Vertical Stabilizer and Rudder

Vertical Stabilizer (Internal Structure)

Composite Layers

Main Attachment Fittings (Lugs)

Rudder Hinge

Rudder
Examination

Methods

- Visual and Fractographic Examination
- Nondestructive Inspection (NDI)
- Materials Testing and Microstructural Examination
- Lug Tests
Visible Damage

Visible damage observed at rudder hinge line and lug locations.

Some lug pieces remained attached to the fuselage.
Fractographic Examination

Methods and Results

- Composite fractures examined at high magnification using scanning electron microscopy
- Lug area fractures photographed at more than 300 locations
- Over 500 square inches of crack surfaces examined at high magnification
- No fatigue observed
Fracture Pattern

Vertical stabilizer cross-section as viewed from behind

Left Lugs

Right Lugs

Tension
Fracture Pattern

Vertical stabilizer cross-section as viewed from behind

Left Lugs

Right Lugs

Bending

Tension
Fracture Pattern

Consistent with overload bending to the left
Right Rear Lug Fracture

- Structural analysis predicted fracture initiation at the location circled in red.
- Structural analysis was consistent with damage observed.
Fracture pattern for the accident right rear lug was as expected given the accident loads.
Summary

• Composite structure was manufactured as expected.

• No evidence of preexisting damage was observed.

• Damage patterns were consistent with an overload failure in bending to the left.
American Airlines Flight 587
Belle Harbor, New York
November 12, 2001

NTSB Board Meeting
October 26, 2004