THA #370

Flight Test Area: Commercial Certification (FAA)

Document Number: 27.1323

Document Title: Airspeed Indicating System

Discipline: pitot-statics

Maneuver Title: Trailing Bomb

Maneuver Description: Constant speed runs are done in flight, both level and climbing or descending with a trailing reference sensor. Actual pressure height and speed of the rotorcraft is then compared to the trailing bomb sensed pressure height and speed to determine errors as a function of rotorcraft speed and climb/descent rate.

Hazard: Separation of trailing device from aircraft.

Aircraft Type(s): Rotary

Power Plant(s): Turboprop, Recip

Habitation: Yes

Risk Level: Low

Risk Criteria: combination of probability of occurrence and severity

Corrective Action: If the trailing device departs the aircraft, determine the impact point and, if possible and appropriate, land and render aid as required.

Cause(s):

1. Inadvertent release of trailing device.

Mitigation(s):

1.1 Prior to engine start, both pilot and copilot review switchology and procedures for cargo release.

Objective: Reduces Probability

Type: Training

1.2 After takeoff and achieving safe height and speed the pilot not flying should safe the cargo release mechanism.

Objective: Reduces Probability

Type: Procedure

1.3 Avoid overflight of populated areas.

Objective: Reduces Severity

Type: Procedure

Considerations: Reduces the consequences of an inadvertent release, should it happen.

1.4 Design release mechanism with good human factors to prohibit unintentional activation such as:  
 Location not near commonly used switches  
 Release switch/lever not like nearby ones  
 Require a 2-step activation (e.g. guarded)

Objective: Reduces Probability

Type: Analysis

THA #371

Flight Test Area: Commercial Certification (FAA)

Document Number: 27.1325

Document Title: Static Pressure Systems

Discipline: pitot-statics

Maneuver Title: Trailing Bomb

Maneuver Description: Constant speed runs are done in flight, both level and climbing or descending with a trailing reference sensor. Actual pressure height and speed of the rotorcraft is then compared to the trailing bomb sensed pressure height and speed to determine errors as a function of rotorcraft speed and climb/descent rate.

Hazard: Separation of trailing device from aircraft.

Aircraft Type(s): Rotary

Power Plant(s): Turboprop, Recip

Habitation: Yes

Risk Level: Low

Risk Criteria: combination of probability of occurrence and severity

Corrective Action: If the trailing device departs the aircraft, determine the impact point and, if possible and appropriate, land and render aid as required.

Cause(s):

1. Inadvertent release of trailing device.

Mitigation(s):

1.1 Prior to engine start, both pilot and copilot review switchology and procedures for cargo release.

Objective: Reduces Probability

Type: Training

1.2 After takeoff and achieving safe height and speed the pilot not flying should safe the cargo release mechanism.

Objective: Reduces Probability

Type: Procedure

1.3 Avoid overflight of populated areas.

Objective: Reduces Severity

Type: Procedure

Considerations: Reduces the consequences of an inadvertent release, should it happen.

1.4 Use good human factors design of the release system, such as making the release mechanism different from other nearby switches, coloring it differently, etc...

Objective: Reduces Probability

Type: Design

2. Failure of suspending cable

Mitigation(s):

2.1 Perform a thorough preflight inspection of trailing bomb system to include cable and attachment points.

Objective: Reduces Probability

Type: Procedure

3. Impact of trailing bomb with ground or obstacles.

Mitigation(s):

3.1 Determine and use a minimum safe altitude to use the trailing bomb. Review local maps and charts to know where obstacles are when testing at low altitude.

Objective: Reduces Probability

Type: Procedure

THA #375

Flight Test Area: Commercial Certification (FAA)

Document Number: 27.307

Document Title: Proof of Structure

Discipline: rotary flight envelope

Maneuver Title: Pull-up Maneuver

Maneuver Description: Trim at the target airspeed. Then with the collective fixed, pitch up and slow the rotorcraft. While still slow, depress the nose and begin an accelerating dive. Approaching the target speed, begin a pull-up to achieve the desired load factor at the initial trim speed, all at the level flight attitude.

Hazard: Loss of Control

Aircraft Type(s): Rotary

Power Plant(s): Turbojet, Recip

Habitation: Both

Risk Level: High

Risk Criteria: Typical per FAA Order 4040.26 and subjective combination of probability and severity.

Corrective Action: If mast bumping occurs, do not continue testing. Land immediately and do a maintenance inspection before further flight.

Cause(s):

1. Mast bumping during abrupt pullups at forward cg

Mitigation(s):

1.1 The preflight briefing will highlight the possibility of mast bumping during abrupt pullup maneuvers, especially with forward cg.

Objective: Reduces Probability

Type: Procedure

2. Mast bumping due to exceeding the target load factor (g's)

Mitigation(s):

2.1 Start pull-up maneuvers from a nose low attitude, initially at a low pitch rate; on subsequent pull-ups increase the pitch rate in small increments until the target g is obtained.

Objective: Reduces Probability

Type: Procedure

Considerations: A good technique for pull-up maneuvers is to use the following procedure. Trim at the target airspeed. Then with the collective fixed, pitch up and slow the rotorcraft. While still slow, depress the nose and begin an accelerating dive. Approaching the target speed, begin a pull-up to achieve the desired load factor at the initial trim speed, all at the level flight attitude.

2.2 The pilot not flying should call out g's in real time to assist the pilot flying avoid an over g condition.

Objective: Reduces Probability

Type: Procedure

2.3 Use a build-up process in the pull-up G level to avoid over-G.

Objective: Reduces Probability

Type: Procedure

THA #376

Flight Test Area: Commercial Certification (FAA)

Document Number: 27.143(c)

Document Title: Controllability and Maneuverability

Discipline: rotary flight envelope

Maneuver Title: Low Speed Controllabililty

Maneuver Description: As per CFR 27.143 and AC 27-1B, para. 27.143  
  
Verification flight tests include flying the helicopter at various azimuths including sideward and rearward flight up to and including 17 knots GS and at max altitude or 7000 feet, whichever is less (per the AC).  
  
Frequently the helicopter is tested to a speed well in excess of 17 knots. GS is accurately maintained using either a pace vehicle or onboard GPS equipment.

Hazard: Loss of Control

Aircraft Type(s): Rotary

Power Plant(s): Turbojet, Turbofan, Recip

Habitation: Yes

Risk Level: High

Risk Criteria: FAA Order 4040.26

Corrective Action: Either add collective to get away from the ground, or if ground impact is inevitable, lower collective and land.

Cause(s):

1. Loss of power due to engine compressor stalls

Mitigation(s):

1.1 A test buildup in density altitude and weight will be used beginning with low density altitude and low weight

Objective: Reduces Probability

Type: Procedure

1.2 Pilot/Engineer not flying will closely monitor engine parameters at and near limiting gross weight.

Objective: Reduces Probability

Type: Procedure

2. Loss of cyclic or pedal control margins

Mitigation(s):

2.1 Maximum wind should be 5 kts or less.

Objective: Reduces Probability

Type: Procedure

Considerations: When winds exceed 5 kts the possibility of a wind gust is higher and a sudden gust during a test point near the limit of controllability could cause loss of control.

2.2 Non-flying pilot or engineer should monitor control margins in real time.

Objective: Reduces Probability

Type: Analysis

Considerations: Minimum control margins should be established and briefed prior to testing. A control margin limit (usually pedal) is the lowest margin where a moment can still be generated (about 5 to 10%). CRM procedures and terminology should also be established and briefed prior to each flight.

2.3 Envelope expansion should be done in a buildup manner, both in terms of velocity and azimuth. Azimuth increments of 30 degrees should be flown and each azimuth should be expanded in speed from a hover in 5 kt increments.

Objective: Reduces Probability

Type: Procedure

Considerations: Benign azimuths should be done before the expected critical azimuths.

2.4 All crew should wear protective clothing and helmets

Objective: Reduces Severity

Type: Procedure

Considerations: In the event of ground impact, protective equipment and reduce injuries

2.5 Fire and rescue personnel and equipment should be on station and briefed on planned testing and associated hazards

Objective: Reduces Severity

Type: Procedure

2.6 When recovering from various azimuths to forward flight, limit yaw to a slow, controlled rate.

Objective: Reduces Probability

Type: Procedure

THA #386

Flight Test Area: Commercial Certification (FAA)

Document Number: 23.1329

Document Title: Automatic Pilot System

Discipline: flight controls

Maneuver Title: Autopilot Malfunctions

Maneuver Description: Malfunction Tests  
1. Climb, cruise, and descent flight regimes.  
 a) Corrective action should not be initiated until three seconds after the pilot has become aware that a malfunction has occurred. Loads should not exceed 0 to 2 Gs. Speed should not exceedVne or a speed midway between Vmo / Mmo and Vd / Md.   
The altitude loss should be measured.  
2. Maneuvering Flight.   
 a) Corrective action is taken one second after the result of the  
malfunction has alerted the pilot. Loads should not exceed 0 to 2 Gs. Speed should not exceed Vne or a speed midway between Vmo / Mmo and Vd / Md. The altitude loss should be measured.  
3. Oscillatory Tests.  
 a) Determine the effects of an oscillatory signal of sufficient amplitude to saturate the servo amplifier of each device that can move a control surface.  
  
Recovery of Flight Control.   
 Demonstrate recovery by overpowering or by manual use of an emergency quick   
disconnect device after the appropriate delay. The pilot should be able to return the airplane to its normal flight attitude  
under full manual control without exceeding the loads or speed limits defined above and without engaging in any dangerous maneuvers during recovery.   
  
See AC 23-17 Section 23.1329 beginning page 244 for details

Hazard: Loss of all Thrust

Aircraft Type(s): Cargo/Transport

Power Plant(s): Turbojet, Turbofan, Turboprop, Recip

Habitation: Yes

Risk Level: High

Risk Criteria: FAA Order 4040.26A

Corrective Action: None

Cause(s):

1. Second engine failure on one engine approach

Mitigation(s):

1.1 Review dual engine flameout and emergency relight procedures prior to intentional single engine operation.

Objective: Reduces Severity

Type: Procedure

1.2 Conduct test in location within gliding distance of suitable landing area.

Objective: Reduces Severity

Type: Procedure

THA #387

Flight Test Area: Commercial Certification (FAA)

Document Number: 23.1329

Document Title: Automatic Pilot System

Discipline: flight controls

Maneuver Title: Autopilot Malfunctions

Maneuver Description: Malfunction Tests  
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The altitude loss should be measured.  
2. Maneuvering Flight.   
 a) Corrective action is taken one second after the result of the  
malfunction has alerted the pilot. Loads should not exceed 0 to 2 Gs. Speed should not exceed Vne or a speed midway between Vmo / Mmo and Vd / Md. The altitude loss should be measured.  
3. Oscillatory Tests.  
 a) Determine the effects of an oscillatory signal of sufficient amplitude to saturate

Hazard: Controlled Flight Into Terrain (CFIT)

Aircraft Type(s): Cargo/Transport

Power Plant(s): Turbojet, Turbofan, Turboprop, Recip

Habitation: Yes

Risk Level: High

Risk Criteria: FAA Order 4040.26A. Note the test conditions that would be High risk are the ones close to the ground. Climb, cruise and descent conditions would probably be Low risk.

Corrective Action: If at any time the autopilot does something unexpected, disconnect in any way available and discontinue testing until anomaly is understood

Cause(s):

1. Pilots occupied with test related tasks.

Mitigation(s):

1.1 Minimum Crew for High risk (low altitude) points

Objective: Reduces Severity

Type: Procedure

1.2 Check AFCS disconnect function prior to each flight.

Objective: Reduces Probability

Type: Procedure

1.3 Pilot to guard controls

Objective: Reduces Probability

Type: Procedure

1.4 Brief termination criteria and recovery technique.

Objective: Reduces Probability

Type: Procedure

1.5 Safety pilot to monitor runway on approach conditions and make altitude callouts.

Objective: Reduces Probability

Type: Procedure

1.6 Establish a minimum safe test start altitude and "knock-it-off" altitude.

Objective: Reduces Probability

Type: Procedure

1.7 Weather:  
 a) VMC   
 b) Ground Contact (low altitude points)  
 c) Defined Horizon

Objective: Reduces Probability

Type: Procedure