# EASA Operational Suitability Data (OSD) Flight Crew Data

R66

RTR 665

September 2015

# Revision Record

| Revision No. | Section | Pages No. | Date |
|---|---|---|---|
| OEB report | All | All | 16/05/2014 |
| OSD Report | All | All | 28/09/2015 |
| | | | |
| | | | |

# Contents

# OSD – Group Composition

| Name | Position | Office / Branch | Remarks |
|---|---|---|---|
| Stephen Turnour | Certification Manager | Robinson Helicopter company | |
| Tim Tucker | Test Pilot/ Instructor | Robinson Helicopter company | |
| Herbert Meyer | OSD Section manager | EASA | 09/2014 |
| Jean-Marc Sacazes | OEB section manager | EASA | Till 09/2014 |
| Fred Cross | OSD Pilot | EASA | |
| Huysmans Roel | OSD Chairman and Pilot | EASA | |

# Executive Summary

## Manufacturer Application

In August 2013, Robinson Helicopter Company made a formal application to EASA, Certification Directorate – for an OEB for the evaluation of the new R66 helicopter.

In September 2015 the report was transferred into OSD FC data in accordance with CS-FCD, Initial issue 31/01/2014 and the relevant requirements for pilot licensing and air operations which were applicable at the time of the evaluation.

## Scope of the evaluations

The OSD report addresses:

- Aircraft Type Designation and Pilot License Endorsement;
- Pilot Initial Type Rating Training "minimum syllabus" (ITR)
- Additional Type Rating Training "minimum syllabus" (ATR)
- TASE Training areas of special emphasis.

## Preamble

Where references are made to requirements and where extracts of reference texts are provided, these are at the amendment state at the date of evaluation or publication of this document. Users should take account of subsequent amendments to any references, in particular concerning requirement for civil aviation aircrew and air operations.
Determinations made in this document are based on the evaluations of specific configurations of aircraft models, equipped in a given configuration and in accordance with current regulations and guidance.
Modifications and upgrades to the aircraft evaluated require additional OSD assessment for type designation, training / checking / currency, operational credits, and other elements within the scope of the OSD evaluations.
In accordance with Commission Regulation (EU) No 69/2014 of 27 Jan 2014, the Operational Suitability Data contained in this document are identified as follows:

**[M]** Mandatory Operational Suitability Data (OSD), bearing the status of rule (see GM No 3 to 21A.15(d))

**[AMC]** Non-mandatory Operational Suitability Data (OSD), bearing the status of Acceptable Means of Compliance (see GM No 3 to 21A.15(d))

*Robinson R66 is listed in the Type Certificate Data Sheet delivered by EASA under Type Certificate Data Sheet* EASA.IM.R.507.

# Abbreviations / Acronyms

| | |
|---|---|
| AC | Alternating Current |
| AMC | Acceptable Means of Compliance |
| ATR | Additional Type Rating |
| CPD | Common Procedure Document |
| DAU | Data Acquisition Unit |
| DC | Direct Current (electrical) |
| EASA | European Aviation Safety Agency |
| EDU | Electronic Display Unit |
| FADEC | Full Authority Digital Engine Control |
| FFS | Full Flight Simulator |
| FSTD | Flight Simulation Training Device |
| FTO | Flight Training Organization |
| GA/TU | Go Around / Transition Up |
| IEM | Interpretative and Explanatory Material |
| IFR | Instrument Flight Rules |
| IR | Instrument Rating |
| ITR | Initial Type Rating |
| MDR | Master Difference Requirements |
| MET-H | Multi Engine Turbine (Helicopter) |
| MGT | Measured gas (turbine) temperature |
| MTOM | Maximum Take Off Mass |
| NAA | National Aviation Authority |
| N/A | Not Applicable |
| ODR | Operator Differences Requirements |
| OEI | One Engine Inoperative |
| OEB | Operational Evaluation Board |
| OPS | Flight Operations |
| OTD | Other Training Device |
| PFL | Practice forced landing |
| PIC | Pilot in Command |
| RFM | Rotorcraft Flight Manual |
| RPM | Revolution Per Minute |
| SET(H) | Single Engine Turbine (Helicopter) |
| TRI | Type Rating Instructor |
| TRTC | Type Rating Training Course |
| TRTO | Type Rating Training Organization |
| VFR | Visual Flight Rules |
| VNE | Velocity Never Exceed |
| VTOL | Vertical Take Off & Landing |

Part-ARA ....Annex VI to Commission Regulation (EU) No 290/2012 of 30 March 2012 amending Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ARO ....Annex II to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-CAT........Annex IV to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-FCL........Annex I to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ORA.......Annex VII to Commission Regulation (EU) No 290/2012 of 30 March 2012 amending Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ORO.......Annex III to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-SPA........Annex V to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

# 1. General Description of the R66

### General

The Robinson R66 is a five-place, single main rotor, single engine turbine helicopter aircraft constructed primarily of metal. The primary fuselage structure is composed of welded steel tubing and riveted aluminium sheet. The tail cone is a monocoque structure in which aluminium skins carry most primary loads. Fiberglass and thermoplastics are used in secondary cabin structure and in various ducts and fairings. The cabin doors are also constructed of fiberglass and thermoplastics.

### Landing Gear

The helicopter is equipped with a skid-type landing gear. A spring and yield skid type landing gear is used. Most hard landings will be absorbed elastically. However, in an extremely hard landing, the struts will hinge up and outward as the center crosstube yields to absorb the impact. Slight yielding of the aft crosstube is acceptable. However, yielding which allows the tail skid to be within 38 inches of the ground when the helicopter is sitting empty on level pavement requires crosstube replacement.

### Dynamic Systems

The dynamic systems of the R66 comprise two subsystems, the “Drive” and the “Rotor” system (main and tail).

- The drive system consists of a Main Gear Box (MGB) and a Tail Rotor Drive System.

<u>Main Gearbox</u>

The engine is mounted in a 37° nose-up attitude. A sprag-type overrunning clutch mates directly to the splined engine power take-off shaft. The clutch is connected to a shaft with flexible couplings at both ends to transmit power to the main gearbox.

<u>Tail Rotor Drive System</u>

The tail rotor drive line consists of an intermediate shaft running aft from the main gearbox and a long tail rotor driveshaft which runs the length of the tail cone.

- The rotor system consists of the main rotor system and the tail rotor system.

The main rotor has two all-metal blades mounted on the hub by coning hinges. The coning and teeter hinges use self-lubricated bearings. Each blade has a thick stainless steel spar at the leading edge which is resistant to corrosion and erosion. Aluminium skins are bonded to the spar approximately one inch aft of the leading edge.

The tail rotor has two all-metal blades and a teetering hub with a fixed coning angle. The tail rotor blades are constructed with wrap-around aluminium skins and forged aluminium root fittings.

### Flight controls

The flight control system controls the aircraft attitude and direction through main and tail rotor.

Dual controls are standard equipment and all primary controls are actuated through push-pull tubes and ball cranks. Bearings used throughout the control system either are sealed ball bearings which do not require lubrication or have self-lubricated liners.

Flight control operation is conventional. The cyclic is center mounted with the left and right control grips mounted to a cross tube which pivots on the center cyclic post. On later aircraft, the pilot’s cyclic grip angle can be adjusted fore and aft relative to the cross tube by a mechanic to achieve the most comfortable hand position. The most forward position provides the most control clearance at aft cyclic for larger pilots.

Pilots should always verify the ability to apply full control travel prior to flight.

The collective stick has a twist grip to provide input to the engine fuel control. Raising or lowering collective provides power turbine governor inputs via an interconnecting linkage.

Pilot-side tail rotor pedals are adjustable to get an easy control the anti-torque flight control.

### Rotor brake

The rotor brake system is used to stop the rotation of the rotor. The rotor brake is mounted on the aft end of the main gearbox and actuated by a cable connected to a pull handle located on the cabin ceiling. The brake must be released before starting the engine. When the brake is engaged, the starter is disabled.

### Power Plant

One Rolls-Royce model 250-C300/A1 free-turbine turbo-shaft engine powers the helicopter. The engine is equipped with an ignition exciter, igniter, starter-generator, two tachometer senders, and additional power plant instrument senders.

A direct drive, squirrel cage style cooling fan is mounted to the intermediate shaft and supplies cooling air to the engine and gearbox oil coolers.

The engine is fitted with an Engine Monitoring Unit (EMU), which is a digital recording device mounted behind the right rear seatback panel. The EMU continuously monitors N1, N2, engine torque, and MGT.

### Fuel system

A single bladder-type crash resistant fuel cell supplies fuel via gravity flow to the engine. The fuel cell incorporates left and right vent fittings, a filler port, a fuel gage sender, a low fuel sender, a sump drain and a finger strainer at the fuel outlet. The fuel cell is secured inside aluminium structure. The engine incorporates a fuel pump assembly with an inlet filter.

### Hydraulic system

Hydraulically-boosted main rotor flight controls eliminate cyclic and collective feedback forces. The hydraulic system consists of a pump, three servos, a reservoir and interconnecting lines. The pump is mounted on and driven by the main gearbox. A servo is connected to each of the three push pull tubes that support the main rotor swash-plate. The reservoir is mounted to the aft end of the main gearbox and includes a filter, pressure relief valve, and pilot-controlled pressure shut-off valve.

### Electrical Power

A 28-Volt DC electrical system is standard. The primary system components are a sealed lead-acid battery, a starter generator and a generator control unit. The battery is located beneath the left front seat or in a compartment in the left side of the baggage compartment.

## Cockpit Layouts

Original 7-Instrument Console with Pilot Avionics Console


8-Instrument Console with Pilot Avionics Console

G500H Instrument Console

## Instrument Panel

Standard primary instruments are a vertical speed indicator, airspeed indicator, engine ($N_2$) and rotor dual tachometer, sensitive altimeter, torque meter and magnetic compass. Engines gauges include an $N_1$ tachometer, measured gas (turbine) temperature, oil temperature and fuel quantity. Also standard are a clock, an ammeter, a digital outside air temperature gage/voltmeter and an hour meter.

## Annunciator Panel

The annunciator panel consists of illuminated segments located at the top of the main instrument panel. If a caution or warning condition occurs, the appropriate segment illuminate indicating the nature of the problem.

# 2. Aircraft Main Characteristics:

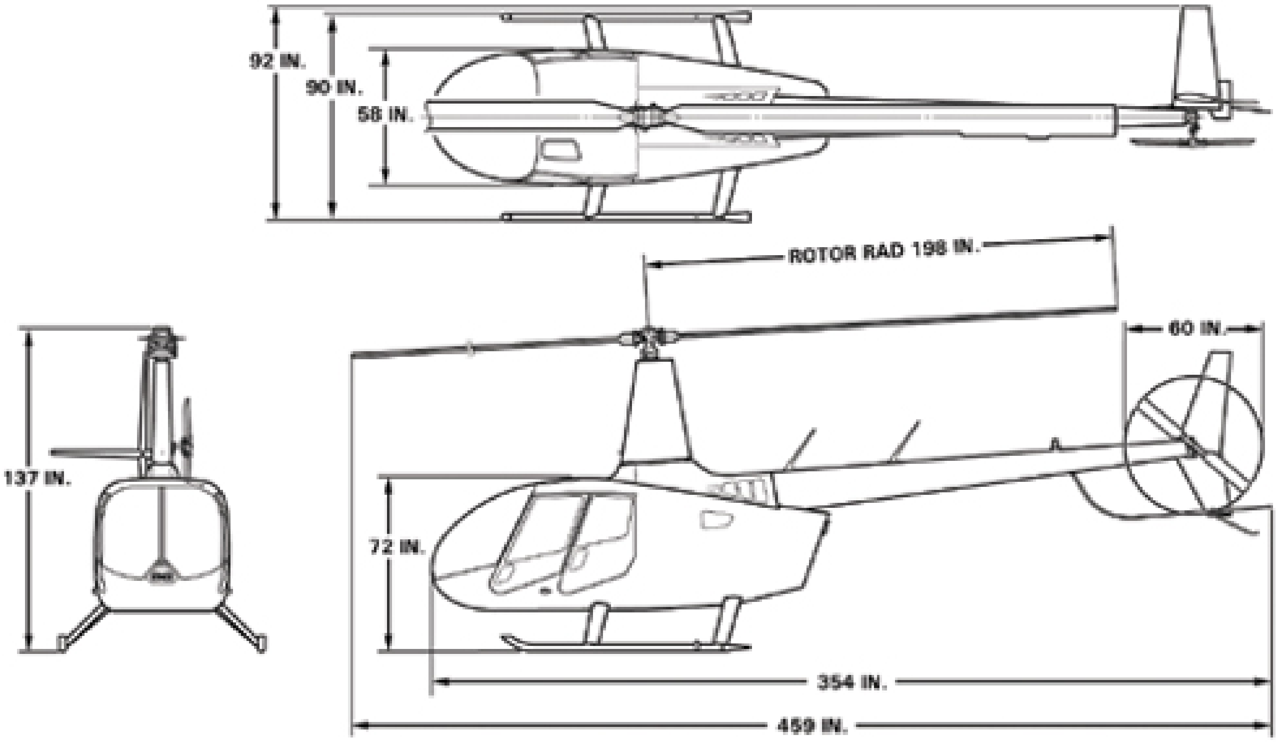
## 2.1 Summary of main characteristics of the Robinson R66

<table>
<tr><th></th><th></th><th></th><th>R66</th></tr>
<tr><td rowspan="5">Dimensions</td><td rowspan="3">Fuselage</td><td>Length (maximum)</td><td>11659 mm (459 inches)</td></tr>
<tr><td>Width</td><td>1473mm (58 inches)</td></tr>
<tr><td>Height</td><td>3480 mm (137 inches)</td></tr>
<tr><td>Main rotor</td><td rowspan="2">Diameter</td><td>10058 mm (396 inches or 33 feet)</td></tr>
<tr><td>Tail rotor</td><td>60 inches</td></tr>
<tr><td colspan="3">Number of Main Rotor Blades</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Minimum Flight Crew</td><td colspan="2">VFR</td><td>1</td></tr>
<tr><td colspan="2">IFR</td><td>N/A</td></tr>
<tr><td>Seating Capacity</td><td colspan="2">Including Pilot Seats</td><td>5</td></tr>
<tr><td>Engine(s)</td><td colspan="2"></td><td>1 Rolls-Royce 250-C300/A1</td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Fuel tanks</td><td colspan="2">Total usable</td><td>279 litres (73.6 US gallons)</td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="2">Air Speed</td><td>Power ON</td><td rowspan="2">Absolute VNE</td><td>130 KIAS (140 KIAS below 998 kg (2200 lb) except Pop-out Floats & Police Versions)</td></tr>
<tr><td>Power OFF</td><td>100 KIAS</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Rotor Speed</td><td>Power ON</td><td>Maximum</td><td>412 RPM</td></tr>
<tr><td>Power OFF</td><td>Minimum</td><td>359 RPM</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Maximum Operating</td><td colspan="2">Density Altitude</td><td>14000 ft.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Maximum gross weight</td><td>1225 kg (2700 lb)</td></tr>
<tr><td colspan="3"></td><td>-</td></tr>
</table>

(Reading mode: column by column from the left to the right side ⟶)

## 2.2 Exterior Dimension

# Robinson R66



# 3. Operator Difference Requirement (ODR) Tables

No ODR tables have been defined.

# 4. Master Difference Requirement (MDR) Tables

As the R66 has no variants, no Master Difference Requirement tables have been produced.

# 5. Optional Specific Equipment [AMC]

The following optional equipment installations require additional training:

- Pop-out Floats
- Police Version

Familiarization with optional avionics equipment should be made through self-study of manuals or online training material and require additional training to the training defined in 8.5

# 6. Type Rating List and Licence Endorsement List [M]

## 6.1 Type Rating List

With reference to Part-FCL, FCL.010 (‘type of aircraft’) and GM1 FCL.700, the R66 has been evaluated for aircraft categorisation and license endorsement.
The license endorsement is established as R66

| Manufacturer | Helicopter Model / Name | Differences | License endorsement | Complex | OEB / OSD FCD available | Remarks |
|---|---|---|---|---|---|---|
| Robinson Helicopter Corporation<br><br>- SE Turbine - | R66 | | R66 | | 23/09/2015 | |

# 7. Specification for Training

## 7.1 General

The Type Rating Training courses proposed by Robinson Manufacturer fulfilled the minimum requirements of EASA Air Crew Part-FCL. The assessment was based on the R66, Pilot Initial Type Rating Training syllabi.

The pilot type rating training courses are divided into the following phases for approval in Approved Training Organisations (ATO) and also for operator specific training, provided the operator specific documentation is used throughout the course.

- Prerequisites for entry onto the specific course,
- Theoretical knowledge instruction syllabus and test summary,
- Helicopter flight training courses,
- Skill test.

## 7.2 Course pre-entry requirements

All candidates must fulfil the requirements of Part-FCL.725 for the issue of class and type ratings

## 7.3 Licensing requirements

All students must fulfil the requirements of Part-FCL Appendix 9, Flight instruction and skill test.
The AMC2 FCL.725 (a) of the Part –FCL requires.

- for an Initial issue of a SET(H) under 3175 Kg MTOM , an approved flight instruction of at least:

| Helicopter types | In Helicopter | In Helicopter and FSTD associated training Credits |
|---|---|---|
| SET(H) under 3175 Kg MTOM | 5 hrs | Using FFS level C/D: At least 2 hrs helicopter and at least 6 hrs total<br>Using FTD level 2/3: At least 4 hrs helicopter and at least 6 hrs total |

- for an additional issue of a SPH, SET (H) CS 27 and 29 , an approved flight instruction of at least:

| Helicopter types | In Helicopter | In Helicopter and FSTD associated training Credits |
|---|---|---|
| SET(H) to SET(H) | 2 hrs | Using FFS level C/D: At least 1 hr helicopter and at least 3 hrs total<br>Using FTD level 2/3: At least 2 hrs helicopter and at least 4 hrs total |

*Note:*

*These requirements have to be considered as the bare minimum, additional training could be necessary depending on:*
- *complexity of the aircraft type, handling characteristics, level of technology;*
- *Category of helicopter (SEP or SET helicopter, multi-engine turbine and multi Pilot helicopter);*
- *Previous experience of the applicant.*

## 7.4 Initial, Additional Single Engine Turbine (SET) Type Rating [AMC]

### 7.4.1 Initial SET Type Rating (ITR)

Candidates for the Initial **R66** Type Rating who do not hold a SET type rating must:

- Hold a valid Helicopter Pilot licence,
- Hold a SEP type rating
- Comply with the requirements set out in Part –FCL Subpart H – Section 1 & 3

### 7.4.2 Additional SET Type Rating (ATR)

Candidates for an **R66** Type Rating who already hold a SET rating must:

- Hold a valid Helicopter Pilot licence,
- Hold a SET Type Rating
- Comply with the requirements set out in Part FCL Subpart H – Section 1 & 3.

## 7.5 Theoretical knowledge syllabus and test summary [AMC]

### 7.5.1 Initial and Additional Type Rating

Theoretical instruction should be provided in accordance with Part FCL Subpart H – Section 1 – FCL.725

The following sections present a summary of the material that an Initial and Additional Type Rating training program should consider. Whilst based on the Robinson Manufacturer programs, training providers should ensure their type specific courses cover the pertinent material.

| Initial and Additional Type Rating theoretical knowledge syllabus | ITR | ATR |
|---|---|---|
| Turbine Engine Theory(*) | 2.0 | |
| Helicopter structure, engine, transmissions, electrical, fuel, rotors and equipment, normal and abnormal operation of the systems | 8.0 | 8.0 |
| Limitations (**) | 1.0 | 1.0 |
| Performance, flight planning and monitoring (**) | 1.0 | 1.0 |
| Weight and balance | 1.0 | 1.0 |
| Emergency procedures (**) | 1.30 | 1.30 |
| Pilots pre-flight walk around, ground handling, equipment installation removal, pilots servicing (****) | 1.0 | 1.0 |
| Optional equipment | In addition | In addition |
| **TOTAL THEORETICAL KNOWLEDGE SYLLABUS** | 15.30 | 13.30 |
| Theoretical examination session (***) | 1.30 | 1.30 |
| **TOTAL (HOURS)** | 17.0 | 15.0 |

*Note:*

*(*) If an initial type rating for a turbine powered aircraft is required, the candidate must first undergo a turbine engine theoretical course.*

(**) *Theoretical instruction elements that can be covered during the ground training course and/or during flight training briefing phase.*

*(***) The theoretical knowledge examination shall be written and consist of at least 50 multiple-choice questions distributed appropriately across the main subjects of the syllabus.*

*(****) Instruction elements that can be covered during ground training course and/or during flight training briefing phase*

## 7.6 Flight training course summary [AMC]

### 7.6.1 Initial and Additional SET Type Rating

The following table indicates the minimum flight training required determined by the OSD for different combinations with/without regards to previous Robinson R22 or R44 experience. Each helicopter flight session could be extended or reduced at the discretion of the instructor, but the total minimum flight time is unchanged. Additional flight could be necessary at the discretion of the instructor if the trainee has not successfully demonstrated the ability to perform all maneuvers with a high degree of proficiency.

| Type Rating Flight Training Syllabus | SET ITR | ATR* | ATR** |
|---|---|---|---|
| Helicopter exterior visual inspection, cockpit inspection, starting procedures(1), pre-take off /landing procedures, taxiing, Air taxiing, general handling, climbing/descending / turns, circuits | 1.15 | 1.0 | 0.8 |
| Take off / landing various profiles including simulated maximum take-off mass, sloping ground / crosswind take off and landings. | 1.15 | 1.0 | 0.7 |
| Basic and advanced autorotation's, practice forced landings, steep turns | 1.15 | 1.0 | 0.7 |
| Abnormal & Emergency Procedures, Autorotative landings, Simulated IF | 1.15 | 1.0 | 0.8 |
| Total Flight Time | 5.0 | 4.0 | 3.0 |
| Skill Test | As required | As required | As required |

* ATR for holders of a SET **without** a R22 or R44 type rating

** ATR for holders of a SET **who additionally hold** a R22 or R44 type rating

(1) During training the candidate should have experience of at least 4 engine starts, ideally 1 of which should be with ground power.

Note

**No credit is given for a reduction of flight training from the R66 towards the R22 or R44**

## 7.8 Training Areas of special emphasis (TASE) [M]

The following procedures for training need special attention. Therefore the OSD highlights the manufacturer recommendations and training providers have to take into account the following elements:

### 7.8.1 TASE / Training Methodology for Pilots and Instructors

- **Autorotation / Autorotative landings**
  - Autorotation training as detailed in Section 4 of the FM shall be conducted within gliding distance of a suitable landing area.
  - Autorotation training shall be performed with a trainee and an Instructor only
  - An $N_1$ Deceleration Check shall be conducted prior to the conduct of an autorotation .
  - Cabin heat must be selected off before commencing autorotation.
  - Practice autorotation entry
    - To initiate the autorotation the throttle should be closed before lowering the collective.
    - Recommended airspeed of 60-70kts should be maintained with the RRPM in the green.
  - **Power recovery procedure**
    - At approximately 40ft AGL a cyclic flare should be commenced to reduce forward speed and rate of descent, and smoothly roll throttle full on to recover engine power
    - Pilots need to be aware of the lag in response of a turbine engine during the recovery phase.
    - At 8 feet AGL the aircraft should be levelled and collective applied to control descent.
  - **Autorotative landing**
    - When practicing an autorotation landing to the ground it should be performed in the same manner as power recovery autorotations except the throttle should be

kept closed throughout the manoeuvre. Always contact the ground pointing straight ahead with skids level...

- **Simulated Hydraulic failure**
  - A switch located on the top of the pilot's cyclic grip is used to simulate a loss of hydraulic system pressure. Use care not to switch hydraulics off inadvertently.
  - If switched off, hydraulics should always be re-engaged with a relaxed grip on the controls to prevent over-control. Avoid re-engaging hydraulics between hover and 100 feet AGL
  - Hydraulics-off hovering can be challenging. A landing site where a run-on landing can be made should be available.

- **Low "G" Mast Bumping**
  - Excessive rotor flapping can be caused by Low G Conditions and teetering of rotor.
  - Due to light weight and high power of the R66, it can be susceptible to Low-G Mast Bumping in turbulent conditions.
  - Example: low tank fuel, single pilot - light and fast.
  - If significant turbulence is encountered, reduce airspeed to 60-70kts.
  - Avoid abrupt forward cyclic movements and initiate descent with collective.
  - Recover thrust by aft cyclic (to reload the disks) rather than lateral cyclic roll, then correct laterally.
  - Ensure smooth input on controls; not abrupt, full range, un-coordinated input.

- **Engine Start**
  - Engine starting can be critical in a turbine engine. Extensive damage can result if excessive measured gas temperatures (MGT) are allowed to occur during the start process (hot start). Pilots need to be very familiar and focused on the proper starting procedure. Factors such as battery voltage, fuel introduction, MGT limitations and time between starts must be well understood.
  - If student has previous experience in R44, note difference in operation of fuel cutoff control in R66 and mixture control on R44 and R44 II.
  - Instructors are recommended to be in a position to be able to terminate the start sequence if the student is slow to react.

Notes

**The OSD advises an in depth reading, analysis and knowledge of all the safety tips and notices listed in the Robinson Helicopter Company`s Pilot Operating handbook of the R66.**

# 8. Specification for Testing, Checking, Currency & Recent Experience

## 8.1 Skill test

As required by Part-FCL.725 (c)

## 8.2 Proficiency Checks

As required per FCL 740 H

## 8. 3 Specification for Recent Experience

As required by Part FCL.060

# 9. Specification for Flight Simulation Training Devices

No FSTD's exists at the moment of this report.

# 10. Appendices

Appendix 1: EASA TCDS. EASA.IM.R.507