

## Impact

### Decrease the risks associated with rotorcraft certification compliance demonstration

The safety of certification flight testing can be improved by demonstrating compliance through flight simulation. The most demanding and hazardous flight tests can be performed in a virtual environment to minimise the exposure to potentially hazardous test conditions.

### Promote a better industry and authority understanding of the rotorcraft characteristics by increasing flight test effectiveness in terms of data gathered and number of configurations

During flight simulation it is possible to collect a large amount of test data that cannot be easily measured during a test flight. Additionally, it is possible to perform a large number of repetitions to assess piloting variability without substantially increasing costs and with no additional risk.



### Reduce cost of rotorcraft certification evaluated.

A significant cost saving will be realised considering the better value for money potential of simulated tests. **Simulation can reduce the required flight testing for SHOL qualification by up to 70%, generating a significant reduction in cost. These cost savings are also expected to be achievable for certification topics investigated in RoCS.**

### Reduce the time-to-market of new products

New helicopter certification could be achieved in an average time close to 3 years from the first flight. Sometimes this time is however more than 5 years. The time spent to set up a single flight test can be very large, and it may involve the coordination of a large crew.

**Replacing flight tests with pilot-in-the-loop simulation offers a potential reduction in personnel involved of 99%. Of course this reduces the time required to organise and conduct tests.**

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Certification by Simulation

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## Rotorcraft Certification by Simulation

Project aims to explore the possibilities, limitations, and guidelines for best practices for the application of flight simulation to demonstrate compliance to the airworthiness regulations related to helicopters and tiltrotors.



## Objectives of the project

### 1. Develop guidelines for certification of rotorcraft for flight aspects by simulation

Certification of rotorcraft by flight simulation has been exploited in the past on a case-by-case basis to reduce the cost and flight test safety risks associated with certification. To allow the exploitation of this approach by all relevant stakeholders, it is necessary to consolidate past experience and develop guidelines supported by both the industry and the certification authority.

### 2. Develop a low-cost, effective, flight simulation environment suitable for certification compliance demonstration for helicopters and tiltrotors

Flight simulators are traditionally defined for training, with a focus on the positive transfer generated on the trainee. The development of a FS for certification purposes requires a change from this point of view, because for certification the models must be high fidelity physically representative of the aircraft and not the result of flight test identification, to ensure that the correct response of the actual aircraft will be simulated

### 3. Verify if certification by simulation could reduce the scope of testing required for the introduction of the next generation of tiltrotors simulation

The introduction of a flying vehicle with a new configuration often introduces many uncertainties in the definition of the correct certification standard to be applied, and consequently in the choice of appropriate testing to demonstrate safety. The availability of guidelines for certification by simulation verified on tiltrotors will represent a formidable tool to compensate for the lack of experience of both the manufacturers and the certification authorities, limiting significantly the amount of hazardous flight testing



## Impact of ROCS

The expected benefits will be on:



### Safety

Increase of safety thanks to the possibility to demonstrate the flight conditions with highest associated risk.



### Economy

Reduction of costs associated with flight testing both in terms of flight hours, and reduction of personnel involved.



### Duration

Tests in a simulator can be completed in a fraction of the time required by a full flight test.



### Effectiveness

Possibility to test numerous configurations with only a slight increase in costs and time.

## Project Phases

### Phase I

The industry and certification authority are engaged to define the list of certification topics that are thought to be suitable for compliance demonstration by flight simulation. A subset of these will be selected for case study in the next phase. **In parallel, WP3 and WP4 will work on the identification of the starting points for the investigations, with the definition of the related simulation fidelity metrics with input from Leonardo Helicopters and the certification authority.**

### Phase II

**Starts with the definition of the related simulation fidelity metrics with input from Leonardo Helicopters and the certification authority.** After the identification of the capability gaps, improvements to the flight simulation models and simulator cueing environment will be investigated using models provided by Leonardo Helicopters and consortium simulation facilities.

### Phase III

Will see the consolidation of the final set of guidelines and application to the Leonardo Helicopters simulation facility, and demonstration through application to models of the Next Generation Civil Tilt Rotor Technology Demonstrator (NGCTR-TD) and the NGCTR New Tilt Rotor Concept (NGCTR-NTC). Piloted simulations will be performed, initially on the helicopter selected by Leonardo Helicopters. **These will be followed by verification of the applicability of the proposed approaches to the NGCTR tiltrotor models.**

