

CASE STUDY

# BOEING 757 Antenna Installation Bird Strike Substantiation

## / Task Objectives

Airframe Designs was engaged by STC Twenty One (EASA Part21J DOA) to carry out a bird strike assessment of a Cobham SATCOM HGA-7000 antenna installed on the forward fuselage crown on a BOEING 757-200 aircraft.

The objective was to convince both the FAA and EASA that the installation met the original certification basis requirements for discrete source damage per FAR/CS 25.571 (e)(1) i.e.

The aircraft must be capable of successfully completing a flight in the event of structural damage caused by impact with a 4-pound bird at operational speed and altitudes up to 8,000 feet.



The assessment identified critical features associated with the antenna itself and its attachment to the fuselage to identify the most likely points of structural failure.



### Overall Risk Assessment

In addition to the strength calculations for the bird impact force, qualitative assessments also considered:

- The probability of bird strike based on the size and location of the antenna in relation to the aerodynamic boundary layer and flying attitude of the aircraft.
- Service history of the HGA-7000 in terms of number of installations, types of platform, and years in service.
- Antenna / fuselage materials, construction, means of attachment and level of redundancy in available load paths.
- Ability of the radome to experience a discrete penetration during impact but retain the ability to hold stagnation pressure.

Large Antennas / Decision Criteria & Analysis Methods

## Bird Impact Loading

An assessment was required to determine static strength Reserve Factors (RFs) for quasi-static strength and quantify the level of conservatism included in the assessment.

An empirical formula from RAE paper TR72056 was used to calculate the impact force acting on the antenna:

#### $F = 1.18M^{\frac{2}{3}}V^2Cos\alpha$

- F = Force normal to the impacted plane
- M = Mass of the Bird
- V = Impact velocity
- $\alpha$  = Impact angle



eq.1

Thickness of turbulent boundary layer at x = 25 [m]:  $\delta(x) = \frac{0.37 \cdot x}{\sqrt[5]{Re_v}} = \frac{0.37 \cdot 25}{\sqrt[5]{427567114}} = 0,173 \text{ [m]}$ 

> "AFD provided structural specialists with experience in the application of the empirical formula for the assessment of bird impact forces.

Extensive dialogue between AFD, Cobham, STC21, and the authorities (EASA and FAA) resulted in agreement on the Certification Plan and proposed Means of Compliance, leading to a successful STC application."

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