

Docket No. SA-542

Exhibit No.: 7-C

NATIONAL TRANSPORTATION SAFETY BOARD

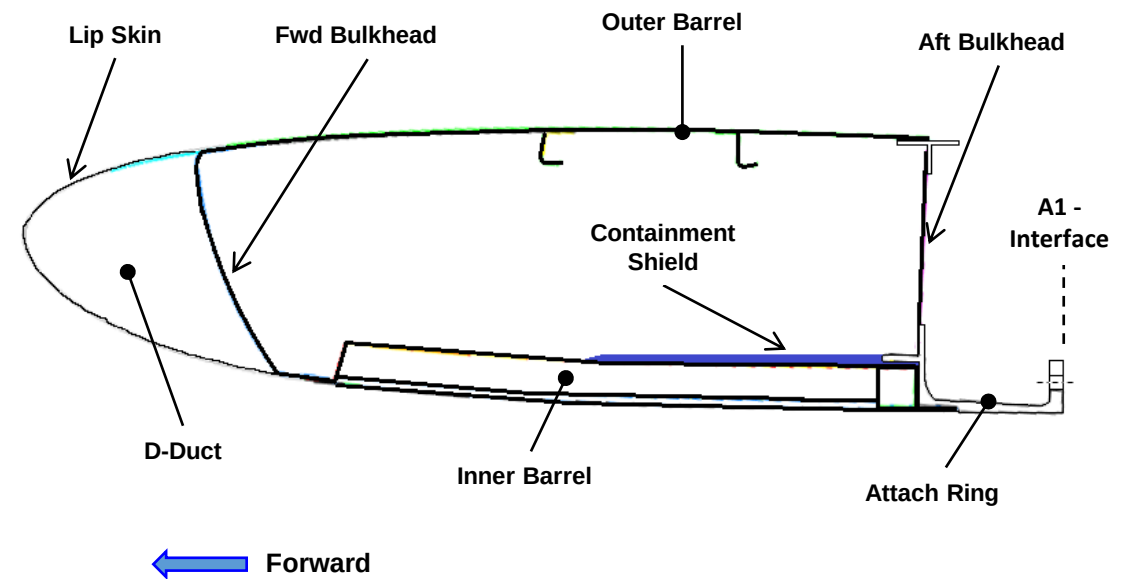
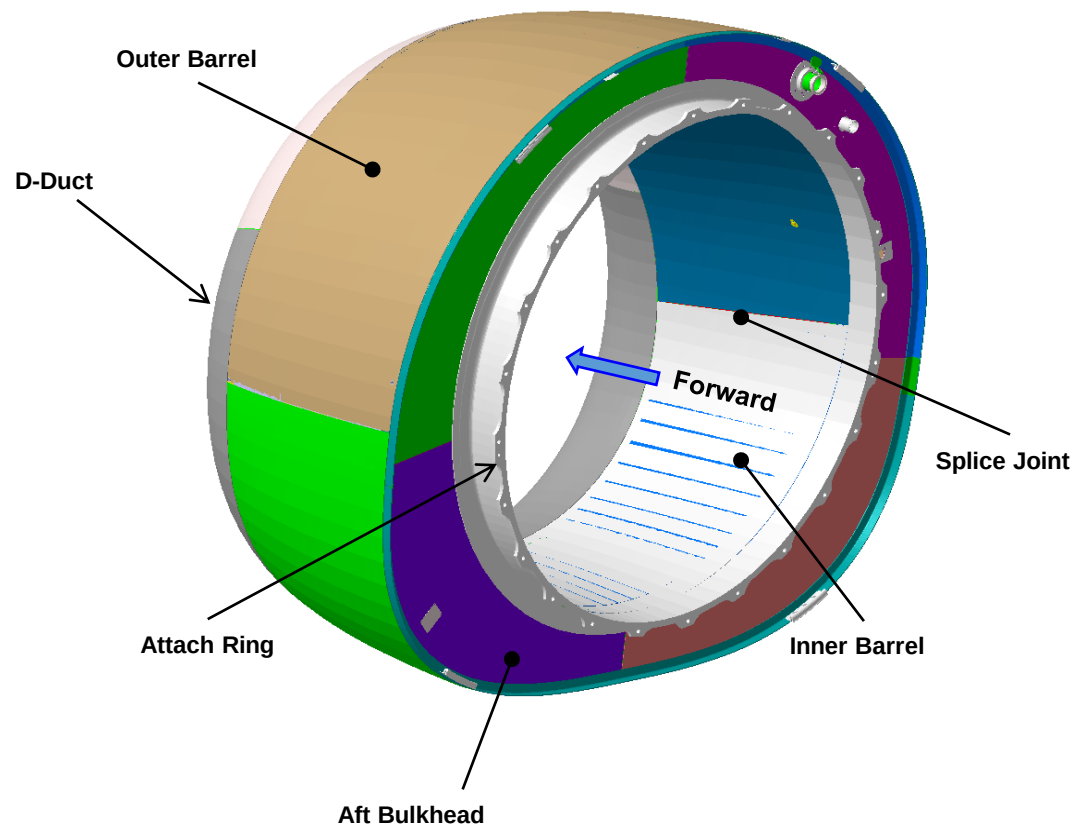
Washington, D.C.

UTAS Supporting Material
(9 Pages)

NTSB Public Hearing
Supporting Material
November 14, 2018

NTSB ID No. DCA18MA142

Inlet Overview



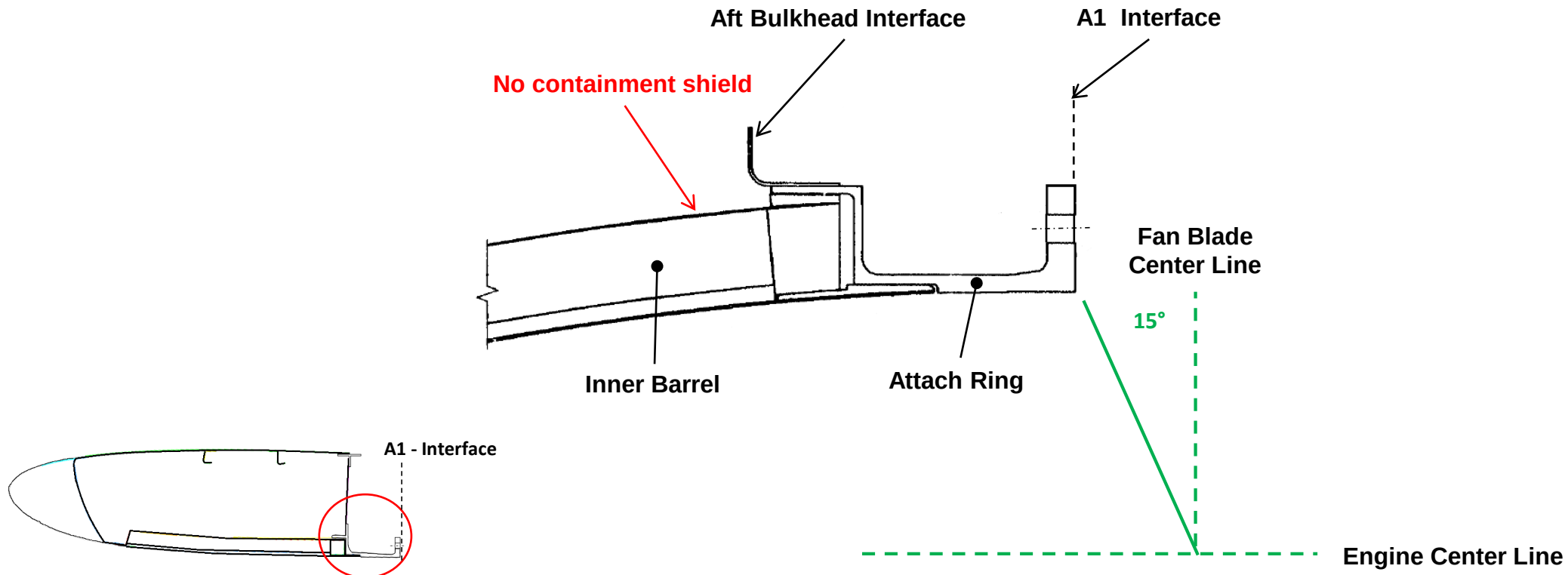
Cross-Section of Inlet

Initial Inlet Design: No Containment Shield

Designed to Boeing Specification Control Drawing (SCD, Rev A, June 1994)

CFM56-7 fan case designed to provide containment up to 15° conical spread angle, as defined in AC 20-128

Fan Blade Out (FBO) containment capability not required for Inlet

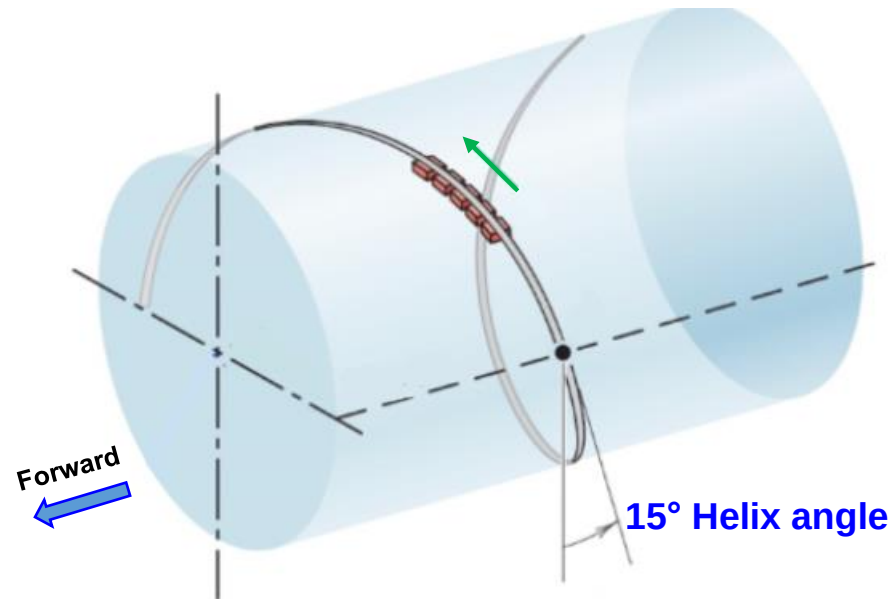


Revised Inlet Specs: Required Containment Shield

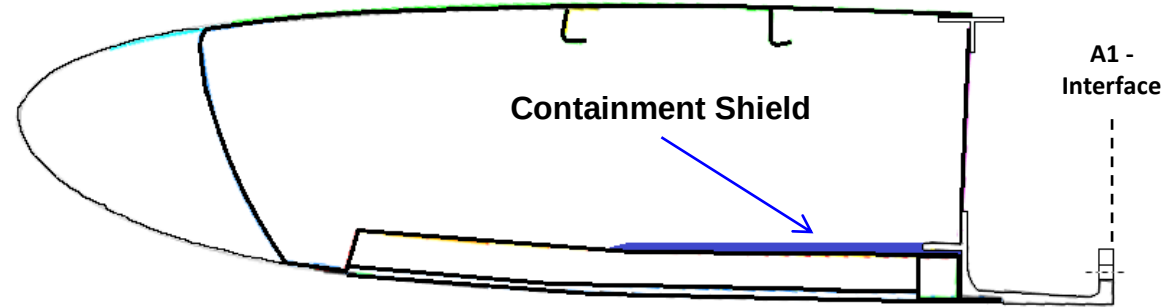
Based on Rig 4 test (Aug 1995), Boeing issued revised design specification (Rev B)

Containment capability for a forward spiraling fan blade fragment

Dimensions:	Specifically defined
Weight:	~ 2 lbs
Velocity:	~ 600 mph
Trajectory:	15° helix angle



Production Inlet Design: Included Containment Shield



Cross-Section of Inlet Incorporating Containment Shield

Engine Certification test (April 1996)

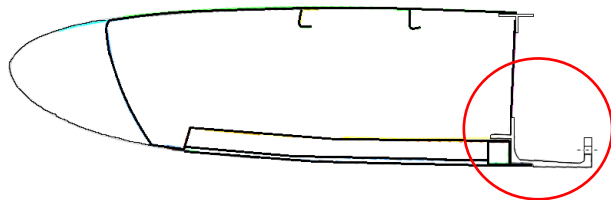
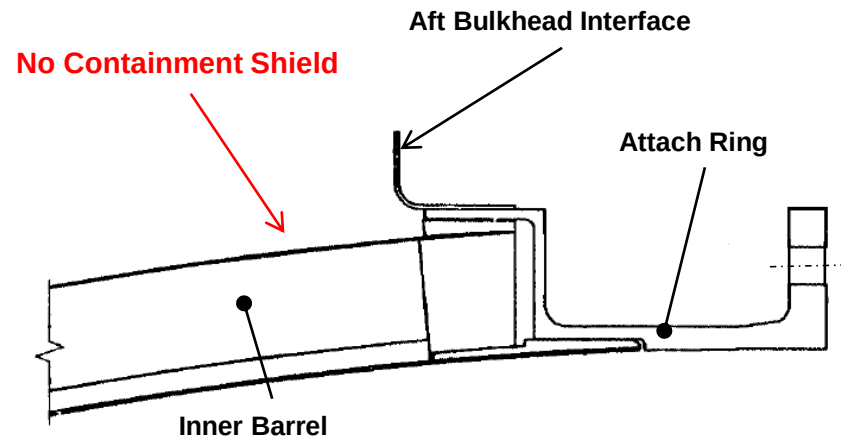
Included Inlet containment shield

No Inlet modifications required after test

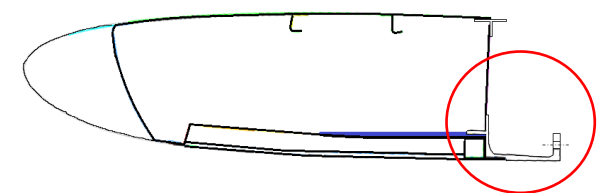
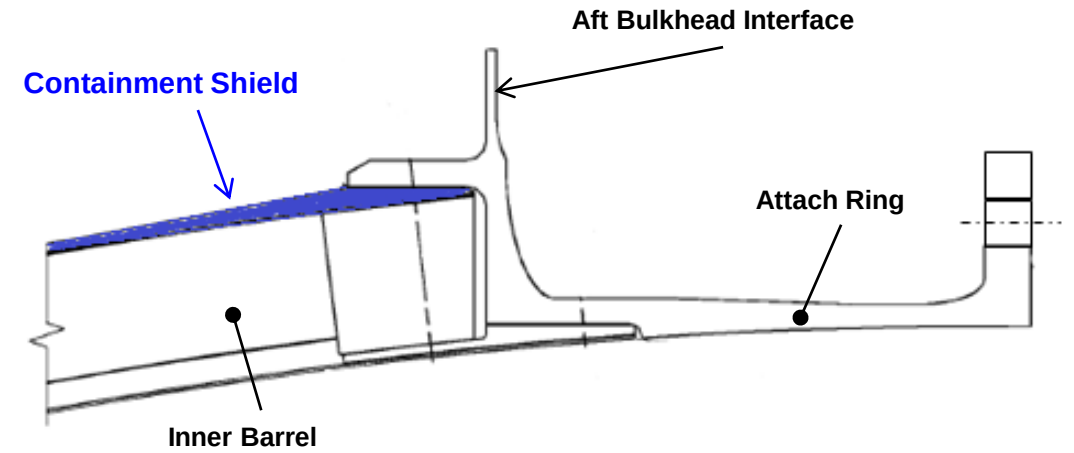
Containment shield performed intended function in two bird strikes (2003 & 2009)

Initial vs. Production Inlet Design Comparison

Initial Design



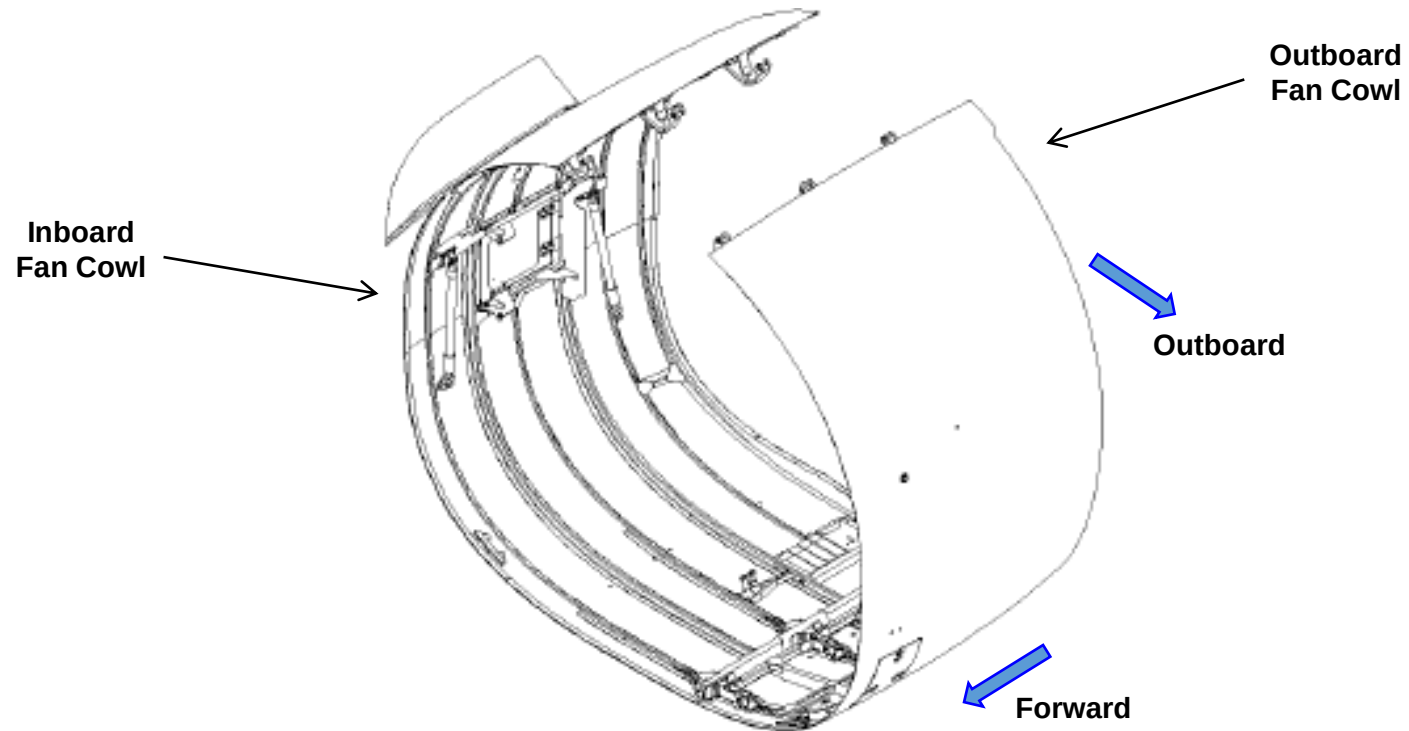
Production Design



Fan Cowl Overview

Designed to Boeing SCD (Rev A)

Requirements did not change over time



Fan Cowl on Engine #1 (LH)

Laboratory Setup

80-90% of Inlet and Fan Cowl parts recovered

Reconstructed in lab environment



Laboratory Setup – Overview



Laboratory Setup – Philadelphia

Pensacola vs. Philadelphia Comparison

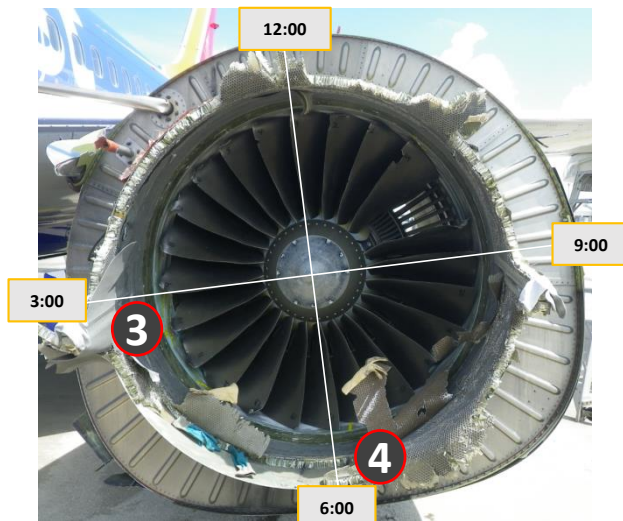
Pensacola (PNS, Aug 2016)



- 1 Fan Cowl**
PNS – Intact
PHL – Portions departed

- 2 Aft Bulkhead**
PNS – Intact
PHL – Departed

Philadelphia (PHL, April 2018)



- 3 Blade Root Impact**
PNS – 3:30 o'clock
PHL – 6:30 o'clock

- 4 Blade Tip Arrested**
PNS – Containment shield at
6:30 o'clock
PHL – Splice joint at 9 o'clock

