Helicopter FSTD functions and subjective evaluation flight

ID code of the FSTD:

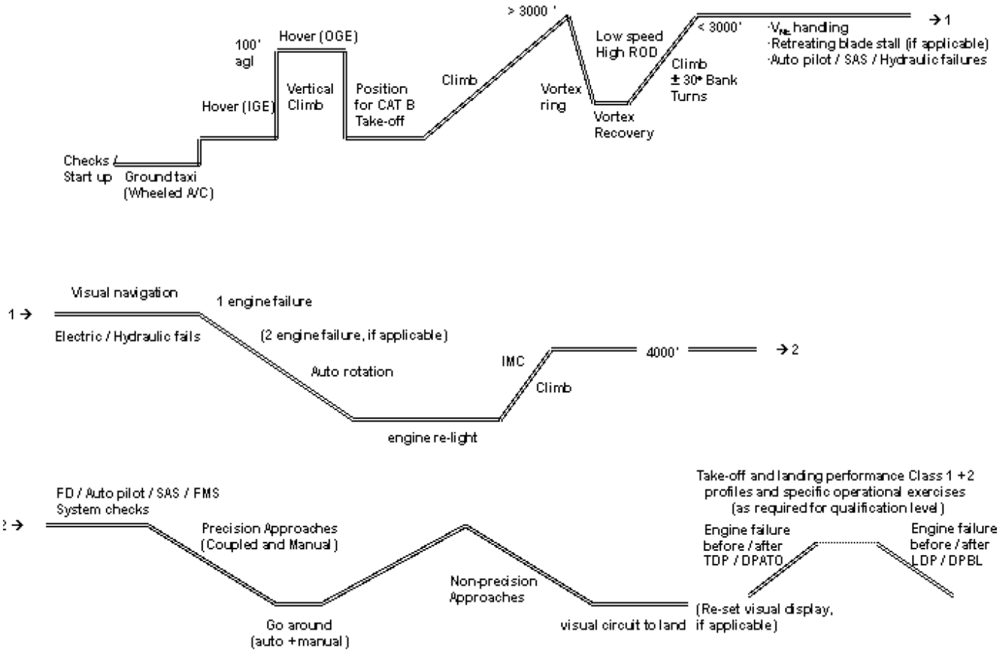
Evaluation date:

The table below presents a structure for a helicopter FSTD evaluation flight. However, this table is not a complete list for any device, so it should be customized for each functions and subjective evaluation flight. Type specific matters (handling, performance, system operation, etc.) should be included with references to flight manual (e.g. RFM). Note that OSD reports list specific training requirements for each aircraft type. Its information should be used and checked that the FSTD can be used for the specific training.

It is important that the test team remember these points for every tested item:

- How much different is the FSTD from real aircraft? How and where do you notice it?
- Has the handling of FSTD changed since last time?
- Is the device suitable for the training task in question?
- Does the device and its systems match the flight manual?
- Is the integration of the device good, i.e. are all the cues (control loading, flight dynamics, visual, motion, instruments, sounds…) given in correct sequence in a realistic manner?

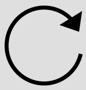
The table below is not too usable alone because of its length. Therefore, it is recommended to prepare a customized and abbreviated 'working checklist' for each evaluation. Also note that AMC1 ARA.FSTD.100(a)(3) gives a typical profile for the flight:



Initial conditions for the flight

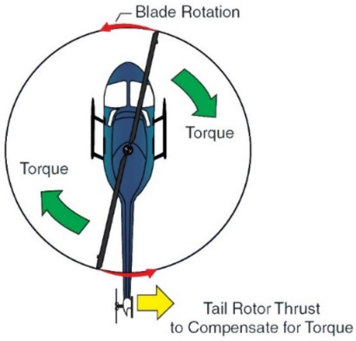
Set the initial conditions to be used for the flight	A/C & ENGINE VERSION:	AIRPORT:	VISIBILITY, CLOUDS & TIME OF DAY: CAVOK, daylight
	WIND:	QNH:	OAT:
	ZERO FUEL WEIGHT and CG:	FUEL WEIGHT:	GROSS WEIGHT (GW) and CG:

Legend for this document

Main rotor turning direction	**Power increase**	**Power decrease**
Counter-clockwise 	Requires left antitorque pedal and cyclic left and forward	Requires right antitorque pedal and cyclic right and aft
Clockwise 	Requires right antitorque pedal and right left and forward	Requires left antitorque pedal and cyclic left and aft

Apparently all North American helicopters have their main rotors turning counter-clockwise. French and Russian helicopters have their main rotors turning clockwise.

This checklist has been prepared by considering helicopters with main rotors turning counter-clockwise (see figure below). So in case of FSTD with rotor turning in the *opposite* direction remember that this checklist shows the *opposite* directions for controls (see table above)!



No.	TEST	DETAILS	REMARKS

A. Preflight

No.	TEST	DETAILS	REMARKS
1.	**Documents, walk-around, safety items**	See Traficom FSTD Form F17	
2.	**Cockpit**	Full Replica of Aircraft • Cockpit system panels (replica) • Cockpit placards • Controls: feel, free-play, friction... • Buttons, switches and levers should have same look & feel as in real A/C • Seats / harness • Headsets • Chart holder • Flash lights • Fire extinguisher, dummy or real, • Cut-off switch / switches	
3.	**Cockpit power off check**	Check that systems are not powered when there is no electrical power → Only systems powered by hot battery bus should be powered.	
4.	**Electrical power supply**	Battery Master ON → Check: • Battery, voltage.............	
5.	**External power**	EXT electrical power ON • Check voltage .... • Check power distribution • Check synoptics	
6.	**Cockpit checks**	**Pre-start checklists as per normal check lists.** → Check different self tests of systems. **Sampling check of all sub-systems:** • Cockpit lights & dimming • Annunciator lights • Cyclic position indication on ADI → Check disappearing with collective up • Circuit breakers • Display failure → Display composite format	

<table>
<tr><th>No.</th><th>TEST</th><th>DETAILS</th><th>REMARKS</th></tr>
<tr><td>7.</td><td>FMS / GPS functions</td><td>FMS / GPS manufacturer and version:
....
Database expiry date: ……………..

Check position initialization
FMS / GPS route programming and check on nav display
→ Save FPL on IOS.

Check FMS functions:
• Alternate FPL
• Changing runway
• Holding pattern</td><td></td></tr>
<tr><td>8.</td><td>Engine Starting</td><td>• EXT PWR OFF
• Normal engine start → Rotor engagement
(Note: for piston engines, a clutch is needed.)
• Alternate start procedure (e.g. governor auto/man)

• Hot start → Cranking
• Hung start
• Quick start

• After Start checks</td><td></td></tr>
<tr><td>9.</td><td>Engine idle and full rpm readings</td><td>Record parameters for ENG MODE switch at GND IDLE and FLIGHT:
→ Check acceleration from GND to FLIGHT mode.
→ Check motion cues.

<table>
<tr><th rowspan="2"></th><th colspan="2">GND mode</th><th colspan="2">FLIGHT mode</th></tr>
<tr><th>Eng 1</th><th>Eng 2</th><th>Eng 1</th><th>Eng 2</th></tr>
<tr><td>TQ</td><td></td><td></td><td></td><td></td></tr>
<tr><td>NG/N1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>ITT/TOT</td><td></td><td></td><td></td><td></td></tr>
<tr><td>NF/N2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>FLI</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>NR</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>PI</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>FF</td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

→ Try take-off with GND IDLE.</td><td></td></tr>
<tr><td>10.</td><td>Cyclic authority</td><td>Test large cyclic inputs on ground with collective at minimum pitch on ground (MPOG). Will the helicopter fuselage pitch or bank excessively (i.e. is the cyclic authority too high)? (It is expected that the disc attitude should change, but the disc should not have enough power the change the attitude of the fuselage.)

Repeat with cyclic raised a little.</td><td></td></tr>
<tr><td>11.</td><td>Before taxi</td><td>Perform normal checklists</td><td></td></tr>
</table>

No.	TEST	DETAILS	REMARKS

B. Taxiing and hover

12.	**Visual**	Check visual for: • Rotor tip path plane & blade's correct direction • Correct buildings • Maintenance ground equipment • Parked aircraft • Daylight shadows • Taxiway markings • Moving ground traffic • CAT I	

13.	**Taxiing**	• Taxi checklist
		• For helicopter with wheels:
		  ○ Brake operation, differential braking
		  ○ Nosewheel (steering by asymmetric braking?)
		  ○ Minimum radius turn (with pedals/brakes)
		  ○ Rolling tendency (in turns)
		  ○ Nose wheel steering & its locking
		  ○ Wind effects
		
		• Lift to hover → Check also lifting to hover without pedal input. The nose should turn to right (opposite direction of the rotor blades).
		
		• Collective friction
		• Check taxiing / air-taxiing
		→ Check how aircraft reacts to collective increase while on ground. Does the aircraft become airborne in correct <u>attitude</u> (often a few degrees bank to the left)?	

No.	TEST	DETAILS	REMARKS
14.	**Hover checks - handling**	Check required torque. Check motion vibrations. Check cyclic sensitivity in hover. Check pedal effectiveness when beginning and stopping hover turn → Tail rotor may reach its thrust limit when quickly stopping right hand side hover turn (for counter-clockwise main rotors). Check collective in hover: → Collective adjust the altitude in hover (due to ground effect). → Collective changes causes need for pedal input and lateral cyclic to maintain hover attitude. (Pulling the collective increases the torque, which must be compensated by increasing tail rotor thrust. This creates a need to use lateral cyclic to prevent lateral drifting due to tail rotor thrust change.) → Check TRQ and NR change vs. collective: • Helicopters with a governor or FADEC (common for turbine helicopters) keep NR constant. No need for manual throttle adjustments. **→ Check quick collective changes (ramp) to see NR changes/oscillations. Check also collective doublets.** **→ Select a governor/FADEC failure and check manual reversion and governing. Check engine parameters vs. collective.** • Helicopters with correlator have a mechanical connection between collective and throttle. NR is kept nearly constant but requires manual fine tuning. • Very old types can have fully manual throttle control. Collective primarily adjusts manifold pressure and throttle primary controls RPM (but both coupled and affect both). Check sensitivity of anti-torque pedals: → Check torque changes vs. required anti-torque pedal input. → During hover the anti-torque pedals are a rate device. Pushing pedal should result in certain yaw rate. → Check rolling tendency associated with pedal push (due to tail rotor is most often not mounted at vertical CG). Check automation for heading hold (if the type has such). Check releasing controls in hover with AFCS off. → Should result in diverging oscillations (period normally between 10-20 sec depending on main rotor size and characteristics). **Hover and slow flight in all SAS modes** → Check also with wind, turbulence & gusts. → For left translations: left and aft cyclic input, and right pedal. (Tail rotor could enter vortex at high velocity.) → For right translations: right and forward cyclic input, left pedal → Compare magnitude of control inputs for left/right translations. **Check high speed sideward and rearward flight.** **Check and exceed critical wind azimuth. → Loss of tail rotor effectiveness.**	

No.	TEST	DETAILS	REMARKS
15.	**Main rotor characteristics**	**Check general characteristics of the <u>main rotor system</u>:** A. <u>Fully articulated</u> where blades are allowed to flap, feather, and lead or lag independently of each other. • Limits for negative G to prevent rotor hitting tail. • Quick to reduce altitude (quick response to collective). B. <u>Rigid or hingeless</u> with blades flexibly attached to the hub. • <u>Very quick and responsive</u> system. Less lag in control response due to large hub moment typically generated. • <u>Vibrations</u> to fuselage in turbulence/gusty weather. • Strongest cross couplings • Mast moment indicator is needed. • Normally not too restrictive G limits. • On ground it is possible to tip the copter laterally with cyclic. → Also flapping limiter can prevent this and give vibration. C. <u>Semirigid or 'teetering'</u> usually composed of two blades rigidly mounted to the hub. Rotor hub is free to tilt. • Reaction to control has 'latency' to pilots because fuselage reacts slowly (since it hangs like a pendulum), but rotor disc reacts immediately. • Vibrations are high. • Vulnerable to mast bumping, so maneuvering in sideslip or low speed at extreme CG positions must be avoided (since they create high flapping angles)	
16.	**Cross couplings**	Check (for SAS off) that using one control effects on all the other axis indirectly. These and their magnitude are type specific and depend on rotor size (weight) and type and control linkages. Especially the cross couplings between roll and pitch depend heavily on helicopter type. **Check validation data (in MQTG) for primary reference or cross couplings.** Note: cross coupling effect are higher for hingeless rotor. The cross coupling for a helicopter with a tilted tail rotor may be for example as: When collective is raised in hover with AP off (i.e. no stabilization), the helicopter banks to the right and pitches up. This is because the tail rotor is tilted (so its thrust has a vertical component also) and therefore rolls the helicopter. And the vertical stabilizer gets an increased force downwards (i.e. pitch up moment) when main rotor thrust is increased by the collective. Therefore, always consider the shape of the whole helicopter when considering cross couplings!	Note: see more details of expected results in Ray W. Prouty's book "Helicopter Aerodynamics" chapter 21.

No.	TEST	DETAILS	REMARKS
17.	**Hover checks – attitude & performance**	**Check hover in head, cross and tailwind. And turbulence/gusts.** → Check: • Attitude (pitch and bank) for hover → Typically a little nose up and left bank. This is affected by the main rotor (hinges or not) and height of tail rotor (above CG or not). • Required control inputs ○ Check turbulence/gusts. Check need to control on all axis. • Required engine torque: ○ should be greater when altitude increases ○ should be less for headwind compared to zero winds or tailwind ○ compare torque for high/low NR • Pedal vs. yaw rate increases for tailwind (due to clean air to tail). • Record and check engine parameters for IGE/OGE: (see table below) • Record and check engine parameters for wind: (see table below)	

- Record and check engine parameters for IGE/OGE:

	IGE height_______ ft		**OGE height_______ ft**	
	Eng 1	Eng 2	Eng 1	Eng 2
TQ				
NG/N1				
ITT/TOT				
NF/N2				
FLI				
NR				
PI				
FF				

- Record and check engine parameters for wind:

	height ____ ft **zero winds**		**height ____ ft** **headwind ___ kts**		**height ____ ft** **tailwind ____ kts**	
	Eng 1	Eng 2	Eng 1	Eng 2	Eng 1	Eng 2
TQ						
NG/N1						
ITT/TOT						
NF/N2						
FLI						
NR						
PI						
FF						

No.	TEST	DETAILS	REMARKS

C. Manoeuvring

18.	**Translational lift**	Begin from IGE hover with a heavy gross weight with zero wind.
		• Accelerate forward very slowly.
		• Check vibrations and control positions for translational lift
		• Keep controls fixed stationary.
		
		• At about 10 kts the front rotor tip meets the vortices which have a downwards airflow which reduced lift at the front of the disc. This creates a slight roll to left. (Roll to right for backwards translations.)
		
		• **Check transverse flow effect** → Slight roll to right when accelerating through about 20 kts (zero wind). (Roll to left for backwards translations.)
		
		• **When passing about 30 kts (effective translational lift,** i.e. vortices are left behind and rotor receives clean air and hence better effectiveness):
		  ○ Torque increases → Associated yaw to left
		  ○ Pitch up moment (aft part of rotor produces more lift and gyroscope effect advances that by 90°)
		  ○ Vertical speed upward increases due to more lift
		
		Check that above mentioned phenomena is negligible in OGE.	

19.	**Maneuvering IGE/OGE**	**Check sideways & rearward flying** • Check pedal turn (in hover) → If collective is not raised, the helicopter descent slightly during turn since more power goes to tail rotor. → For right hand side turn the airflow to the tail rotor creates a vortex ring state. Tail rotor loses efficiency and therefore yaw rate increases (and can become uncontrollable for high pedal inputs). → When stopping right hand side pedal turn, the tail rotor blade angles increase rapidly. Their AoA increase may result in tail rotor stall. Also, drivetrain mechanism may be overloaded. Therefore, right hand side pedal turns must be stopped gently. → Check stopping of pedal turn in both directions: is it enough to relax the pedal pressure, or to press the opposite pedal? Compare to real aircraft. • Check autopilot hover (4 axis AP)	

No.	TEST	DETAILS	REMARKS
20.	**Controls & trims**	**Cyclic:** • Control force for all range (SAS on/off) → Does cyclic force depend on IAS? (Depends on if the control system is reversible or irreversible. Check manual.) • Check force trim functions → Detaches trim actuators and makes cyclic loose • Pitch / roll beep trim operation → Check its <u>control speed</u> of controlling of <u>attitude & upper modes</u> (FD modes). See RFM. • Follow-up trim operation for quick/slow cyclic inputs (follow-up trim makes flying at slow IAS easier by trimming automatically to desired attitude) **Collective:** • Force trim • Collective / yaw beep trim operation • Engine trim switches **Pedal:** • Control force for all range (SAS on/off) • Press pedal and release. Will and should pedal return to centre? Check system description from manual. **Check operation of all other switches in cyclic & collective** • Check trim synoptics	
21.	**Airport visual database**	• Taxiway markings & lights • Ground textures • Marker boards / signs → Compare to chart • Taxiway light and position • Light colors / brightness: **day / twilight / night** • CAT I hold position • Representative marking on ground • Runway light positions / colors • Directionality of airport lights • Airport environment for correct terrain and significant features • Check crashing into building / obstacle • **Check visual effect of own helicopter downwash (dry / wet tarmac, grass, snow)**	

<table>
<tr><th>No.</th><th>TEST</th><th>DETAILS</th><th>REMARKS</th></tr>
<tr><td>22.</td><td>Environment effects</td><td>
Instructor controls of:

Cloud base / top
Visibility
RVR
Aerodrome lighting (light intensity)
Ground and flight traffic

Check RVR setting on IOS vs. runway edge lights at airport & runway: ....
<table>
<tr><th></th><th>Preset CAT I (500 m)</th><th>Preset CAT II (300 m)</th><th>Preset LVTO</th></tr>
<tr><td>Day</td><td></td><td></td><td></td></tr>
<tr><td>Dusk</td><td></td><td></td><td></td></tr>
<tr><td>Night</td><td></td><td></td><td></td></tr>
</table>
Check weather and visual effects:

External lights (ldg light, search light, strobes...) and reflection from fog
Rain (rwy surface, lights, blurry image)
→ Check use of wipers
Brown out, white out

</td><td></td></tr>
</table>

No.	TEST	DETAILS	REMARKS

D. Takeoff and climb

23.	**Rejected take-off / Quick stop after engine failure**	Perform a short field take-off profile → Engine failure just before TDP → Perform a quick stop with aggressive flare. → How strong right pedal input is required to stop yawing? → Measure distance used along runway.	
24.	**Clear area takeoff**	Normal take-off or rolling take-off Check motion and visual cues during acceleration Establish at V_Y=..............kt	Describe the profile:
25.	**Climb performance**	Vertical climb for low/high NR (e.g. 100/102%) → A rule of thumb: When NR increases by X %, the lift of the main rotor increases by 2X % (because rotor thrust ~ NR^2, i.e. T ~ ω^2 and $T=C_T\rho A\omega^2R^2$). For example if NR increases 2%, lift increases by 4%. Record climb parameters & compare to RFM. → Rate of climb tolerance is ±100 fpm or 10% Climb while maintaining recommended speed profile. Sideslip (HDG vs TRK at zero wind) .... Slip ball attitude .... Bank attitude .... Pitch attitude .... Start Altitude .... time 0 sec End altitude .... time .... Recorded R/C ...., R/C by Flight Manual .... Difference in R/C .... VSI at start ...., VSI at end	Note the difference between: -minimum drag attitude -wings level & slip ball centered Measure the inherent sideslip.

No.	TEST	DETAILS	REMARKS

E. Cruise

26.	**Route flight segment & navigation**	Check **radio navigation and GPS** systems and displays → Fail a navigation unit/source and select data from opposite side. Use of FMS and manual tuning of ground stations → Check FMS navigation functions such as: • direct to • add/delete waypoint • change STAR or destination Fail AHRS and/or ADS. Check indications. Check autopilot operations	
27.	**Communication**	Idents, ATIS, communications → Note that 8.33 kHz was required by 31.12.2017 but some countries have made exempetions: https://ext.eurocontrol.int/833/Airspace_8.33kHz_Radio.html	
28.	**Visual**	Check **visual navigation** → Below 5000 ft should be possible to navigate by sole reference to visual landmarks. Terrain contouring should be suitably presented. Check different clouds and visibilities.	
29.	**Avionics & systems**	Check (by sampling) normal and backup operation of systems	
30.	**Climb & cruise performance**	Check & record **performance** characteristics → Compare to RFM	
31.	**FD modes**	**Refer to RFM.** Check use of FD modes ('upper modes'): • ALT captures • NAV captures at different airspeeds and intercept angles • IAS mode and ALT change → Vary IAS speeds • V/S hold and IAS hold → Vary both V/S and IAS Check <u>malfunction(s)</u> for FD modes. Check that AFCS keeps slip ball in the middle (turn coordination). Check mode limitations (e.g. max angle to join LOC) as per RFM. Check 4-axis control functions. Check associated malfunction.	

No.	TEST	DETAILS	REMARKS

F. Manual flying and SAS

32.	**Manual flying characteristics**	Check manual flying at different airspeeds and altitudes, e.g. acceleration / decelerations, turns, control forces and buffet for different airspeeds Change gross weight and CG for / aft limits For aggressive maneuvering (see FAA "Helicopter flying handbook" page 9-2) this applies to most helicopters: • Left turns, TQ increases (more antitorque) • Right turns, TQ decreases (less antitorque) • Aft cyclic, TQ decreases, NR increases • Forward cyclic, TQ increases, NR decreases • In steep turns, nose drops IAS increase causes pitch up moment (requiring forward cyclic to maintain level flight) → Translation backwards causes pitch down moment. (See Raunio's book para 11.5.) Check NR/engine (NR/N2) split with engines running by quickly lowering the collective fully down.	
33.	**SAS and control inputs**	With no attitude mode or upper mode active (i.e. SAS only), check the following for different airspeeds from Vtoss to max cruise speed: • Trim for hands-off level flight with constant IAS. • Make a small cyclic movement (against spring) and keep it for a few seconds. Check that heading/pitch start changing. • Bring the cyclic back to neutral trim point. • Does the helicopter attitude follow the cyclic nicely? Or does this initiate oscillations? Compare to the real helicopter behavior. ATT hold mode coupled, check the following inputs (≈±10% of whole scale): • Cyclic pitch/roll • Collective • Pedal Check roll moment due to sideslip: sideslip to right should cause rolling moment to left.	
34.	**SAS off**	Helicopter is in its least stable state. → The smaller the airspeed, the greater the instability. (Above 50-60 kts pedals are not needed, but are needed below.) Instrument flying requires a lot of piloting. **→ Check ILS approach in CAT I with SAS off**	

No.	TEST	DETAILS	REMARKS
35.	**Free responses**	From a trimmed level flight, excite a quick pedal doublet. → See directional yaw oscillations for all AP/SAS modes. From a trimmed level flight, excite a quick cyclic input. → See oscillations for all AP/SAS modes (damped response?). From a trimmed flight, rapidly increase torque with collective. → See oscillations for all AP/SAS modes. See cross coupling.	
36.	**Power management**	Check power management (manual & automatic) Check transient changes in NR: increase torque quickly → NR reduction decrease torque quickly → NR increase Fail EEC / FADEC → Check manual engine operation Check torque limiter and other protections Pull collective until drop in NR. → Check warning	
37.	**Entering vortex conditions**	Vortex ring = rotor tip vortices become enlarged, helicopter settles into its own downwash, rotor stalls Enter vortex by vertical descent (easiest to experience at hover ceiling with IAS=0 kts) with RoD minimum 300 fpm (test different RoD up to ≈ 1000 fpm), constant TQ ≈ 20-100%. → Increase torque gradually when the first vibrations occur. → Check for vortex indications: vibrations/oscillations (motion and/or flight controls), loose controls and rapidly increasing RoD, increasing collective results in greater rate of descent Recovery: Cyclic forward and collective momentarily down → Check helicopter correct response	
38.	**Turning climb, acceleration**	Climb at Vy and bank 30 degrees left and right. Level off ft and accelerate to MCP	

No.	TEST	DETAILS	REMARKS
39.	**Retreating blade stall**	Check IAS > VNE. Check retreating blade stall: → Fly level flight with MCP to max continuous level speed (Vh) → Then descent and accelerate to Vne → Low NR may be needed. → Fly overspeed and then make a small cyclic aft or collective up movement. → Select these to get results easier: • High gross weight • High airspeed, • High altitude • Steep turn if necessary • Select EEC to manual mode to manually set low NR. → Check vibrations, pitch up and/or left bank moment.	

No.	TEST	DETAILS	REMARKS

G. Systems

40.	**TCAS**	Check both correct are wrong/delayed pilot actions. Check that RAs are correct for both. Check that the required vertical speed (mostly 1500ft/min or 2500 ft/min depending or RA) are correct. Check that TCAS functions correctly when the set QNH is different from the standard 1013 hPa. Used scenarios and altitudes: _______________	
41.	**Icing**	Check effects of icing (with anti-ice equipment off) in level flight → Then select anti-ice equipment on and check that their effect	
42.	**Weather radar (WXR)**	Select a thunderstorm → Check operation and indications of weather radar Check ground mapping Check ARA approach	

No.	TEST	DETAILS	REMARKS

H. Descent and autorotation

43.	**Descent**	Check normal descent. Check low speed and high rate of descent.	
44.	**Dual engine failure**	Fail one engine → Check handling characteristics during transition AEO -> OEI → Then fail second engine • Check autorotation entry (NR vs. collective) → Yaw moment (creates a sideslip which could generate roll angle if not corrected by the pilot) → Check NR decay vs. collective lowering (different pilot reaction times, e.g. 0-2 seconds) → Check how much right pedal is needed to stop yawing. → Check minimum NR below which NR can't be recovered. • Check autorotation handling characteristics: o Slip ball indication and sideslip (HDG vs TRK) o Rotor RPM vs. collective and required pedal input. o Check rotor RPM for collective fully down (RPM controlled by the mechanical stops) o Aft cyclic input loads the rotor (coning) and NR increases. o Forward cyclic input unloads the rotor and NR decreases. o Pedal input during turns causes loss of airspeed and downward pitching. • Check indications, instruments and synoptics → Rotor RPM (NR) higher than engine N2 or NF RPM, i.e. split. • Check autorotation performance: IAS ______ (use max endurance speed, i.e. min RoD speed), RoD ______ GW ______ Sideslip (HDG vs TRK) ______ • **Check flare and touchdown** → Check rotor inertia. → How much energy and for what time can be received from the rotor? → Check use of appropriate flare technique (see also RFM): • cyclic flare (up to 45˚) as long as possible (results in NR increase) • flare will diminish by itself • then a rapid collective pull → Check min NR on touchdown **Check warning for high/low NR and check synoptics.** Check also: • Vertical autorotation (IAS ≈ 0 kts) • Autorotation with autopilot/flight director in IMC • Complete engine power loss from hover in IGE (a landing without damage should be successful for a light helicopter) • Minimum NR below which NR can't be recovered	

No.	TEST	DETAILS	REMARKS

I. Instrument take-offs and approaches

45.	**Instrument take-off** (after quick start)	Select CAT I (500 m, 200 ft) → Check transition to instruments vs. visual	
46.	**LVTO**	Set minimum allowed RVR (RVR 150 m) → Check take-off. Check visual cues. Check lights.	
47.	**ILS coupled approach**	Select CAT I weather Check on different approaches: • Check 4-axis AP (i.e. kees also IAS) when turbulence / gusts / x-wind is selected • Fail one AP → Check changing to another AP • **Check altimeter cold air temp error (OAT -30°C)** • Check automatic level off (if applicable) • **Check loss of translational lift at ≈25 kts** → It should create a pitch up moment which is balanced by cyclic. • Check running / roll-on landing	
48.	**Go around, autocoupled**	Establish holding with AP coupled → Check G/A mode indications → Enter holding pattern manually to FMS if needed	
49.	**Reposition for Non-precision approach**	• VOR / LOC / NDB approach	
50.	**PBN**	• Check RNAV (GNSS) approach → Check indications and avionics as per type → Check coupling to AP upper modes → Check possible VNAV guidance, source (baro or SBAS) and profile → Check RNP change from 1.0 to 0.3 • Check LPV approach Check associated RNAV system malfunctions. → Check nav accuracy (on FMS) and warnings → Check RAIM before/after malfunction Check go-around → Check sequencing of waypoints → Enter missed approach holding with autopilot	
51.	**Visual circuit to land**	Check visual: • Directionality of lights • Minimum weather for circuit	

No.	TEST	DETAILS	REMARKS

J. Engine failures and CAT A

52.	**Clear area** **CAT A take-off** **Engine fail** **before TDP**	Reposition to runway take-off position Set conditions: Max CAT A take-off weight:.............. OAT: .... °C TDP: .... ft → Check database day / twilight / night → Check handling characteristics & performance	Describe the profile:
53.	**Helipad CAT A take-off** **Engine fail** **before TDP**	Reposition to helipad Set conditions: Max CAT A take-off weight:.............. OAT: .... °C TDP: .... ft	
54.	**Helipad CAT A take-off** **Engine fail after TDP**	Set conditions: Max CAT A take-off weight:.............. OAT: .... °C TDP: .... ft Check OEI power timer and limits Check **Ng topping** (automatic power addition to remaining engine to maintain NR constant). For example if both engines are at 40% TRQ and one engine fails, the other engine is set to 80% (=2 x 40%).	
55.	**Helipad CAT A take-off** **Engine fail** **before LDP**	Quick start engine Reposition to helipad final Fly CAT A runway approach → Check engine failure before LDP → Check OEI fly away → Check exceeding OEI engine limits.	
56.	**Engine fire**	Visual take-off to traffic circuit → Engine fire at down wind leg → Check warnings: CAS, eng control lever, eng control panel, fire detection panel → Check indications & systems after shutdown	
57.	**OEI landing**	Check handling characteristics & hover performance	

No.	TEST	DETAILS	REMARKS

K. Systems and special training cases

58.	**Crash**	Check crashing to obstacles (tree, building, power line...)	
59.	**System failures**	Sample multiple system malfunctions. Write a list below: • • • • •	
60.	**Hydraulics failures**	Hydraulic system failure → Emergency landing gear extension → Landing with touch down. Check gear.	
61.	**Electric failures**	• Generator and/or bus failures	
62.	**Tail rotor failures**	Reposition to final → Select tail rotor failures: Check <u>tail rotor **pitch angle** stuck</u> • Approach and landing • Check that yaws to right when raising collective. Check <u>tail rotor **drive shaft** failure</u> • Autorotational landing Fly intentionally below minimum speed with high engine power. → Check that the helicopter spins to the right (for counterclockwise rotors). Spin rate is proportionate to the amount of power being used.	
63.	**Smoke**	Check smoke generation system	
64.	**FMS SAR modes**	Check FMS SAR modes: 1 hoist pick-up	
65.	**EGPWS / TAWS**	Simulated version: .... Check functions.	
66.	**ARA**	Check airborne radar approach onto oil rig • Check radar echoes. • Aid from NDB / GPS? • Check oil rig in visual Is oil rig on Northern Sea available? It would be good for training purposes.	
67.	**Elevated FATO (final approach and takeoff area)**	Check visual database. Check its operational use and required handling characteristics. Check wind circulation for oil rig, etc	
68.	**Ship landing**	Check landing on ship	
69.	**Ditching**	Check ditching with floats	

No.	TEST	DETAILS	REMARKS
70.	**External load**	Check short and long lone load lifting Check dual rescue hoist operations Check use of cargo hook camera	
71.	**Confined area and/or slope**	Check visual database. Check its operational use and required handling characteristics. Check maximum performance take-off (nearly vertical profile). Check landing & take-off on a slope → Critical for counter-clockwise rotor helicopters: right side wheel down (since translating tendency adds to the rollover force), crosswind from left, left yaw input, CG on the right laterally.	
72.	**Special scenarios**	Any other items to be evaluated, for example: • Sinking ship • Car chase • SAR • Windshear • Hoist operations • NVG / NVIS: Check first that the dark closed cockpit has no light leaks. Then move to checking of NVG/NVIS in different flight and weather conditions. • Etc…	
73.	**After landing**	Shutdown engines → Check N1 deceleration. Check ITT behavior.	

TCAS

See also CAT.IDE.A.155 and GM1 CAT.OP.MPA.295 and EASA ETSO-C118 and ETSO-C119.

- **TCAS II ver 7.1:** Required in Europe for all new aircrafts after 1 March 2012. Required for all aircraft after 1 Dec 2015. Same as ver 7.0 with the following changes:
  - CP112E: Aircrafts on same level. → Pilot reacts in **opposite direction** to RA, so both aircraft start climb or descent. → Situation should result in **reversal** climb/descent.
  - CP115: RA "Adjust vertical speed, adjust" is replaced with single "Level-off" (i.e. 0 ft/min). New aural alert (source Eurocontrol, 'Overview of ACAS II', version 3.0, 12 Jan 2012) is:

UPWARD SENSE			**DOWNWARD SENSE**		
RA	**Required ft/min**	**Aural**	**RA**	**Required ft/min**	**Aural**
Level off	0	Level off; level off	Level off	0	Level off; level off

- **TCAS II ver 7.0:** Based on 1000 ft separation. Required for RVSM airspace. Altitude threshold for TA is 850 ft. Altitude threshold for RA it is 300-700 ft depending on altitude. Target vertical miss distance is 300-700 ft depending on altitude. TA caution area 20-48 sec. RA warning area 15-35 sec. All RAs are inhibited below 1000 ft AGL RA. Aural alerts (source Eurocontrol, 'Overview of ACAS II', version 3.0, 12 Jan 2012):

UPWARD SENSE			**DOWNWARD SENSE**		
RA	**Required ft/min**	**Aural**	**RA**	**Required ft/min**	**Aural**
Climb	1500	Climb, climb	Descend	-1500	Descend, descend
Crossing Climb	1500	Climb, crossing climb; Climb, crossing climb	Crossing Descend	-1500	Descend, crossing descend; Descend, crossing descend
Maintain Climb	1500 to 4400	Maintain vertical speed, maintain	Maintain Descend	-1500 to -4400	Maintain vertical speed, maintain
Maintain Crossing Climb	1500 to 4400	Maintain vertical speed, crossing maintain	Maintain Crossing Descend	-1500 to -4400	Maintain vertical speed, crossing maintain
Reduce Descent → Replaced in 7.1	0, -500, -1000, -2000	Adjust vertical speed, adjust	Reduce Climb → Replaced in 7.1	0, 500, 1000, 2000	Adjust vertical speed, adjust
Reversal Climb	1500	Climb, climb NOW; Climb, climb NOW	Reversal Descent	-1500	Descend, descend NOW; Descend, descend NOW
Increase Climb	2500	Increase climb, increase climb	Increase Descent	-2500	Increase descent, increase descent
Preventive RA	No change	Monitor vertical speed	Preventive RA	No change	Monitor vertical speed
RA Removed	-	Clear of conflict	RA Removed	-	Clear of conflict

- **TCAS II ver 6.04:** This was never mandated in Europe. Based on 2000 ft separation at FL300. Not approved for RVSM airspace above FL300. Altitude threshold for TA is 1200 ft. Altitude threshold for RA it is 800 ft. RA is either preventive or corrective. Target vertical miss distance is 300-700 ft depending on altitude. All RAs are inhibited below 400 ft AGL RA. TA caution area 20-48 sec. RA warning area 15-35 sec. Aural alerts (source FAA AC 20-131A, 29 Mar 1993)
  - Climb RA "Climb, Climb, Climb"
  - Descend RA "Descend, Descend, Descend"
  - Preventive RA "Monitor Vertical Speed; Monitor Vertical Speed"
  - Reduce Climb "Reduce Climb; Reduce Climb"
  - Reduce Descent "Reduce Descent; Reduce Descent"
  - Altitude Crossing Climb "Climb, Crossing Climb; Climb, Crossing Climb"
  - Altitude Crossing Descent "Descend, Crossing Descend; Descend, Crossing Descend"
  - Increase Climb "Increase Climb; Increase Climb"
  - Increase Descent "Increase Descent; Increase Descend"
  - Reversal to a Climb "Climb, Climb Now; Climb, Climb Now"
  - Reversal to a Descent "Descend, Descend Now; Descend, Descend Now"
  - Clear of Conflict "Clear of Conflict"

- **TCAS I:** Does not provide RA. Provides TA only. TCAS I is not mandated in Europe and there are no operational rules regarding the use of TCAS I. TCAS I is intended to operate using Mode A/C interrogations only. Furthermore, it does not coordinate with other TCAS. Therefore, a Mode S transponder is not required as a part of an TCAS I installation. Aural alert is "Traffic, Traffic".

Categories A and B, performance classes 1, 2 and 3

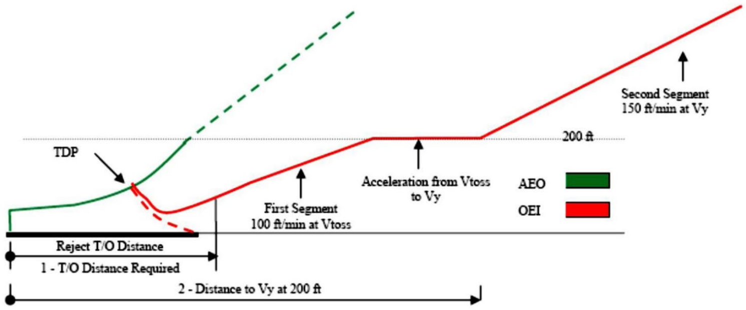
Source: EASA regulations (e.g. Part-CAT)

Category A and category B are related to aircraft certification (see CS-27 and CS29)

- '**Category A** with respect to helicopters' means a multi-engined helicopter designed with engine and system isolation features specified in the applicable airworthiness codes and capable of operations using take-off and landing data scheduled under a critical engine failure concept that assures adequate designated surface area and adequate performance capability for continued safe flight or safe rejected take-off in the event of engine failure.
- '**Category B** with respect to helicopters' means a single-engined or multi-engined helicopter that does not meet Category A standards. Category B helicopters have no guaranteed capability to continue safe flight in the event of an engine failure, and unscheduled landing is assumed.

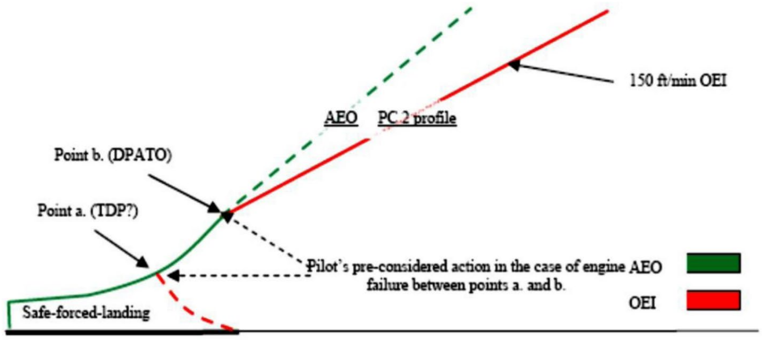
Performance classes 1, 2 and 3 are related to operations (see Part-CAT)

- 'Operation in **performance class 1**' means an operation that, in the event of failure of the critical engine, the helicopter is able to land within the rejected take-off distance available or safely continue the flight to an appropriate landing area, depending on when the failure occurs.
  → Helicopters operated in performance class 1 shall be certified in category A.



PERFORMANCE CLASS 1

- 'Operation in **performance class 2**' means an operation that, in the event of failure of the critical engine, performance is available to enable the helicopter to safely continue the flight, except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which cases a forced landing may be required.
  → Helicopters operated in performance class 2 shall be certified in category A.
  → Performance class 2 is an AEO take-off that, from DPATO, has to meet the requirement for OEI obstacle clearance in the climb and en-route phases. Performance class 2 can be considered as *performance class 3 take-off or landing*, and performance class 1 climb, cruise and descent. It comprises an all-engines-operating (AEO) obstacle clearance regime for the take-off or landing phases, and a OEI obstacle clearance regime for the climb, cruise, descent, approach and missed approach phases.



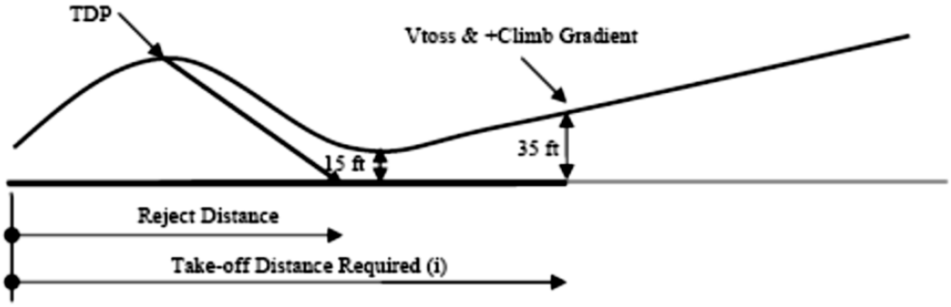
PERFORMANCE CLASS 2

- 'Operation in **performance class 3**' means an operation that, in the event of an engine failure at any time during the flight, a forced landing may be required in a multi-engine helicopter and will be required in a single-engine helicopter.
  → Helicopters operated in performance class 3 shall be certified in category A or category B.

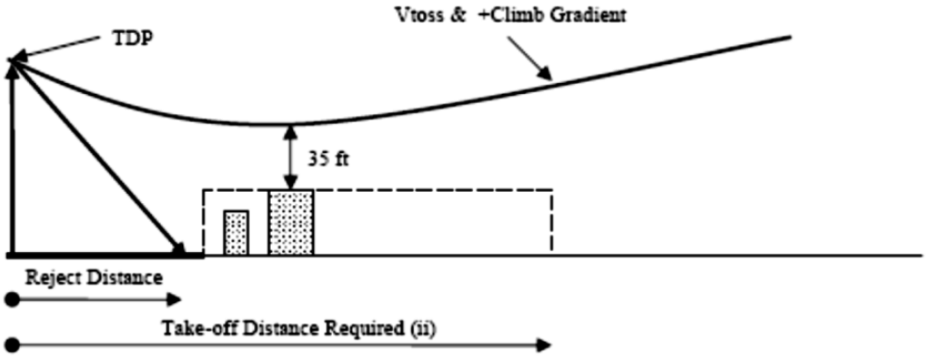
Definitions of take-off profiles

Source: EASA regulations (e.g. GM to Section 2, Chapter 3 performance class 2)

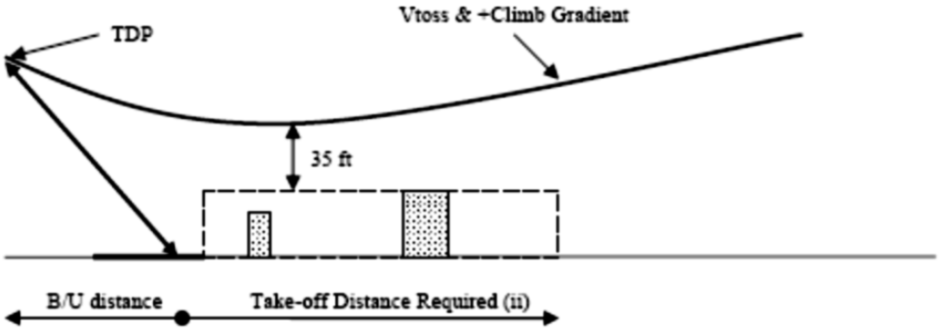
CAT A clear area take-off procedure (runway)



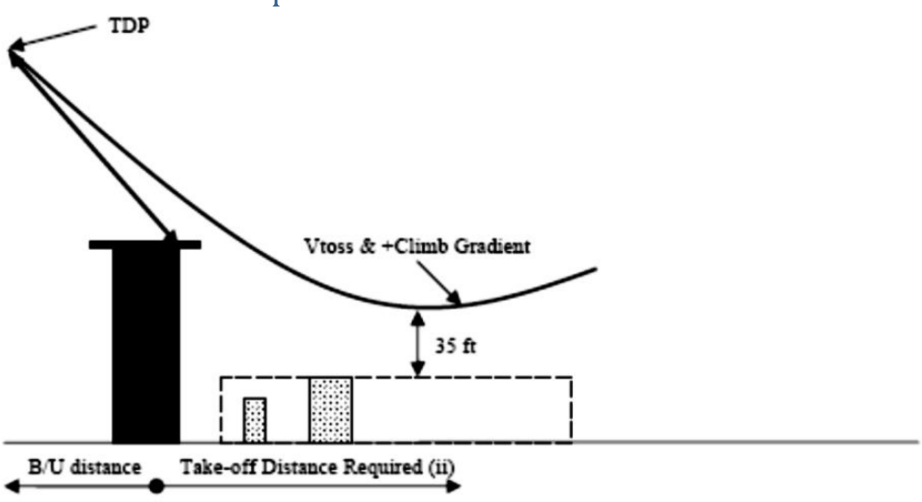
CAT A short field take-off



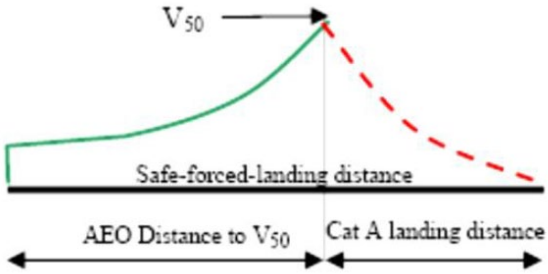
CAT A helipad take-off



CAT A elevated helipad take-off



CAT B safe-forced-landing



Performance class 2 helideck / elevated FATO take-off