



L3 CS-FSTD(A) COMPLIANCE

TECHNICAL OVERVIEW – EASA NOV '18

Rob Pritchard – Performance Simulation Group Team Leader (Training Systems UK)

28 November 2018



Commercial Training Solutions



TRAINING SYSTEMS TRAINING TECHNOLOGY THAT'S CLOSER TO REALITY

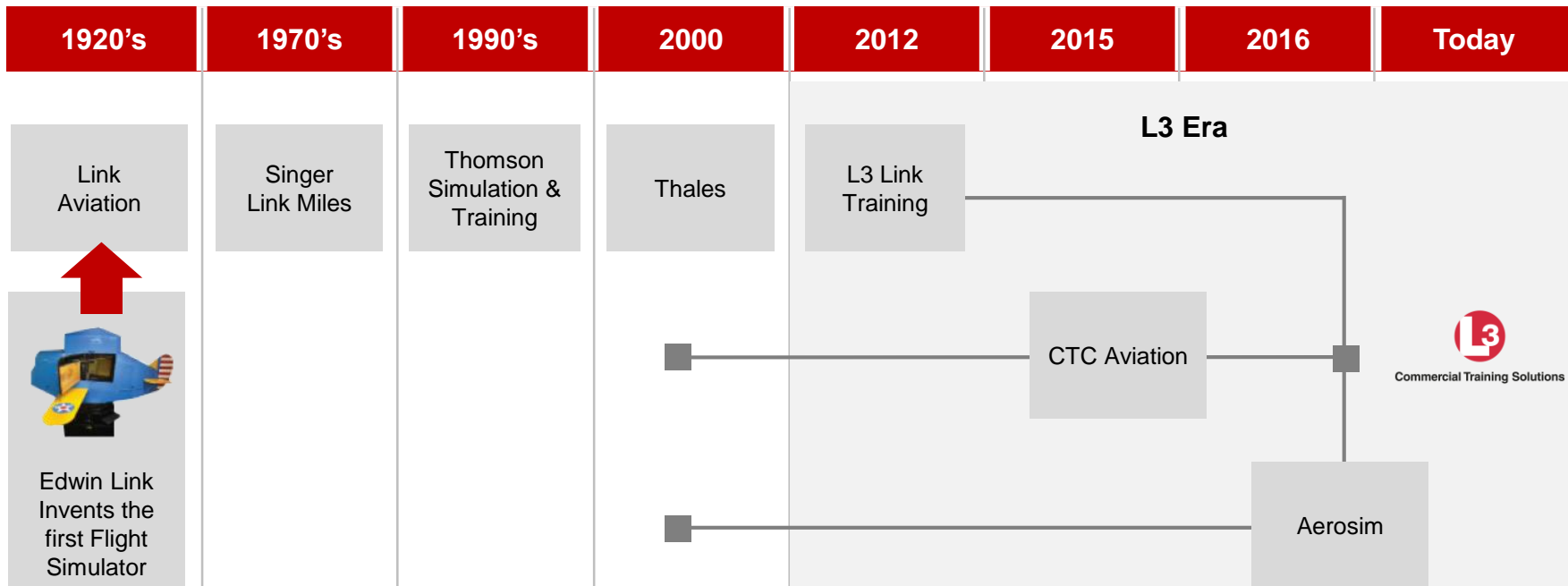
L3 CTS (formerly Link UK and Aerosim) can trace its heritage back to 1929 when Edwin Link invented the first flight simulator. We continue a proud tradition of supplying the highest level of pilot training equipment. We have over 85,000 square feet of production/design facilities in Gatwick, UK and Minneapolis, USA.



Commercial Training Solutions



A PROUD HERITAGE





L3 Approach to CS-FSTD(A) Issue 2 Specifications

Contents

1	Requirements Overview
2	Technical Considerations
3	Full-Stall
3	UPRT
4	Engine and Airframe Icing
7	Summary





L3 Approach to CS-FSTD(A) Issue 2 Specifications

Requirements Overview

This presentation considers the modifications to the L3 CTS Level D FFS product range and upgrade options to L3 Manufactured in-service Level D FFS to meet compliance with:

- EASA CS-FSTD(A) Issue 2 – Certification Specifications for Aeroplane Flight Simulation Training Devices

The Certification Specifications have been updated to reflect EASA Opinion No 06/2017 and new requirements on loss of control prevention and recovery training (UPRT) into Commission Regulation (EU) No 1178/2011. Upon applicability, it shall also apply to FSTDs used for UPRT as per Commission Regulation (EU) No 965/2012.



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Technical Considerations

The applicable devices and technologies are broad:

- Age of device
- Computing capacity and technology
- Simulator Software toolset (compiler/real-time kernel/auto-test system)
- Current data package revision
- Custom modifications

The options are flexible and tailored to suit:

- OEM data-package enhancement
- Third-party bolt-on options

What is the impact of planned modifications? (QTG/inter-dependencies/capacity/equipment upgrades)



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Full Stall Training

- Requirements covered within CS-FSTD(A) Issue 2 – Book 1
 - 1.1 Appendix 1 to CS FSTD(A).300
Flight Simulation Training Device Standards
 - 1. General, g.2, s.2, s.3
 - 2. Motion System, a.1, d.1
 - 4. Sound System, b.1
- Full Stall Training requirements are Optional
- Depending on preferred approach Stall Modelling enhancements can be achieved via adaptation to OEM supplied data pack model specification or third-party representative stall model.
Considering AMC10 FSTD(A).300 is met.



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Full Stall Training (Continued)

- Typically with OEM supplied route, minimum entry requirements are specified with respects to pre-existing data package.
- Depending on age of data package, further QTG impact may be expected. General rule of thumb – the more software change the higher the impact on QTG.
- Software Modifications to Motion Buffet models expected complementing introduction of new stall modelling enhancements and interface and potentially Sound samples.



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Full Stall Training (Continued)

- For Software Simulation Package approach to data pack and model updates, software modifications required for Model interface (functional interface, model control, reposition, auto-test drivers).
- Objective QTG test updates required – see table of FSTD Validation tests
- For Major Block-point/Standard Revision updates potentially new Flight Test Validation data and Engineering based validation data incorporated. Depends on Aircraft type and age of data package
- Increased testing of wider parts of the simulation modelling may uncover previously unseen deficiencies or errors.



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Upset Prevention and Recovery Training

- Requirements covered within CS-FSTD(A) Issue 2 – Book 1
 - 1.1 Appendix 1 to CS FSTD(A).300
Flight Simulation Training Device Standards
 - 1. General, h.2, h.3
 - 2. Motion System, a.1
- UPRT IOS page will be added to provide Instructor Feedback on Validated Training Envelope and Normal Operating Envelope.





L3 Approach to CS-FSTD(A) Issue 2 Specifications

Upset Prevention and Recovery Training

- Data is provided from the OEM or alternative sources with respects to the validation envelope of the aerodynamic model (Alpha vs. Beta plot annotation)
- Load Factor and Operational Load Factor Limits are derived from FCOM/AFM data along with Airspeeds and Maximum Operating Speeds.
- Modifications to Crash page logic to introduce Ultimate Load Factor Crash to correspond with Structural Limits on V-n diagram.
- In-flight Limitations will be inhibited during UPRT to not conflict with training.



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Upset Prevention and Recovery Training

- How does conducting UPRT affect the operation of the FSTD? – motion, flight control laws etc.
- Important to understand OEM published recovery procedures
- Consider how the Upset Prevention and Recovery Scenarios are implemented
- Make sure suitable information is available to the Instructor to understand the functions

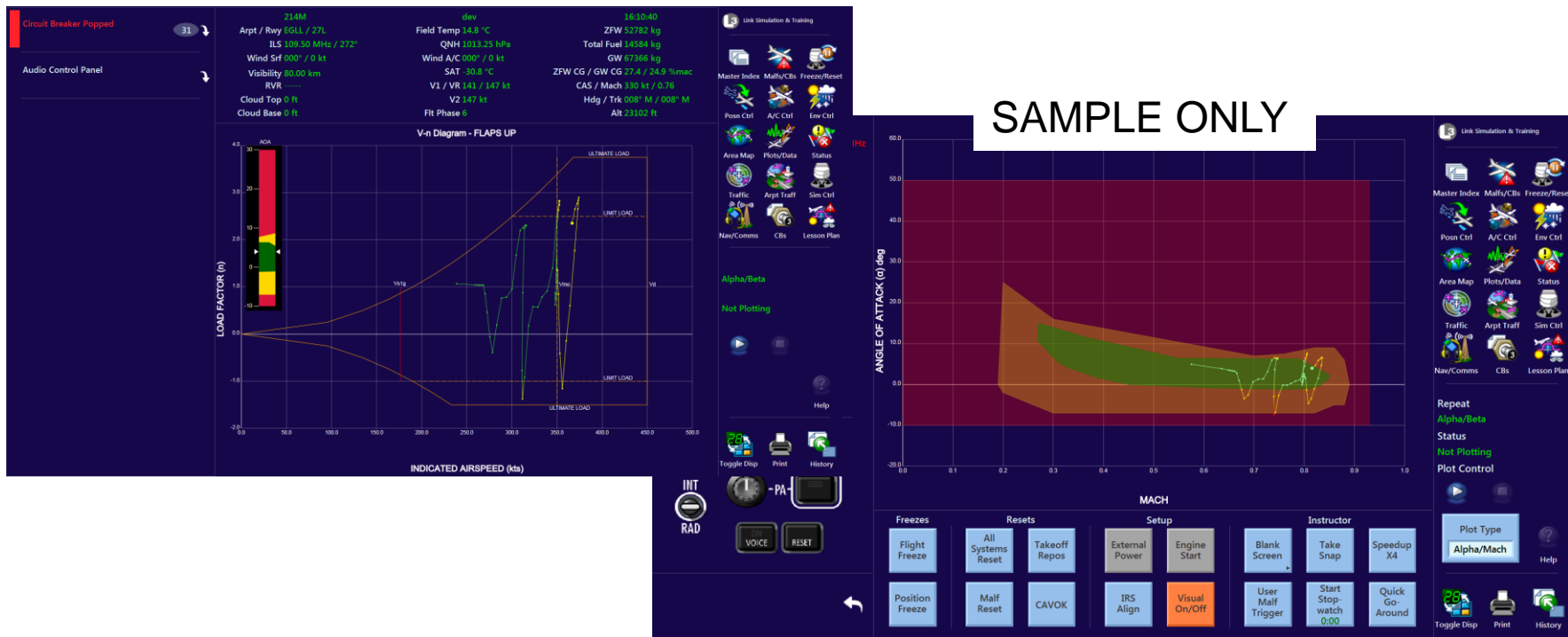
:





L3 Approach to CS-FSTD(A) Issue 2 Specifications

Upset Prevention and Recovery Training



SAMPLE ONLY



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Engine and Airframe Icing Training

- Requirements covered within CS-FSTD(A) Issue 2 – Book 1
 - 1.1 Appendix 1 to CS FSTD(A).300
Flight Simulation Training Device Standards
 - 1. General, d.3, t.1, t.2
 - 2. Motion System, a.1, d.1
- Typically most Aerodynamic models currently deployed are compliant with this requirement.
- Validation data has been provided that demonstrate a baseline performance without ice accretion and a secondary test with aerodynamic degradation with ice accretion relative to the baseline test.



L3 Approach to CS-FSTD(A) Issue 2 Specifications

Engine and Airframe Icing Training

- Consider enhanced modelling on power plant: Ice accumulation on the Engine fan blades
- Consideration for appropriate IOS feedback: Ice fraction, Severity, Increased Mass, Icing Conditions active (temperature range, icing-related cloud).
- Consider implication on Stall speeds and correct correlating behaviour with motion programming
- Ensure correct instrument behaviour and where appropriate correlating motion system behaviour





L3 Approach to CS-FSTD(A) Issue 2 Specifications

Engine and Airframe Icing Training

- A statement of compliance will be required for the QTG detailing a description of expected aircraft specific recognition cues and degradation effects due to a typical in-flight icing encounter. This description must be based upon relevant source data, such as aircraft OEM supplied data, accident/incident data, or other acceptable data sources.
- A description of the data sources utilized to develop the qualified ice accretion models. Acceptable data sources may be, but are not limited to, flight test data, aircraft certification data, aircraft OEM engineering simulation data, or other analytical methods based upon established engineering principles.





L3 Approach to CS-FSTD(A) Issue 2 Specifications

Summary

- Application to a broad lineage of devices to be considered
- Major OEM data packages to support are available or planned
- OEM Stall models validated by SME pilots – but consider who/how/where/when
- There may be impact with need to update to latest data block-point or standard
- Modifications to FSTD could become more than just enhancements to the programming, consider the impact
- Consider the training programme alongside the FSTD enhancements





Thank you



Commercial Training Solutions