Innovation Takes Off
Clean Sky 2 Information Day

Fast Rotorcraft IADP: LifeRCraft
Compound Rotorcraft

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Innovation Takes Off

www.cleansky.eu
LifeRCraft - The Compound Rotorcraft
A new game–changing rotorcraft

Not an airplane, better than a helicopter: a compound VTOL* architecture that retains the best of both aircraft types

Unique capabilities:
✓ Hover/Vertical flight: as good as helicopter
✓ Cruise speed up to 220 kt (410 km/h)

Enabling to meet expectations for door-to-door mobility, environment protection, citizens’ health & safety:
✓ Time efficiency for Rescue & Emergency, Air Taxi
✓ Acoustic footprint & CO2 emission lower than helicopter
✓ Eco-friendly materials, greener life cycle

Thanks to a comprehensive demonstration that will:
✓ De-risk the integration of new configuration thru supply chain
✓ Pave the way for development & marketing prior non-EU competitors to secure sustainable EU growth in rotorcraft sector

(*) VTOL: Vertical Take-Off & Landing

NB: images may not reflect actual demonstrator sizing & components (for illustration purpose only)
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Major Challenges

**Weight, weight, and weight...**

- Additional components: wing and propellers
- Strong engines & power train

**Aerodynamic efficiency:**

- Cruise: low drag, high Lift-to-Drag ratio
- Hover/vertical flight: efficiency & manoeuvrability

**Cost efficiency:**

- Operating cost (per kg payload/km)
- Recurring cost

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Even more crucial than for helicopters, *why?*

- Additional components: wing and propellers
- Strong engines & power train

**Aerodynamic efficiency:** Also crucial!

- Cruise: low drag, high Lift-to-Drag ratio
- Hover/vertical flight: efficiency & manoeuvrability

**Cost efficiency:** Must outperform helicopter

- Operating cost (per kg payload/km)
- Recurring cost

Unique opportunity to mature innovative technologies up to TRL 6 and showcase them for future compound and helicopter products

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LifeRCraft Components and systems

WP1: Project management & integration activities
WP2: Airframe Structure
WP3: Landing system
WP4: Lifting rotor
WP5: Propellers
WP6: Mechanical drive: MGB, PGB, shafts
WP7: Power plant: Engines - adaptation & installation
WP8: Electrical system: power generation, distribution & storage
WP9: Actuators
WP10: Avionics & Sensors
WP11: Cabin & Mission Equipment
WP12: Flight control, AFCS, nav systems
WP13: Validation, verification demonstration: ground tests, flying demonstrator

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Major Work Packages for partnership

Airframe/Central Fuselage:
- Optimised for high speed (low drag) and targeted missions (access, equipment integration)
- Supports wing, Main gear box (MGB) and engines

Wing:
- Supports propeller gearboxes and retractable wing stands
- Integrates propeller drive shaft
- Large Flaps

Tail fuselage: (Horizontal stabiliser and 2 Vertical fins)
- Control surfaces on vertical fins and horizontal stabiliser

Engines:
- Engine adaptation to demo (turbine speed variation, FADEC, starter interface)
- Demonstrator engines

Full retractable wheel landing gear:
- Nose landing gear, main landing gear with brake, wing stands (retractable shock strut)
- Electrical retraction and electrical brake

Transmission:
- Propeller gearboxes (PGB): high power, single stage, angle ~90°
- High speed module(s) of Main Gear Box (MGB)

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Major Work Packages for partnership

Activities for these major packages include:

✓ General design (architecture, interfaces,...) in cooperation with Eurocopter,
✓ Choice of technologies,
✓ Detail design,
✓ Manufacturing of demonstrator parts,
✓ Laboratory tests (optional) and substantiations for flight clearance,
✓ Support to integration tests (ground and flight),
✓ Analysis of tests results.

The volume of these WP’s could exceed the threshold for Core-partner alone or associated with smaller WP’s (see next slide)
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Other Work Packages for partnership

- Digital wind tunnel (CFD analysis)
- Wind tunnel tests (including test mock-up)
- External noise optimisation studies: design optimisation & flight procedures
- Eco design studies
- Propellers
- High torque propeller transmission shafts
- Study of Innovative icing protection system
- Fuel tanks with gauging system
- Upper cowlings
- Electrical system (28/270 VDC): generation, storage, voltage conversion
- Electrical actuators: EMA, trim actuators for additional control surfaces and wing flap actuators, Landing gear retraction
- Active anti-vibration devices
- Internal noise control system
- Cabin doors
- Laboratory tests

For equipment, activities include: specification & interface definition with Eurocopter, Detail design, Manufacturing, Equipment laboratory test, substantiation for flight clearance, Support to integration tests (ground and flight) and Analysis of tests results.

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Thanks for your attention!
Back-Up Slides
LifeRCraft Demo principle

1 = Propellers to benefit from their efficiency in high speed cruise

2 = Slow down main rotor at high speed to avoid drag divergence on advancing blade

3 = Wings to develop a lift in cruise flight

4 = Use tail trim surfaces to adjust equilibrium

Controls:
- Main rotor: collective, roll, pitch
- Propellers: yaw, propulsion

Retreating blade stall
LifeRCraft Drive system

Variable pitch propellers
(constant RPM ratio rotor/prop)

Propeller Gear Box - PGB (RH)

2 Engines

Propeller transmission shaft
(permanent link)

Main Gear Box

Propeller Gear Box - PGB (LH)
Demo Development Plan

WP for partner preparation
Partnership set-up
Pre-design studies
General specification & Preliminary interfaces
General design
Detail interfaces
Detail design
Components manufacturing
Mechanical drive system tests (Back to back)
System integration testing
Rotor system rig tests
Flying demo assembly
Demonstrator ground tests
Demonstrator flying tests
LifeRCraft Project synthesis

PDR: Preliminary Design Review
CDR: Critical Design Review
TR-FC: Test readiness review, Flight Clearance