

Airfield Frangibility Standard Development: Historical to Future

IES ALC, Orlando

Dan Duke, Ph.D. P.E.

October 23, 2014

Project Objectives

- Life safety
- Mitigate damage to aircraft
- Technically well founded
- Clearly understood and documented
- Defined limits and suitability of application
- Consistency
 - Test configurations, instrumentation
 - Analytical methods and results
 - Report requirements
- Realistic and accepted

Clarify and Document

What and how in the past?

Additional insights?

What and how do we fill the gaps?

Clarify and Document

- Impactor assembly
 - How dynamic characteristics effect results
 - Reconciling between various test
 - Seeking more specific requirements for impactor assemblies
- Impact location
 - Height on device
 - Proximity to joints (frangible and structural)
- Soft impactors revisited
 - Tradeoffs with rigid impactor
 - Original failure criteria: Damage to main spar revisited

Clarify and Document

- Flight stability
 - Current example
 - What was done
 - What needs to be done
 - If not an issue – document the source
- Vertical forces on impactor
 - Pull down on wing and cut into the wing
 - Is this an issue?
 - If not, then show why

Clarify and Document

- Material property concerns
 - Documentation
 - Recertification
- Data measurement and reduction
 - Sampling rates
 - Filters
 - Smoothing
- Analytical models
 - Mesh requirements
 - Model details

Documentation

- What was tested
 - Detailed geometrical information
 - Connection details
 - Material properties (as tested – not supplier minimum guarantees)
 - Proximity of impact to connections and frangible joints
 - Impact point on what was tested, how the impactor assembly was constructed

Documentation

- Impactor assembly
 - Specific information regarding mass, stiffness and dimensions of vehicle / cart
 - Frame members sizes, dimensions, materials and connections
 - Specific connection details at interface to impactor

Documentation

- Impactor
 - Material of construction (as tested – mil certification data for metals)
 - Geometric details including formed edge and formed rib dimensions
 - Connection specifics including weld sizes and fastener specification, dimensions and locations

Documentation

- Post processing specifics
 - Damage to impactor including distortion, separation and failed connections (if applicable)
 - Specifics regarding data filtering and smoothing (if applicable)
 - Reconciliation of global dynamic response of the impactor and impactor system with intended measurements of force and energy
 - Comparison with pretest predictions and post test calculations

Documentation

- Post processing specifics
 - Damage to impactor including distortion, separation and failed connections (if applicable)
 - Specifics regarding data filtering and smoothing (if applicable)
 - Reconciliation of global dynamic response of the impactor and impactor system with intended measurements of force and energy
 - Comparison with pretest predictions and post test calculations

Documentation

- Product consistency
 - Recertification plan
 - Plan to avoid material property changes
 - As tested versus as supplied data sheets
 - Proposed submittal package including
 - Detailed drawings
 - Test report
 - Pretest analysis
 - Material certifications
 - Fastener strengths
 - Calculations to support deviation
 -

Questions or Comments?