An Innovative & Data-Driven Approach to Building the Aviation Workforce of Tomorrow in Advanced Air Mobility

VFS eVTOL Writers Group – 7th July 2021

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Agenda

1. CAE at a glance – Who are we?
2. CAE Mission Statement for AAM
3. eVTOL pilot landscape & advanced training processes
4. Challenges of developing an eVTOL pilot training program
5. Embracing modern learning techniques
6. Structuring an eVTOL training program – CBTA approach
7. CAE 7-STEP model to unify the industry
8. Timeline into launching a training program
9. Considerations beyond training
World’s Largest Civil Aviation Training Network

170+ Aircraft

300+* Full Flight Simulators (FFS)

60+ Training Locations

1M+ hours Annual Training Delivery (FY19, FY20)

135,000+ pilots Trained Every Year (FY19, FY20)

Locations
- Cadet training
- Commercial aviation training
- Business aviation training
- Helicopter aviation training
- Aviation recruitment
Supporting OEMs & Operators from design to EiS to continued operations

Leading provider of RPAS training

High fidelity simulation & immersive technologies

Student-centric training solutions

Mission planning tools

Supporting OEMs & Operators from design to EiS to continued operations

Pilot & Technician workforce resourcing

Engineering simulation & certification support

CAE Provides End to End Capabilities Supporting Safety & Readiness
CAE is a **high technology** company at the leading edge of digital immersion, providing solutions to make the world a **safer** place

**Mission Statement**

CAE’s Advanced Air Mobility (AAM) group provides electric vertical takeoff and landing (eVTOL) training, engineering, and operational solutions for private and public entities worldwide in order to shape the next generation of pilots, maintainers, and operators to fly clean, quiet, and revolutionary aircraft.
We are at an inflection point in aviation with an unprecedented need for a sizeable eVTOL pilot workforce and new disruptive training processes.

- AAM will create an additional surge in demand for pilots and by some estimates close to 60,000 pilots by 2028.
- The initial AAM pilot cadre will consist of experienced commercial pilots from both the fixed and rotary-wing aviation communities.
- eVTOL pilots will need additional skill sets to meet the unique capabilities, designs and operational environments of eVTOL aircraft.
- Pilots of eVTOL aircraft may also find a pathway into airlines, business aircraft, or possibly helicopters, opening new opportunities for aviation careers.

In this innovative new industry, we must be equally disruptive with training.

New training technologies and processes will enable a paradigm shift to train pilots in an affordable, scalable means that ensures safety and meets the unique needs of Advanced Air Mobility.
The challenges of developing a training program for eVTOL aircraft

**Unique Operating Environment**

- **Shorter cycles for missions**
  - 5-30 minutes mission duration
  - eVTOL pilots could experience 2-4 critical phases of flight (takeoff/landing) per hour compared to the 2-4 critical phases of flight per day with traditional pilots
  - Limited battery life
- **Congested Air Space**
  - Operations in high density airspace with busy radio transmission requiring more agile decision making and communication
- **Urban Environment**
  - Micro-weather, Comms dead zones
  - Landing in confined, intra-city locations
  - Emergency procedures near populated areas

**Training Challenges**

- **Regulatory**
  - Undefined regulatory requirements for eVTOL pilots (discrepancies between EASA & FAA);
  - Short-term and long-term approach necessary;
- **Single-pilot operations**
  - Most eVTOL OEM's developing single-pilot cockpits;
  - Objective to be fully autonomous;
- **Device challenges**
  - Global deployment need and ability to train Pilots with various backgrounds;
  - Use of latest technology (MR, mini-motion) with little data to support major change in the industry

Several aspects of AAM operations and training procedures will differ from traditional aviation operations, and these will need to be reflected in eVTOL pilot training.
Embracing modern, data driven learning techniques is crucial for effective training

Modern learning techniques like adaptive learning for recurrent courses is proving to be effective, efficient and the way forward for modern training program development.

The use of data analytics is key in ensuring an efficient training footprint that meets the safety requirements, performance evaluation and mission complexities expected of AAM operations.
The Competency-Based Training Assessment (CBTA) process provides a cost-effective, safe, and comprehensive means to develop a pilot training program

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<th>The Opportunity</th>
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<td>The gap in regulation for eVTOL training offers a clean sheet to re-center training around <strong>pilot competencies (outcome of training)</strong>, rather than <strong>prescriptive models (the inputs of training)</strong> seen in traditional pilot training.</td>
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<th>The Benefits</th>
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<td>Potential to <strong>harmonize across various eVTOL designs</strong> with easier path to adoption by regulators, customizable and holistic training across designs.</td>
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<td><strong>Globally accepted</strong> set of pragmatic workflows which identify the necessary pilot knowledge, skills, and attitudes to validate the tasks necessary to safely operate an aircraft.</td>
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<td>Defined assessment criteria to monitor pilot performance and gather data, utilized for <strong>continuous improvement</strong> and <strong>evaluating quality</strong> of training and performance.</td>
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<td>The inclusion of scenario-based training (in the competency-based format) in pilot training activities has proven to <strong>reinforce resilience in pilot decision making</strong>, leading to safe and consistent outcomes.</td>
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The seven-step model to regulatory approval and certainty in determining appropriate pilot training program structure

1. **Data and science**
   - Find scientific articles, research and data to validate recommendations for training technologies and approaches.

2. **Leverage a standard and determine what applies**
   - Benchmark legacy commercial regulatory standards of airplane, rotorcraft and UAS for eVTOL applicability and training gap-analysis.

3. **Document the difference**
   - Once commercial tasks are filtered by applicability, define a generic eVTOL task list.

4. **Determine the best way to train tasks**
   - Refine eVTOL task list with input from OEM and industry stakeholders. Develop matrix on what device is recommended to train the task.

5. **Risk assessment**
   - Risk assess tasks, training devices and determine suitable mitigation.

6. **Develop industry consensus standards**
   - Regulatory agencies, OEMs, ATO’s and other stakeholders develop standards and have these standards accepted by regulators.

7. **Go!**
   - Launch development of training curriculum, materials and training devices. Ongoing work on certification and operational evaluation.
A conventional aircraft manufacturer typically launches training program development 36 months ahead of Day 1 of commercial operations.

- **36 months**: OEM & their Regulator agree on certification plan & documents.
- **30 months**: Equipment Provider designs and deploys simulator, working closely with OEM and Regulators.
- **24 months**: Regulators & OEM prepare for Operational Evaluation (OE).
- **18 months**: OEM prepares engineering documentation.
- **12 months**: OEM prepares manuals and Regulators review & approve.
- **6 months**: Regulators & OEM & Training Provider conduct OE.

**Launch**:
- Regulators issue ROC. OEM & Training Provider resolve all ROCs.
- EIS Pilots qualified & trained.
- Operator applies for AOC supported by Training Provider; Regulators review.
- Operator launches recruitment & hires pilots; Pilots trained.
AAM pilots will be an integral component of this industry from its inception and an essential link to the success of the industry.

For widespread operationalization of AAM, a unified approach is necessary to building a pilot workforce, requiring close collaboration between OEMs, operators, Civil Aviation Authorities, training providers, and the pilot community.

Training is just the first step to gearing up a workforce – the conversation on building and maintaining a cadre of pilots needs to start now!

The industry must have a forward-looking approach that takes into consideration factors beyond training to ensure the success of a qualified AAM workforce.

Challenge: up to 60,000 eVTOL pilots will be required within the first decade of operations.
Thank you!

We are now open for questions!
eVTOL tailored training solutions

- **Competency-based Training & Assessment (CBTA)**
  - Instructional Design (ISD) workflows
  - Engagement of National Aviation Authority in this process

- **Agile vehicle design & flight testing** feeding changes back into continuous-improvement process

- **OEM engagement and task analysis** against legacy benchmark

- **Data-driven recommendations** presented to NAA
  - Defined training & validated devices supporting Operations Evaluation and Type-certification

- **Training authentication** in alternative-training devices to validate training plan
  - DATA-COLLECTION

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Training relevance to Type-’like’ Certification

To achieve vehicle Type Certification, an OEM must concurrently conduct an Operational Evaluation (OE) -like process.

In an OE-like process, regulators evaluate all aspects of the operational program to ensure safety. This includes post-aircraft delivery aspects such as manuals, pilot training programs, training equipment, etc. Certified training program needs to be attached to Type Certification.

Hence, it is crucial aircraft manufacturers have a team focused on the pilot training requirements in advance of Type Certification. Training needs analysis is a first step.

Courseware and simulators must be available ahead of the OE to support a timely EiS.

New entrant aircraft cannot begin operations and generate revenue if the pilot training program has not yet been approved, and certificated pilots are not available to operate these aircraft.
OPERATIONAL EVALUATION (OE)

Purpose:

- A systematic means to determine training, checking and currency requirements for a new aircraft or a variant of an existing aircraft.
- Designed to assure that pilots attain and maintain the knowledge, skills and abilities needed to operate the aircraft safely.
- Determines if aircraft is operationally suitable for the mission for which it was designed.

Defines:

- Aircraft specific training areas of special emphasis.
- Minimum training requirements for pilots.
- Checking / Testing requirements.
- Currency requirements.
- Specification of constraints or credits for related training or previous experience.
OE PROCESS

Training Program Development
- Development of:
  - Courseware
  - Device Training
  - Qualification of Training Devices
  - Training Program owned by OEM
  - Concurrent to Aircraft Type Certification (Airworthiness)

OE
- Conducted by Operational Suitability Regulatory Group
- Regulatory authorities attend proposed training program
- Regulatory Test Subjects validate training program by flying aircraft
- Authorities publish respective reports to define pilot training, checking and currency

Closure of ROCs
- Record of Comments (ROCs)
- Official findings from the OE that must be closed prior to commencement of pilot training
- Must also be closed prior to submission for training program approval

Training Program Approval
- Approval of CAE training program under Part 142/FCL
- Allows CAE to deliver training to pilots
- Includes qualification of Instructor Pilots
- Dependent on OE report(s) and closure of ROCs