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Rotorcraft Sustainability Roadmap: a possible implementation solution

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SUMMARY

- Background
    - Our Ecosystem
    - Strategy vs. Rotorcraft Footprint
    - Sustainable Aviation Solutions
    - Leonardo Fleet Scenario
- Optimization of fuel consumption
    - Parameters
    - A Possible Solution
    - Impact & Expected Benefits
- Conclusion and possible enhancements

Rotorcraft Sustainability Roadmap: a possible implementation solution

Background

The financial aspect of the **Environmental Social & Governance** transition is fundamental to allow the progressive implementation of new technologies, to test and mature them and to help their introduction in a very competitive market.

Sustainable Finance Framework

- Financial instrument
- Platform on EU Taxonomy

Aviation Regulations

- Sustainable Aviation Fuel
- EcoLabel
- Hybrid / Electric / Hydrogen-owered A/C

LEONARDO HELICOPTERS

Sustainability Drivers

Industrial Partnership

- Large EU R&D Program
- Alliance for Zero-Emission Aviation

Disclosure & Commitments

- Target Settings
- Reportings
- Ratings

Sustainability Plan - Integration into Leonardo value chain

VALUE CHAIN: R&D · Operations · Solutions and customer support · Social impacts

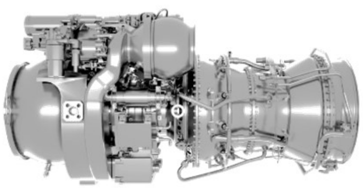
Clusters	Actions
Research and innovation	• Implementation of Leonardo Labs as sustainability drivers in R&I
Industrial and energy efficiency	• Optimisation of productivity by accelerating digitalisation • Energy efficiency
Environmental management and circular economy	• Decarbonisation • Reduction of water withdrawals; reduction and recovery of waste • Reduction of plastic and paper use
Sustainable supply chain and circular economy	• Support for the sustainable development of SMEs • Increased digitalisation of procurement processes • Definition of measures to prevent ESG risks in the supply chain
Earth observation and emergency management	• Advanced solutions in space industry for agriculture and forestry, resilience and risk reduction, environmental protection and emergency response
Mobility solutions and security systems	• Solutions for transportation sector to reduce the environmental impact • Solutions for surveillance
Business integrity and human rights	• Trade control and governance • Strengthening of assessment and control over human rights
Social commitment and scientific citizenship	• Improvement of gender equality within the Group • Development of cross-national STEM programmes

SDGs

- Leonardo sustainability plan, aimed at covering the entire value chain
- Integration of sustainability themes into company's mission and purpose
- Greenhouse Gas Protocol: **Scope 3 - Product-related emissions during manufacturing, use, end of life**:
  - Processing of sold products
    - Materials, Manufacturing Processes, Waste Management
  - Use of sold products:
    - Emissions (CO2, NOx, etc.) during flight and Operations
  - End-of-Life of sold products
    - Disposal, Recycling

LEONARDO Technology Approach

EVOLUTIONARY → *REVOLUTIONARY*



Engine Evolution

Improvements of existing engines architectures coupled woth advanced power management solutions

Sustainable Aviation Fuels (SAF)

Biofuel and synthetic Aviation Fuel (eFuel) combustion as a complement or substitute to Jet Fuel

Hybrid Propulsion

Coupling of traditional engines and electric motors for (main and/or tail) rotor propulsion (e.g. within transmission)

Full Electric Propulsion

Full electric / battery powered propulsion with up to 95% reduction in CO_2 and NOx depending on sustainabiltiy of energy source

Lower disruption for H/C OEMs with higher retrofit opportunities for in service HCs

Higher disruption for H/C OEMs given relevant impacts on H/C architecture

LEONARDO Technology Approach

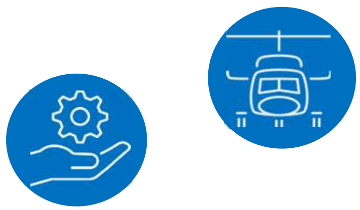
EVOLUTIONARY → *REVOLUTIONARY*

PBN/SBAS

Leveraging navigation robustness and routes optimization to further improve:

- Fuel Consumption **Efficiency**
- Ground **Noise** Impact

DESIGN ENHANCEMENT



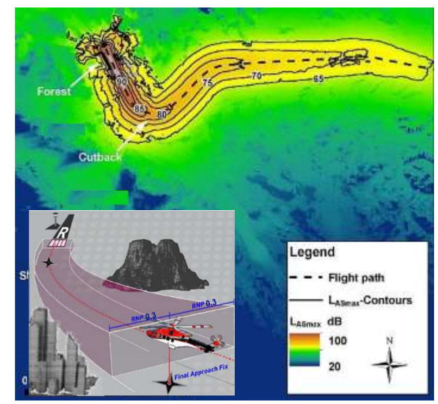
- Components life extensions
- Weight reduction (more payload means **less flying hours**)
- In service fleet upgrades through service bulletins

NEW TAIL ROTOR

- Electrical motor
- fixed-pitch rotors
- Weight reduction

NOISE FOOT PRINT

DFMC NAVIGATION TECHNOLOGY, IMPROVING AND CONSOLIDATING SBAS STANDARDS IN AERONAUTICS



Lower disruption for H/C OEMs with higher retrofit opportunities for in service HCs

Higher disruption for H/C OEMs given relevant impacts on H/C architecture

LEONARDO HELICOPTERS FLIGHT HOURS LOGGED OFFSHORE MARKET

HELOS IN SERVICE

	END 2019	END 2020	END 2021	OCT 2022
A109/119	21	21	22	22
AW139	335	342	351	355
AW169	9	15	17	22
AW189	40	43	44	46
TOTAL	405	421	434	**445**

TOTAL FLIGHT HOURS

	END 2019	END 2020	END 2021	OCT 2022
A109/119	156.105	160.817	165.975	167.682
AW139	1.578.298	1.730.031	1.911.978	2.119.904
AW169	5.927	11.049	16.216	23.234
AW189	58.257	73.741	90.814	109.796
TOTAL	1.798.588	1.975.638	2.184.983	**2.420.616**

FH/YEAR LOGGED

	END 2019	END 2020	END 2021	OCT 2022
A109/119	6.175	4.712	5.158	1.707
AW139	192.844	151.733	181.946	207.927
AW169	2.723	5.121	5.167	7.017
AW189	16.782	15.484	17.073	18.982
TOTAL	218.523	177.050	209.345	**235.633**

Rotorcraft Sustainability Roadmap: a possible implementation solution

Optimization of Fuel Consumption

Optimization of Fuel Consumption

The large amount of Flight Hours Rate Fuel consumption could impacts both **operability**, **sustainability** and **safety**...

It is an opportunity !

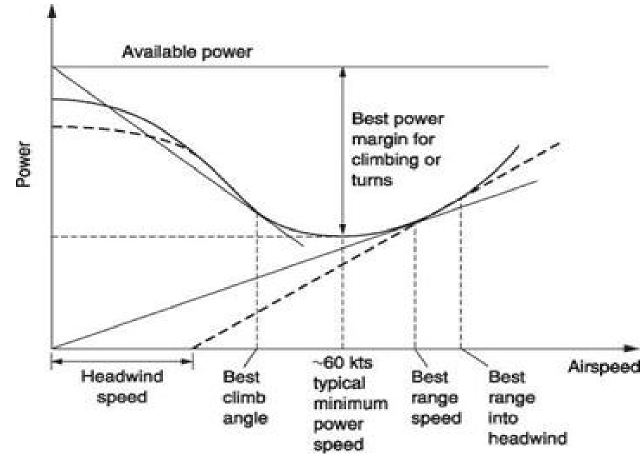
How to do it...

- Optimization for actual weather conditions requires ***proper flight management***
- Best range speed must be ***constantly trimmed*** by correcting the helicopter speed in order to take into account ***wind conditions***
- LH is developing a ***proper means*** to provide crew an easy tool to mantain the best range speed throughout the entire flight.

- Misjudgment of wind compensation can cause a **0,6% to 1,5%** increase in fuel consumption.
- Example of different fuel consumptions when the airspeed is not adjusted for the wind:

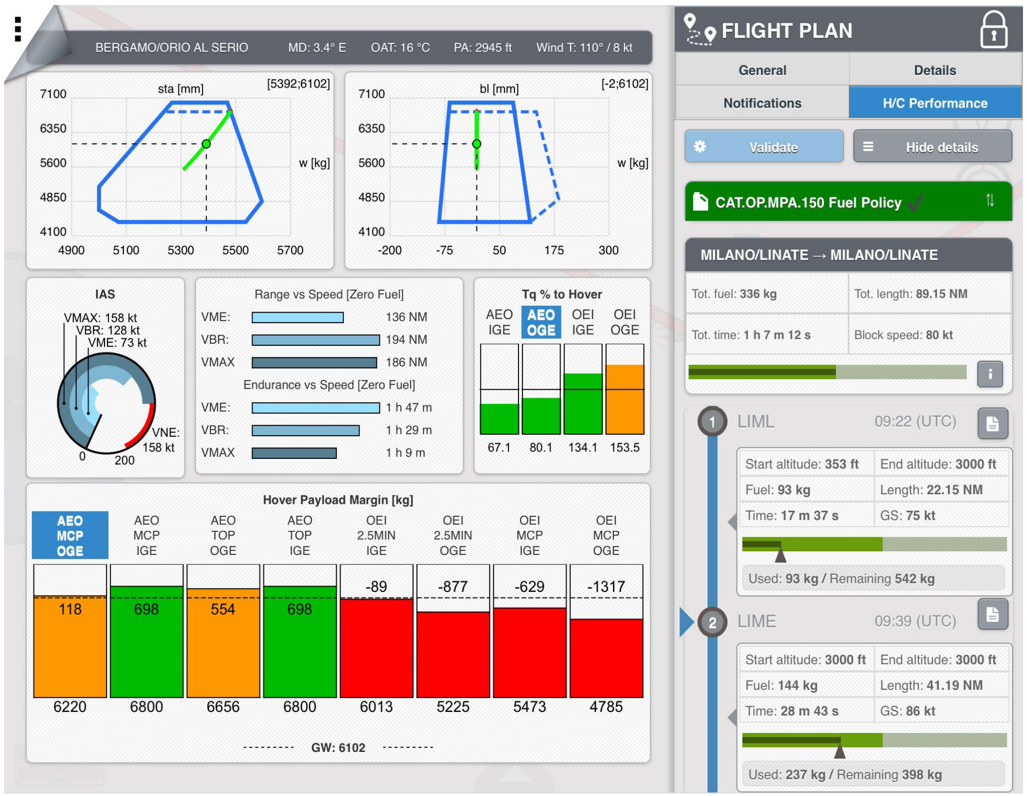
AW139, 6.000 kg Cruise Flight @ Sea Level 140 KIAS

Wind Condition [KTS]	Speed [KGS]	[KIAS]	NM/ 100kg_fuel	∆ Range
30 Tailwind no correction	170	**140**	40.4	
30 Tailwind Best Range recalculated	160	**130**	**40.6**	**+ 0.6%**
30 Nosewind no correction	110	**140**	26.1	
30 Nosewind Best Range recalculated	122	**152**	**26.5**	**+ 1.5%**

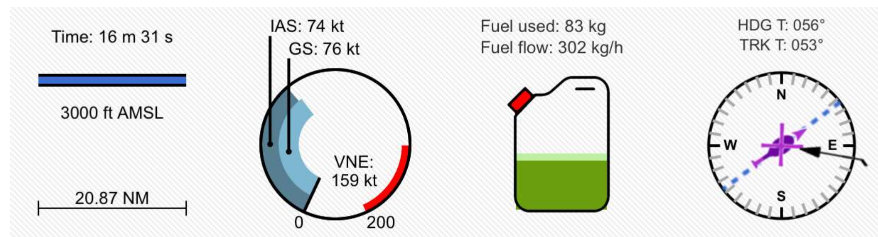


- Decreasing the airspeed to the new calculated best range value of 130KIAS allows to increase the specific range of about **0,6%** with respect to maintain the nominal best range speed.
- Increasing the airspeed to the new calculated best range value of 152KIAS allows to increase the specific range of about **1,5%** with respect to maintain the nominal best range speed.

Skyflight – A Possible Flight Planning Tool



Airspeed correction to maintain the conditions for Best Range shall include following parameters:



OAT

IAS

Wind Direction

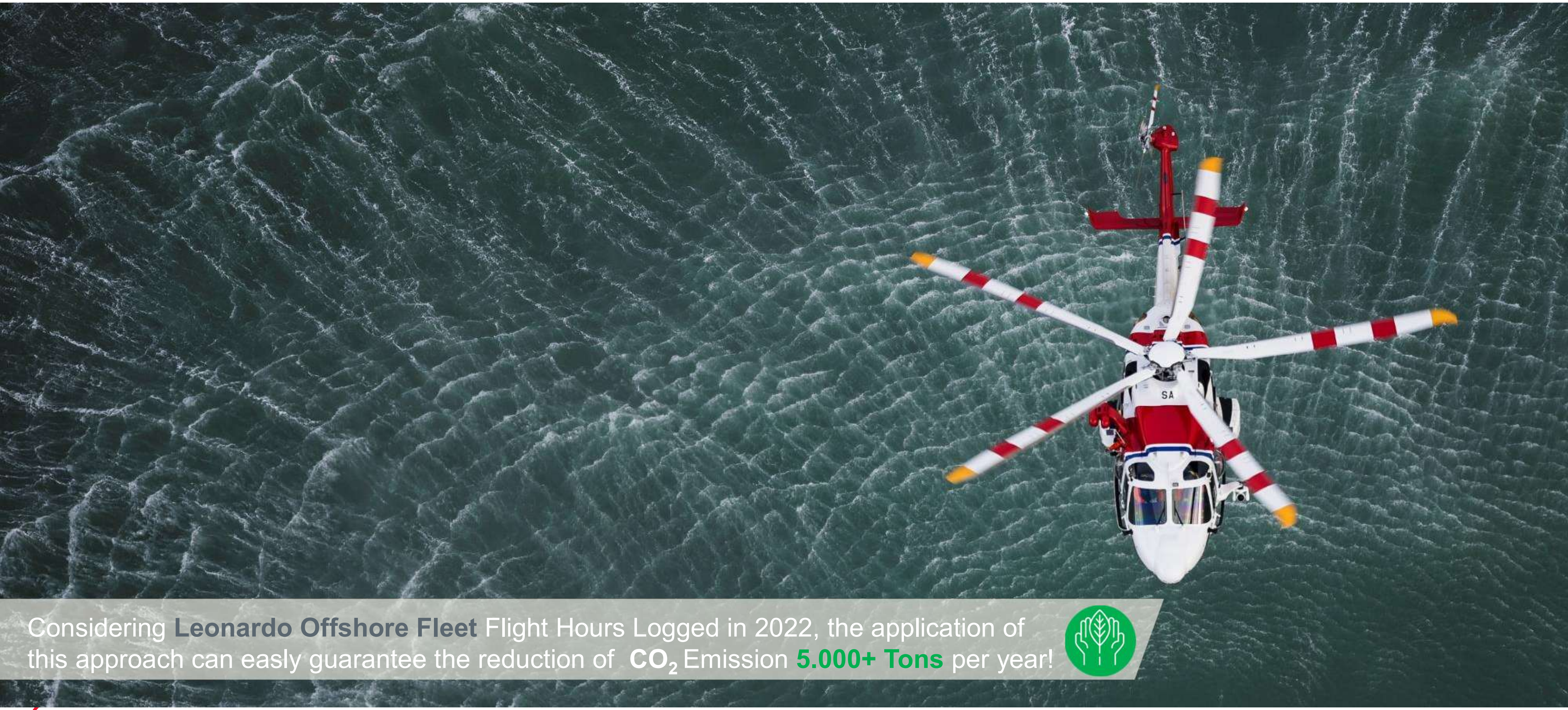
Pressure Alt

Course

Pilot keeps updating the flight parameters and gets in real time the correct **airspeed** and **course** or either alternative **flight levels** for the best range conditions.

OPTIMIZATION

IMPACT & EXPECTED BENEFITS



Considering **Leonardo Offshore Fleet** Flight Hours Logged in 2022, the application of this approach can easily guarantee the reduction of **CO_2** Emission **5.000+ Tons** per year!

Rotorcraft Sustainability Roadmap: a possible implementation solution

Conclusions & possible enhancements

- Tangible solutions that can immediately contribute to **CO_2 emissions reduction** can be easily available with current technology.
- The sensitivity to the best range implementation shall **disseminate world wide** to all flight crews.
- **Automation** will be an accelerator to get benefit in emission reduction.
- The FMS output can also be linked to a dedicated AFCS upper mode "**Cruise Mode (Range)**" for full automation in **all phase of flight**.

*Leonardo is fully committed to find **Environmental & Sustainability** solution to support the future or vertical lift transportation*

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THANK **YOU**
FOR YOUR ATTENTION

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