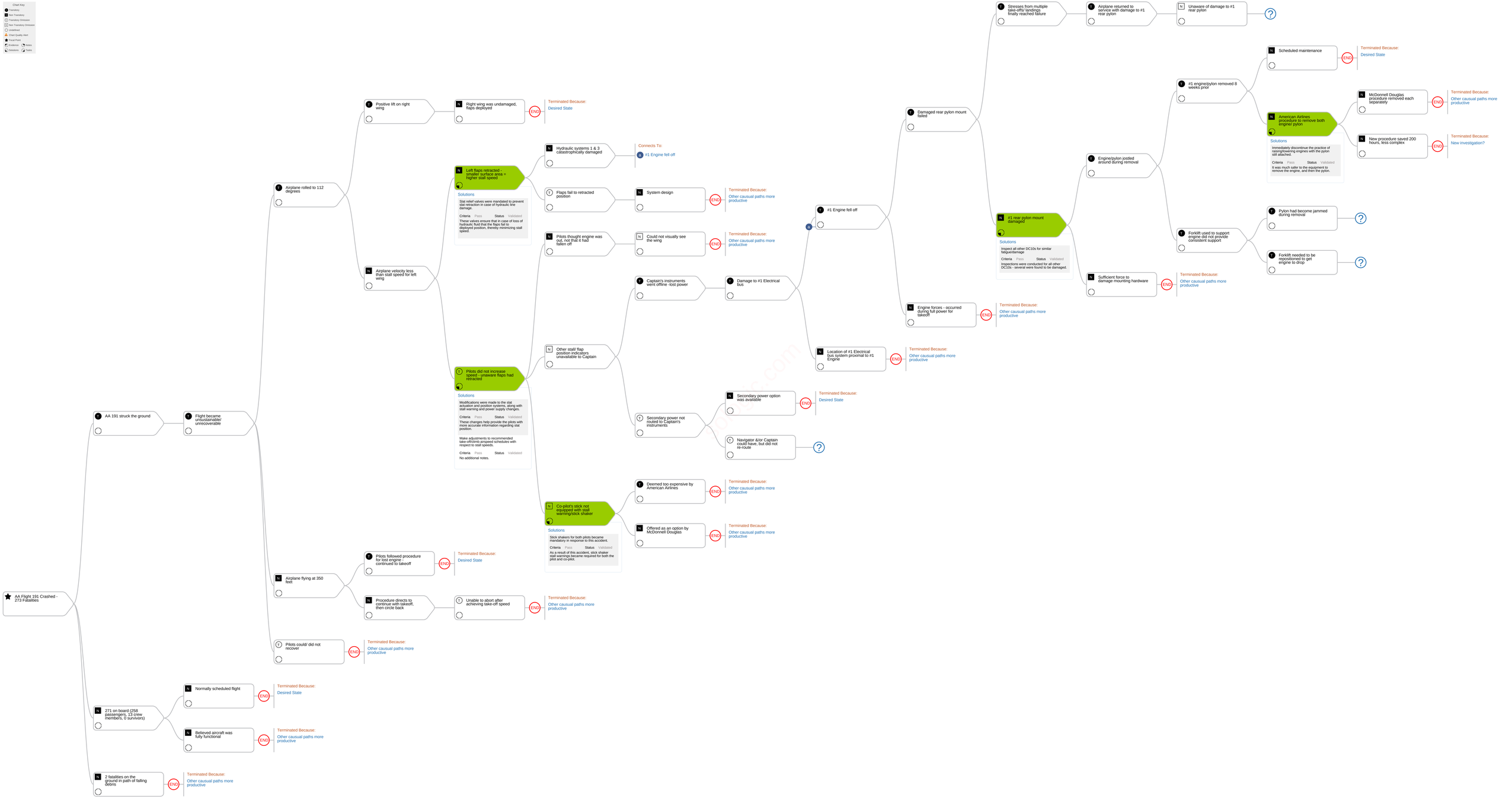
Chart Key
Transitory
Non Transitory
Transitory Omission
Non Transitory Omission
Undefined
Chart Quality Alert
Focal Point
Evidence
Notes
Solutions
Tasks
AA Flight 191 Crashed - 273 Fatalities
AA 191 struck the ground
Flight became unsustainable/ unrecoverable
Airplane rolled to 112 degrees
Positive lift on right wing
Right wing was undamaged, flaps deployed
END
Terminated Because:
Desired State
Airplane velocity less than stall speed for left wing
Left flaps retracted - smaller surface area = higher stall speed
Solutions
Slat relief valves were mandated to prevent slat retraction in case of hydraulic line damage.
Criteria Pass Status Validated
These valves ensure that in case of loss of hydraulic fluid that the flaps fail to deployed position, thereby minimizing stall speed.
Hydraulic systems 1 & 3 catastrophically damaged
Connects To:
#1 Engine fell off
Flaps fail to retracted position
System design
Terminated Because:
Other causual paths more productive
Pilots thought engine was out, not that it had fallen off
Could not visually see the wing
Terminated Because:
Other causual paths more productive
Pilots did not increase speed - unaware flaps had retracted
Solutions
Modifications were made to the slat actuation and position systems, along with stall warning and power supply changes.
Criteria Pass Status Validated
These changes help provide the pilots with more accurate information regarding slat position.
Make adjustments to recommended take-off/climb airspeed schedules with respect to stall speeds.
Criteria Pass Status Validated
No additional notes.
Other stall/ flap position indicators unavailable to Captain
Captain's instruments went offline -lost power
Damage to #1 Electrical bus
#1 Engine fell off
Damaged rear pylon mount failed
Stresses from multiple take-offs/ landings finally reached failure
Airplane returned to service with damage to #1 rear pylon
Unaware of damage to #1 rear pylon
#1 rear pylon mount damaged
Solutions
Inspect all other DC10s for similar fatigue/damage
Criteria Pass Status Validated
Inspections were conducted for all other DC10s - several were found to be damaged.
Engine/pylon jostled around during removal
#1 engine/pylon removed 8 weeks prior
Scheduled maintenance
Terminated Because:
Desired State
American Airlines procedure to remove both engine/ pylon
Solutions
Immediately discontinue the practice of raising/lowering engines with the pylon still attached.
Criteria Pass Status Validated
It was much safer to the equipment to remove the engine, and then the pylon.
McDonnell Douglas procedure removed each separately
Terminated Because:
Other causual paths more productive
New procedure saved 200 hours, less complex
Terminated Because:
New investigation?
Forklift used to support engine did not provide consistent support
Pylon had become jammed during removal
Forklift needed to be repositioned to get engine to drop
Sufficient force to damage mounting hardware
Terminated Because:
Other causual paths more productive
Engine forces - occurred during full power for takeoff
Terminated Because:
Other causual paths more productive
Location of #1 Electrical bus system proximal to #1 Engine
Terminated Because:
Other causual paths more productive
Secondary power not routed to Captain's instruments
Secondary power option was available
Terminated Because:
Desired State
Navigator &/or Captain could have, but did not re-route
Co-pilot's stick not equipped with stall warning/stick shaker
Solutions
Stick shakers for both pilots became mandatory in response to this accident.
Criteria Pass Status Validated
As a result of this accident, stick shaker stall warnings became required for both the pilot and co-pilot.
Deemed too expensive by American Airlines
Terminated Because:
Other causual paths more productive
Offered as an option by McDonnell Douglas
Terminated Because:
Other causual paths more productive
Airplane flying at 350 feet
Pilots followed procedure for lost engine continued to takeoff
Terminated Because:
Desired State
Procedure directs to continue with takeoff, then circle back
Unable to abort after achieving take-off speed
Terminated Because:
Other causual paths more productive
Pilots could/ did not recover
Terminated Because:
Other causual paths more productive
271 on board (258 passengers, 13 crew members, 0 survivors)
Normally scheduled flight
Terminated Because:
Desired State
Believed aircraft was fully functional
Terminated Because:
Other causual paths more productive
2 fatalities on the ground in path of falling debris
Terminated Because:
Other causual paths more productive