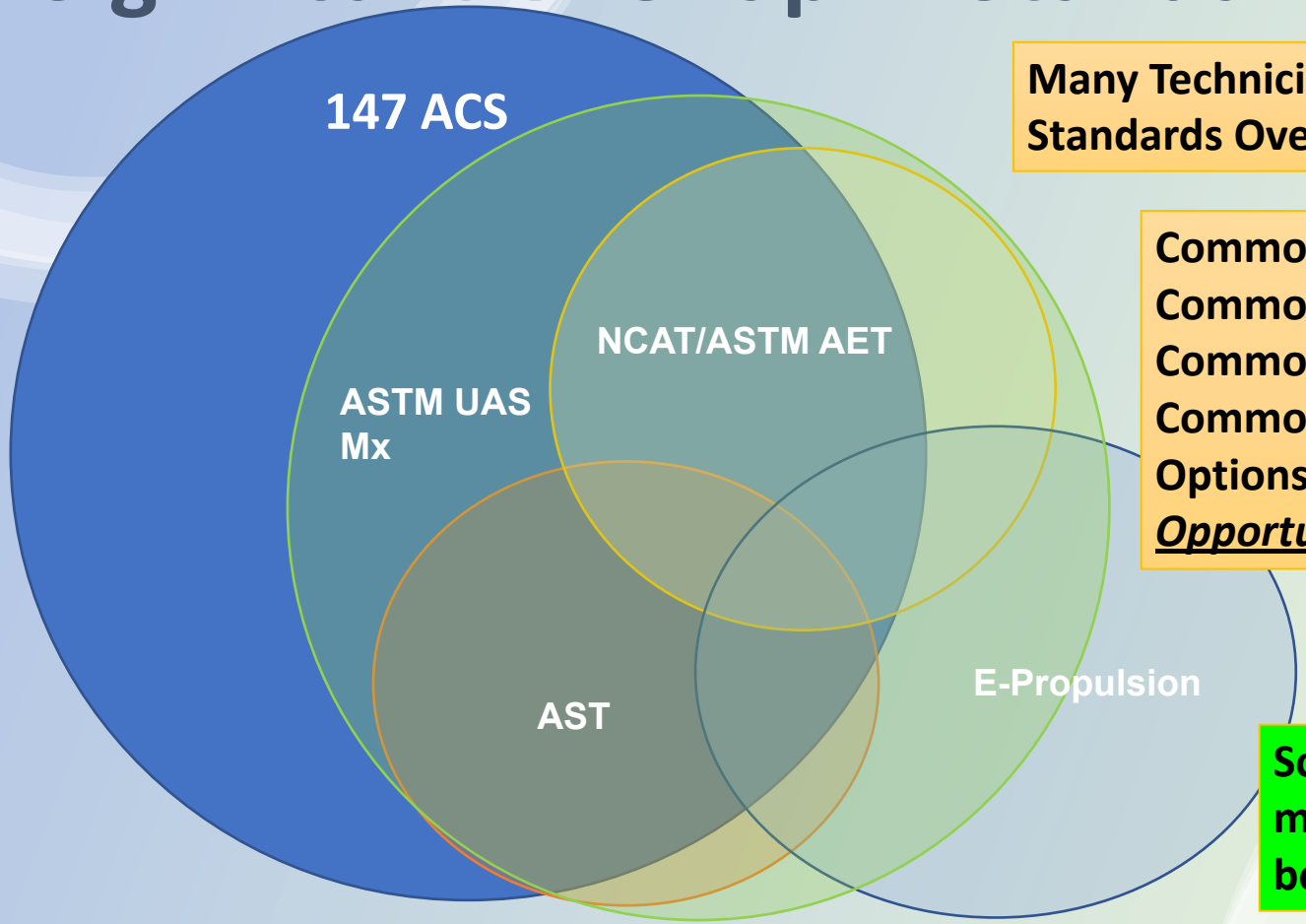
Phase 5

Curriculum Development & Training

- Reference sources
- Tooling/equipment/ aids
- Training delivery

"Partnership effort is needed – Reduce stove pipes"

Significant Overlap in Standards



Many Technician Certification Standards Overlap

Common Standards =
Common Training =
Common Lessons =
Common Equipment =
Options for Schools =
Opportunity for Students

Schools can offer many credentials beyond A&P

"The FAA is relying more and more on industry to help guide the regulatory environment, and that includes standards that are developed by ASTM." Jonathan Daniels, CEO of Praxis Aerospace.

"The standards that exist provide about an 80 percent solution as-is, but some of them need to be revised or expanded while some new standards need to be created" Anna Dietrich, AC 377 Committee Chair

"Unify all groups through a common process for creating a qualified technician"

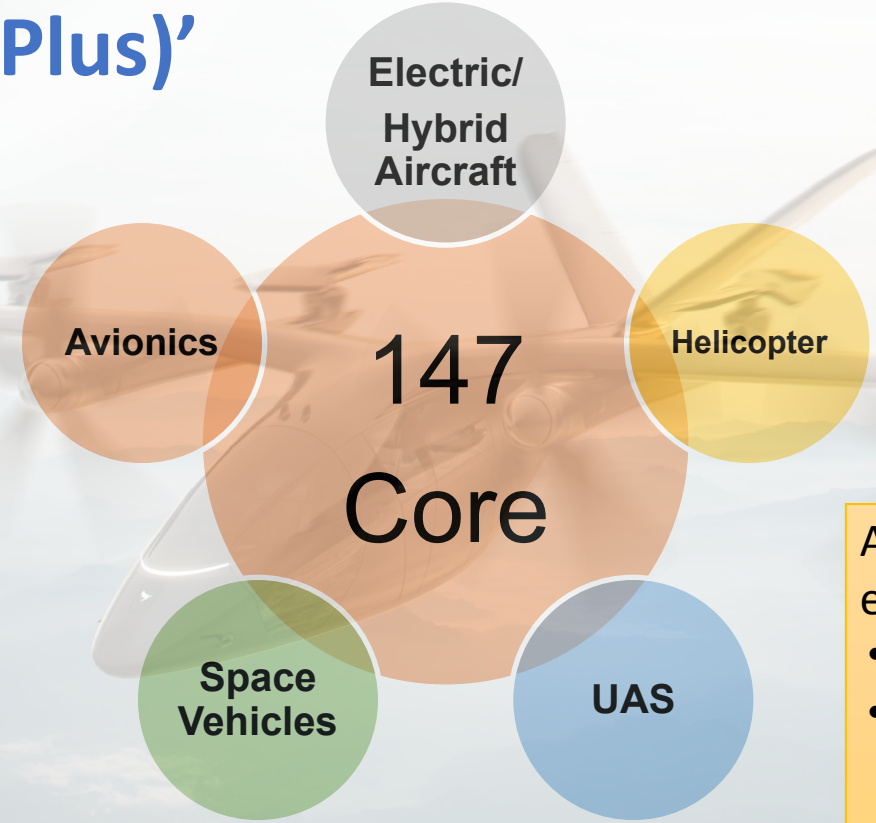
Stakeholder Partners

- ATEC
- Industry
- Associations
- Schools (AMTS)

- **Inclusive, holistic approach, broad base support**
- **Additional expertise and expanded network & influencers**
- **Enables broader acceptance, credentialling and training**

Technician Curriculum Deployment Model – Option 1

‘147+ (Plus)’



Additive programs bolted to established cores

- Flexible
- Localized workforce development based on employer demographics

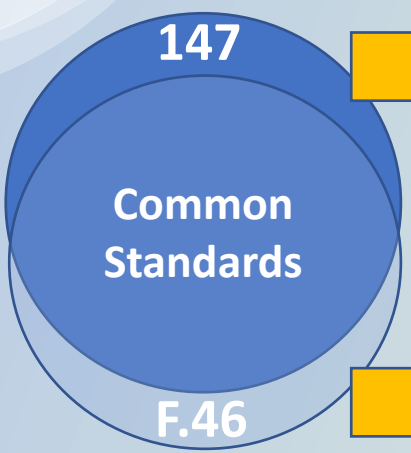
Technician Curriculum Deployment Model – Option 2

2 Unique Standards

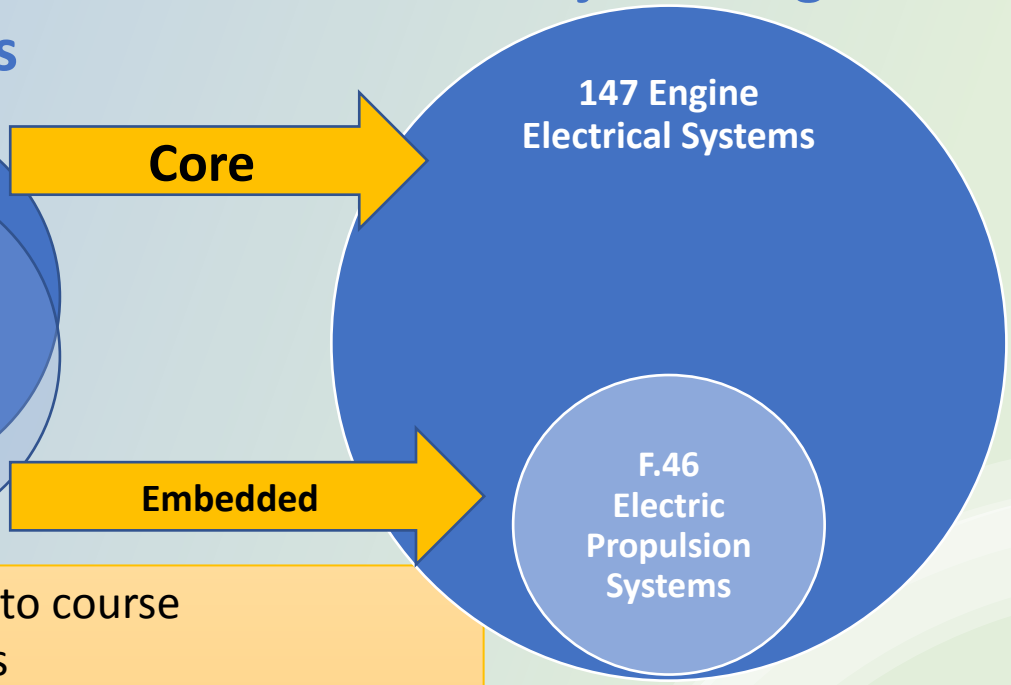
147 Engine Electrical Systems

ASTM F.46 Electric Propulsion Systems

Shared Standards



147 Subject Integration



Integrated standards into course

- Overlap of standards
- Minimal investment and curriculum changes
- Ease of scheduling + value added skills

‘147 Integration’

UTAH ADVANCED AVIATION MAINTENANCE PLANNING (UAAMP) WORKING GROUP

- Who we are
  - In coordination with the Utah Department of Transportation's mission to enhance quality of life through transportation—specifically through providing better mobility, good health, connected communities, and strong economy—the UAAMP working group is a consortium of stakeholders committed to supporting the goals and objectives of aviation maintenance professional training programs with a focused interest on preparing future professionals for the advent of electric aircraft and other associated and emerging technologies.
- Our mission
  - Create a qualified workforce to enable and sustain the safe integration and operation of advanced air mobility vehicles.
- History
  - Founded Spring 2022
- Membership
  - UDOT Aeronautics Division, Utah State University, Salt Lake Community College, Utah Valley University, Southern Utah University, Electric Power Systems (current chair), Industry stakeholders, Aspire, Weber State University

UAAMP – OBJECTIVES

- Define and develop knowledge, skills, and abilities as well as standards associated with AAM technologies, and new conventional aircraft technologies
  - For UAAMP reference, AAM Technologies include
    - Electric Aircraft
    - e-VTOL (powered lift)(UAM)
    - e-CTOL
    - Hybrid-electric
    - Hydro-electric (hydrogen)
    - Uncrewed Aircraft Systems (small – large)
    - Passenger and cargo operations
    - Autonomous and piloted ops
- Develop associated standards and curriculum recommendations and curriculum implementation recommendations
- Assess education infrastructure requirements within the state relative to recommendations
- Establish pathways for deployment of recommendations

UAAMP – PARTNERSHIPS & LINKS TO INDUSTRY

- General Aviation Manufacturers Association Electric Propulsion & Innovation Committee (GAMA EPIC) – informed stakeholder
- American Institute of Aeronautics and Astronautics (AIAA) – informed stakeholder
- NBAA Emerging Technologies Committee – informed stakeholder & committee membership
- Aviation Technician Education Council (ATEC) – active collaborator & committee membership
- ASTM International – active collaborator
- SAE ITC – active collaborator
- National Center for Autonomous Technologies (NCAT) – active collaborator
- National Electric Vehicle Consortium (NEVC) – active collaborator
- Northwest Engineering and Vehicle Technology Exchange (NEVTEX) – active collaborator

UAAMP – NATIONAL REACH, NATIONAL IMPACT

Utah Advanced Aviation Maintenance Planning (UAAMP) working group advocating, influencing, and informing research and special projects associated with technician standards and curriculum for e-Aircraft

1

Published report to NSF, sponsored by the National Center for Autonomous Technologies, involving recommendations for common core standards for autonomous systems technicians

2

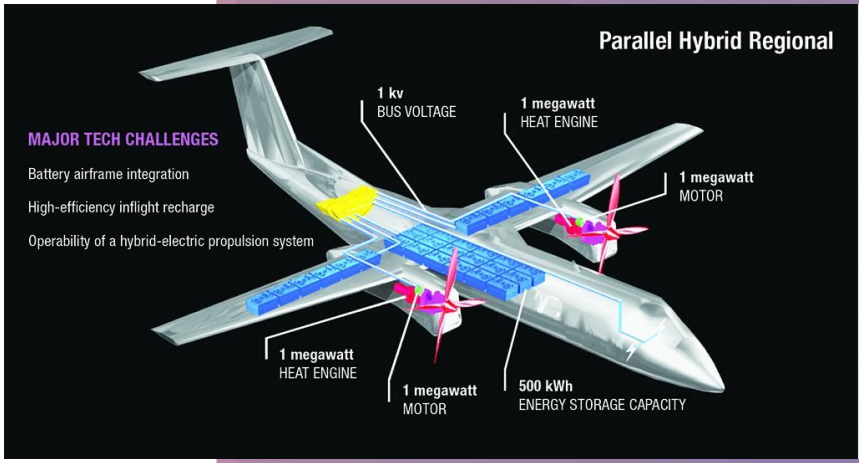
Development of common core standards, credentials, and curriculum for EV technicians across technology platforms to include ground transportation, marine, and aviation

3

Research proposal to NASA titled: **Revolutionizing the Future of Aviation Maintenance- A Workforce Development Plan to Navigate the Complexities of a New Aviation Maintenance Ecosystem.** Response to NASA solicitation for "Future Aviation Maintenance Technical Challenges." PI, Clemson University

4

ASTM Int'l initiative: Avionics technician proposal, new 'Avionics – Line Service' rating add-on to Aircraft Mechanic's certificate

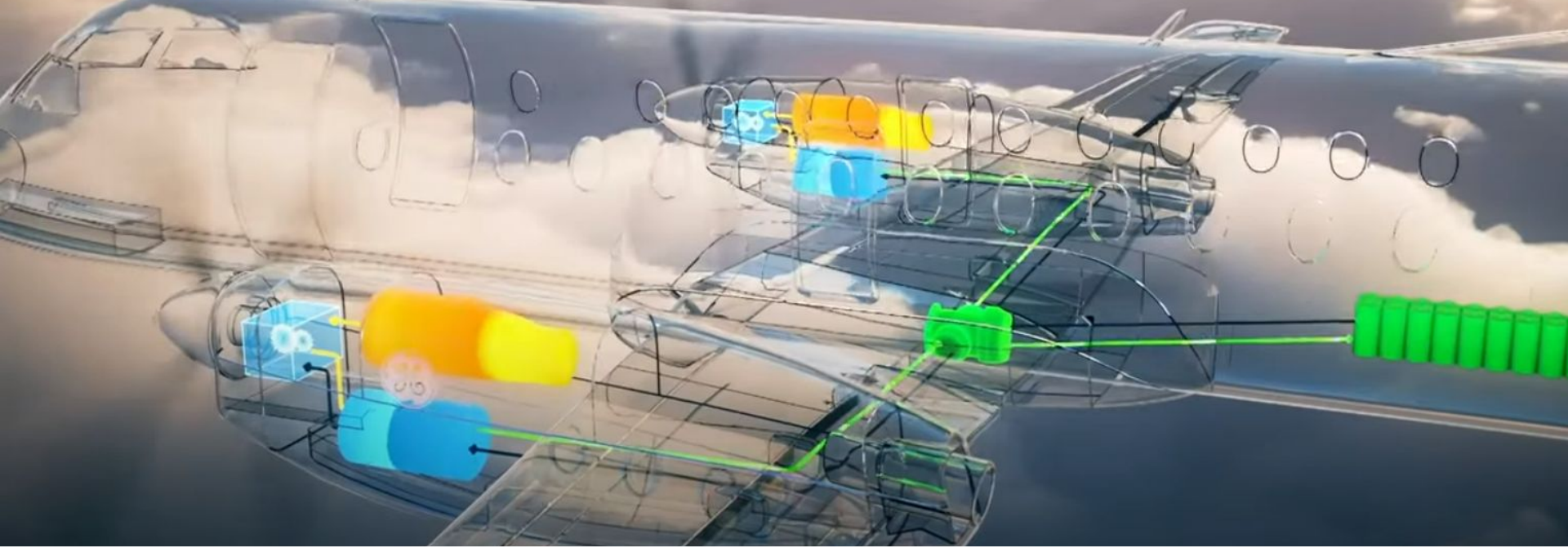


UAAMP – POSITIVE IMPACT TO OUR COMMUNITY

- Aspire - National Science Foundation (NSF) Generation 4 Engineering Research Center (ERC)
  - Vision - Widespread electrification of all vehicle classes, improved air quality, and public infrastructure that provides an inexpensive, seamless charging experience.
  - Participating in UAAMP group meetings – Helping to inform electrification of airports
- Education & Training
  - Forward looking to create and integrate AAM/EV curriculum into Part 147 Aircraft Maintenance Technician Schools
- Senate Bill Initiatives
  - Senate Bill 122 - requires the Department of Transportation to convene a working group to study advanced air mobility
  - Senate Bill 125 - Designates the ASPIRE Engineering Research Center at Utah State University as the lead research center for strategic planning for electrification of transportation infrastructure and requires certain actions.

THANK YOU

TIME FOR Q&A



QUESTIONS FOR THE AUDIENCE

- How do you feel about the integration of these emerging technology platforms entering service?
- Do you see a business and community benefit?
- What challenges do you foresee?
- How can we get potential talent to enter the high technology career field that aircraft maintenance is?
- How can UAAMP support you?