3.1 Findings

1. The captain and the first officer (the flying pilot) were properly certificated and qualified under Federal regulations. No evidence indicates any preexisting medical conditions that may have adversely affected the flight crew's performance during the flight. Flight crew fatigue was not a factor in this accident.

2. The accident airplane was properly maintained and dispatched in accordance with Federal regulations.

3. The air traffic controllers who handled American Airlines flight 587 were properly trained and qualified. The local controller complied with Federal Aviation Administration wake turbulence spacing requirements when handling flight 587 and Japan Air Lines flight 47, which departed immediately before flight 587.

4. The witnesses who reported observing the airplane on fire were most likely observing a fire from the initial release of fuel or the effects of engine compressor surges.

5. Flight 587's cyclic rudder motions after the second wake turbulence encounter were the result of the first officer's rudder pedal inputs.

6. Flight 587's vertical stabilizer performed in a manner that was consistent with its design and certification. The vertical stabilizer fractured from the fuselage in overstress, starting with the right rear lug while the vertical stabilizer was exposed to aerodynamic loads that were about twice the certified limit load design envelope and were more than the certified ultimate load design envelope.

7. The first officer had a tendency to overreact to wake turbulence by taking unnecessary actions, including making excessive control inputs.

8. The American Airlines Advanced Aircraft Maneuvering Program ground school training encouraged pilots to use rudder to assist with roll control during recovery from upsets, including wake turbulence.

9. The American Airlines Advanced Aircraft Maneuvering Program excessive bank angle simulator exercise could have caused the first officer to have an unrealistic and exaggerated view of the effects of wake turbulence; erroneously associate wake turbulence encounters with the need for aggressive roll upset recovery techniques; and develop control strategies that would produce a much different, and potentially surprising and confusing, response if performed during flight.

10. Before the flight 587 accident, pilots were not being adequately trained on what effect rudder pedal inputs have on the Airbus A300-600 at high airspeeds and how the airplane's rudder travel limiter system operates.

11. The Airbus A300-600 rudder control system couples a rudder travel limiter system that increases in sensitivity with airspeed, which is characteristic of variable stop designs, with the lightest pedal forces of all the transport-category aircraft evaluated by the National Transportation Safety Board during this investigation.

12. The first officer's initial control wheel input in response to the second wake turbulence encounter was too aggressive, and his initial rudder pedal input response was unnecessary to control the airplane.

13. Certification standards are needed to ensure that future airplane designs minimize the potential for aircraft-pilot coupling susceptibility and to better protect against high loads in the event of large rudder inputs.

14. Because of its high sensitivity (that is, light pedal forces and small pedal displacements), the Airbus A300-600 rudder control system is susceptible to potentially hazardous rudder pedal inputs at higher airspeeds.

15. To minimize the potential for aircraft-pilot coupling events, transport-category pilots would benefit from training about the role that alternating full control inputs can play in such events and training that emphasizes that alternating full rudder inputs are not necessary to control a transport-category airplane.

16. There is a widespread misunderstanding among pilots about the degree of structural protection that exists when full or abrupt flight control inputs are made at airspeeds below the maneuvering speed.

17. Federal Aviation Administration standards for unusual attitude training programs that take into account industry best practices and are designed to avoid inaccurate or negative training would lead to improvement and standardization of industry training programs.

18. The use of lower levels of automation, such as simulators without motion or simple computer screen displays, may be more appropriate to provide the necessary awareness training with less danger of introducing incorrect information.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the in-flight separation of the vertical stabilizer as a result of the loads beyond ultimate design that were created by the first officer's unnecessary and excessive rudder pedal inputs. Contributing to these rudder pedal inputs were characteristics of the Airbus A300-600 rudder system design and elements of the American Airlines Advanced Aircraft Maneuvering Program.