LEONARDO

Electronics

Helicopters

Aircraft

Cyber & Security

Space

Unmanned Systems

Aerostructures

Leonardo Helicopters

SOLAKONFERANSEN 2022
OFFSHORE FLIGHT SAFETY

Sustainability through improved environmental footprint and adopting new technologies

Luca Medici – Aircraft System Integration

Clarion Hotel Air, Sola

19 – 21 September 2022

SUSTAINABILITY DRIVERS for LEONARDO

Sustainable Finance Framework

Financial instrument to sustain Environmental Transition framed by EU Regulation.

Platform on EU Taxonomy to build the metrics and green eligibility.

PLATFORM ON SUSTAINABLE FINANCE

Aviation Regulations

ICAO ENVIRONMENT

Sustainable Aviation Fuel extensive Life Cycle based criteria (ICAO-CAEP Env.)

Hybrid / Electric / Hydrogen-powered A/C certification specifications (EASA EPAS 2022-2026).

EcoLabel Environmental Label for Aircraft (EASA EPAS 2022-2026).

LEONARDO HELICOPTERS

Sustainability Drivers

Research, Policy, Industrial Partnership

CLEAN AVIATION JOINT UNDERTAKING

Large EU R&D Program launched with ambitious technology development (i.e. Clean aviation)

Alliance for Zero-Emission Aviation launched for coordinating efforts across aviation

Alliance for Zero-Emission Aviation — PREPARING EUROPE FOR HYDROGEN & ELECTRIC FLIGHT

Corporate Disclosure & Commitments

Target Settings commitment with a solid strategy

SCIENCE BASED TARGETS

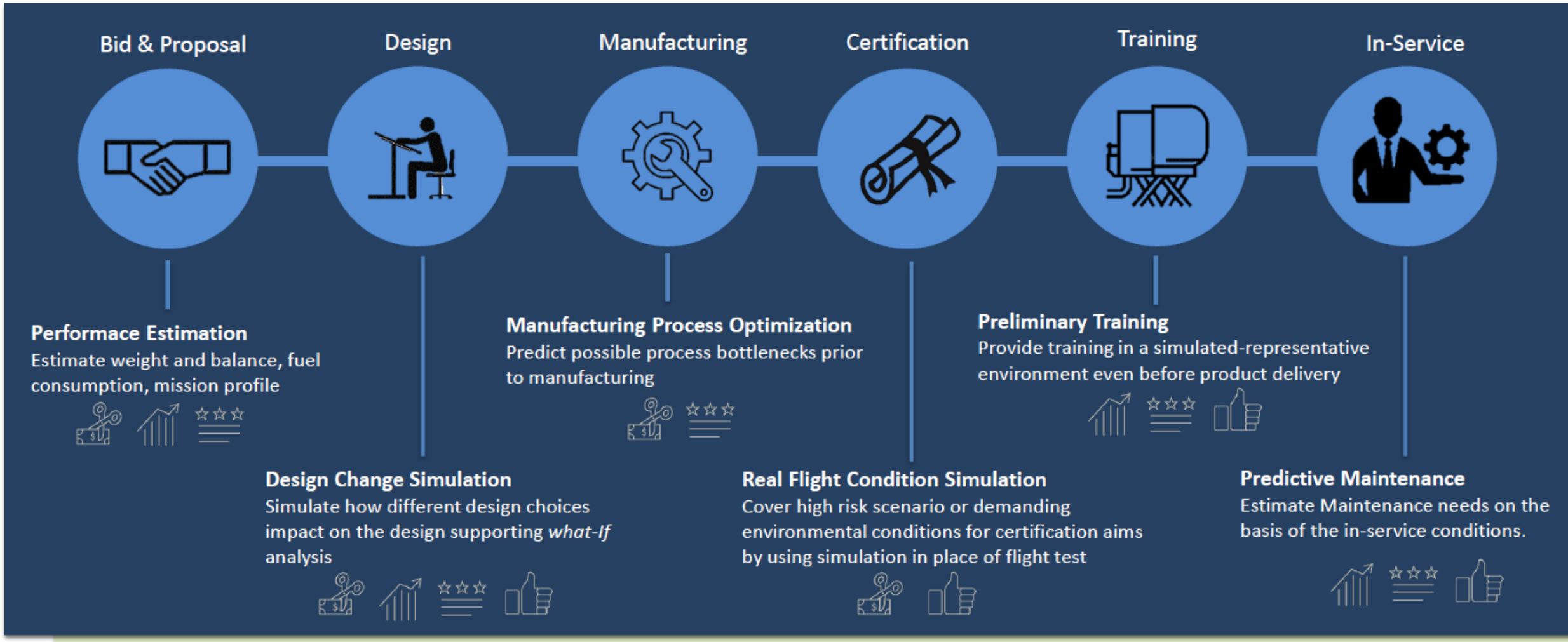
Reportings disclose climate-related risks, performance and governance

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

Ratings require specific impact monitoring

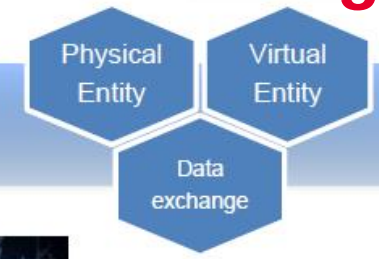
CDP

From Production to Training: Digitalization at the Service of ESG Targets



From Production to Training: Digitalization at the Service of ESG Targets

*«A Digital Twin is a **virtual replica** of a **physical entity** - a product or a process - that can be continuously updated by the **data** from its physical counterpart»*



Design & Development | **Manufacturing** | **In-service**

Business Value

DESIGN DATA*

MANUFACTURING DATA*

OPERATIVE DATA*

INTELLIGENT / INTERACTIVE DIGITAL TWIN

Full Predictive

MODEL DIGITAL TWIN

is the **digital model** of the product or process created on the basis of design data

SHADOW DIGITAL TWIN

the **Shadow Digital Twin** is created by feeding the model with manufacturing information

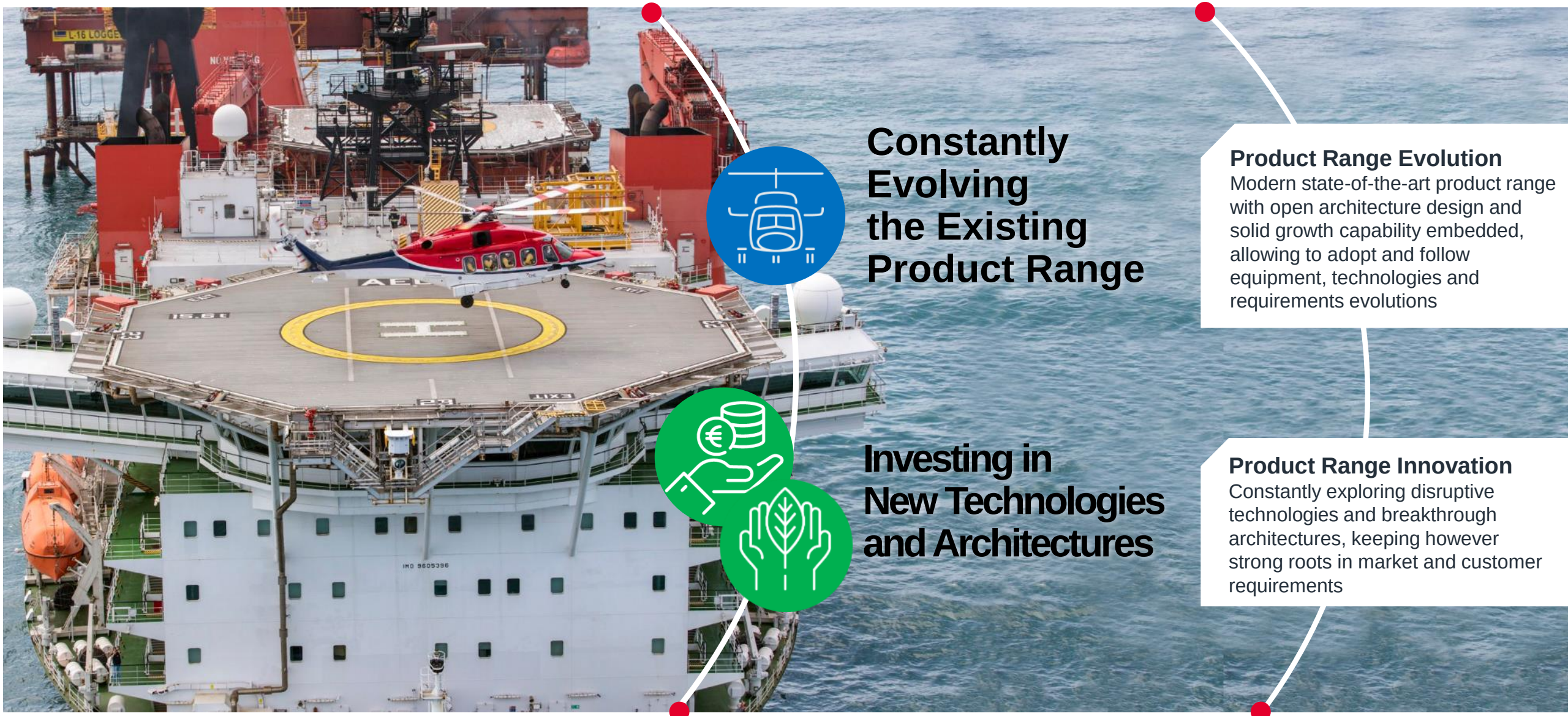
DIGITAL TWIN

The digital representation enlarges its potentialities in terms of product management by the introduction of product usage information

Cost & Complexity

*single source of truth.

Leonardo Helicopter Products Approach to Sustainability and ESG Targets



Constantly Evolving the Existing Product Range

Product Range Evolution
Modern state-of-the-art product range with open architecture design and solid growth capability embedded, allowing to adopt and follow equipment, technologies and requirements evolutions

Investing in New Technologies and Architectures

Product Range Innovation
Constantly exploring disruptive technologies and breakthrough architectures, keeping however strong roots in market and customer requirements

Product Range EVOLUTION is a KEY DRIVER for Sustainability Improvements...

More Efficient Design
means More Sustainability

Components life extensions (less overhaul, logistics, maintenance), weight reduction (more payload, less flying hours), equipment upgrades through service bulletins (operative life extension of each SN) etc.

Safety at the Core in any Improvement

Focus on Operations
allows Footprint Reduction

PBN routes optimization, Robust RNP 0.3 / 0.1 capabilities with Dual Frequency Multi-Constellation SBAS Navigation Capacities, SAF Fuel etc.

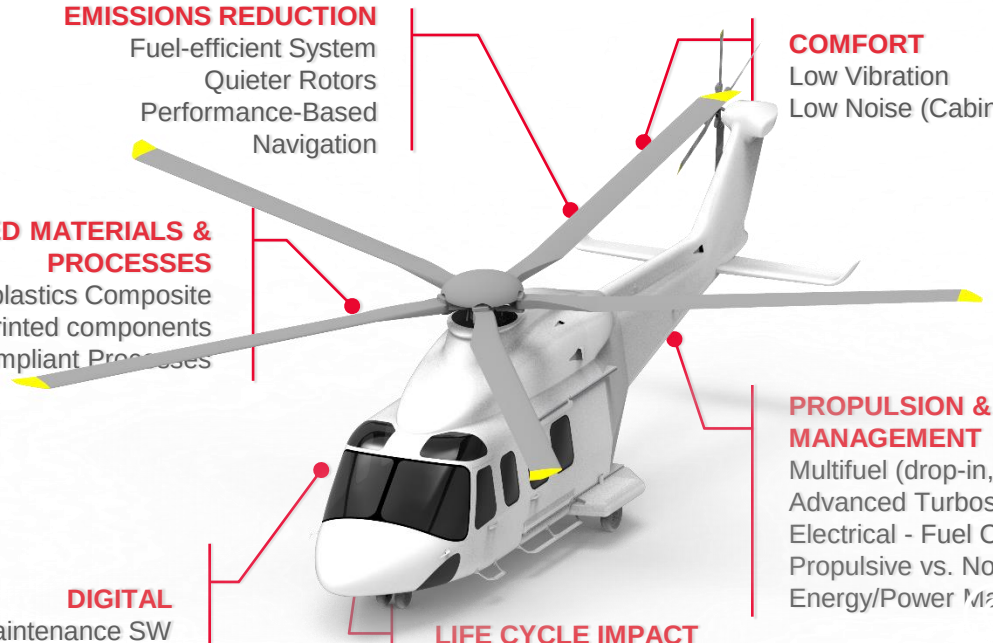
Efficiency
By Design

Safety
360°

Greener
Operations

Platform Architecture – Sustainable Rotorcraft

SUSTAINABLE ROTORCRAFT TOPICS



EMISSIONS REDUCTION
Fuel-efficient System
Quieter Rotors
Performance-Based Navigation

COMFORT
Low Vibration
Low Noise (Cabin)

ADVANCED MATERIALS & PROCESSES
Thermoplastics Composite
3D printed components
REACH-Compliant Processes

PROPULSION & POWER MANAGEMENT
Multifuel (drop-in, non drop-in)
Advanced Turboshaft
Electrical - Fuel Cell
Propulsive vs. Non-propulsive
Energy/Power Management

DIGITAL
Usage & Maintenance SW
Diagnostics/Prognostic on condition

LIFE CYCLE IMPACT
Life Cycle Assessment
Green Register
Environmental Product Declaration(EPD)

PERFORMANCE | SAFETY | OPERATIONS | COST | PASSENGERS | INFRASTRUCTURES

ENABLING TECHNOLOGIES

Propulsion & Power Management	*Turboshaft (configuration, materials, eFuels) Hybrid/Electrical (motors, batteries, Fuel Cells), Energy Mgt.*
Emissions Reduction	*Fuel-efficient Design & Propulsion Quieter Rotors, Flight Trajectories*
Advanced Materials & Processes	*Composite, 3D printed, REACH-compliant materials & processes*
Comfort	*Low Vibration/Cabin Noise Techs. (aerodynamics, materials, passive-active systems)*
Digital	*Usage & Maintenance SW, Diagnostics/Prognostics on condition*

OTHER ENABLERS

Policies & Regulations

GREEN DEAL

REACH COMPLIANCE

EASA

A General Example, the AW189 Program Continuous Improvement...

CUSTOMERS & ENVIRONMENT: The AW189 path to GROWING EFFICIENCY and SUSTAINABILITY

2018

- Oil Rig Approach
- RNP 0.3
- LPV
- EAFR
- Lightweight seats
- Fuselage weight reductions
- SLL extensions

2019

- HTAWS Offshore Modes
- GBAS
- Cockpit Camera
- Fuselage weight reductions
- SLL extensions

2020

- SLL extensions
- Corrosion Protection program completion

2021

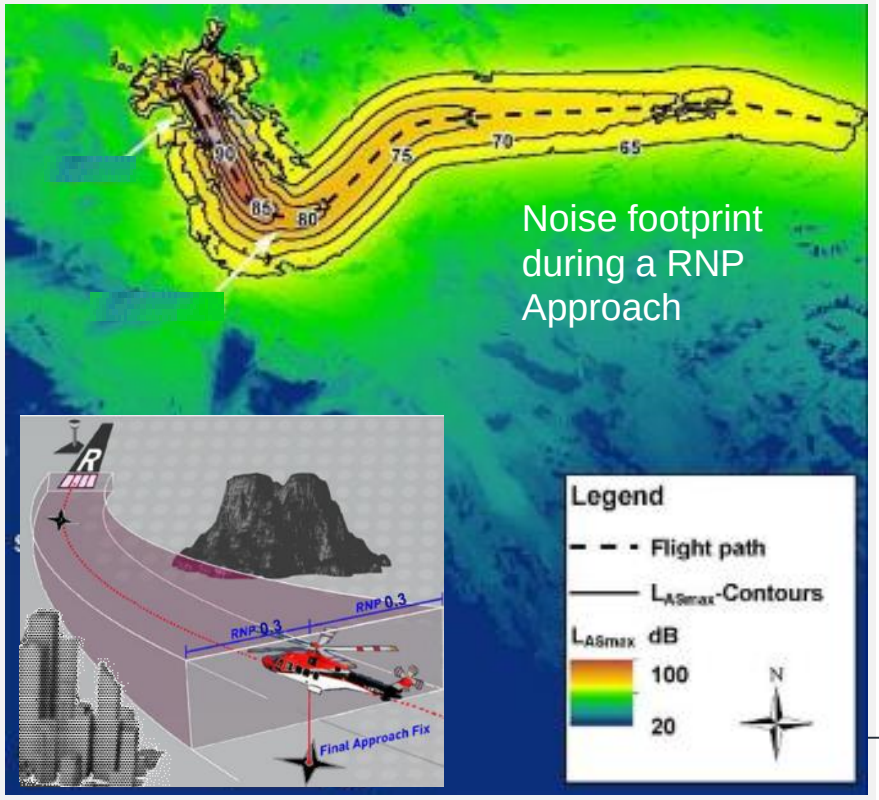
- EnginesTime Limited Dispatch
- Automatic PAC
- Weight reductions
- SLL extensions

CONSTANTLY RAISING THE BAR ON:

EFFICIENCY **SAFETY** **OPERATIONS**

Reinforcing PBN/SBAS Operations: Dual Frequency Multi-Constellation Navigation

Leonardo actively invests in the DFMC Navigation Technology, with the aim of improving and consolidating SBAS standards in Aeronautics



Operational Benefits:

- *Increased integrity, availability and continuity of the signal*
- *Increased robustness against ionosphere storms and interferences*
- *Core constellation redundancy*

Impact on Sustainability:

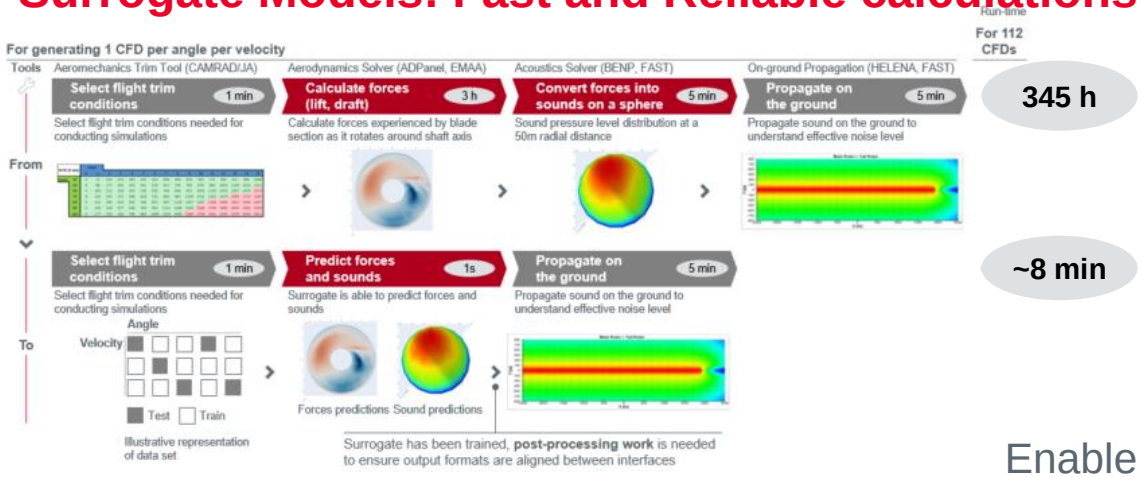
Leveraging on PBN/SBAS navigation robustness, increased routes optimization will contribute to further improving:

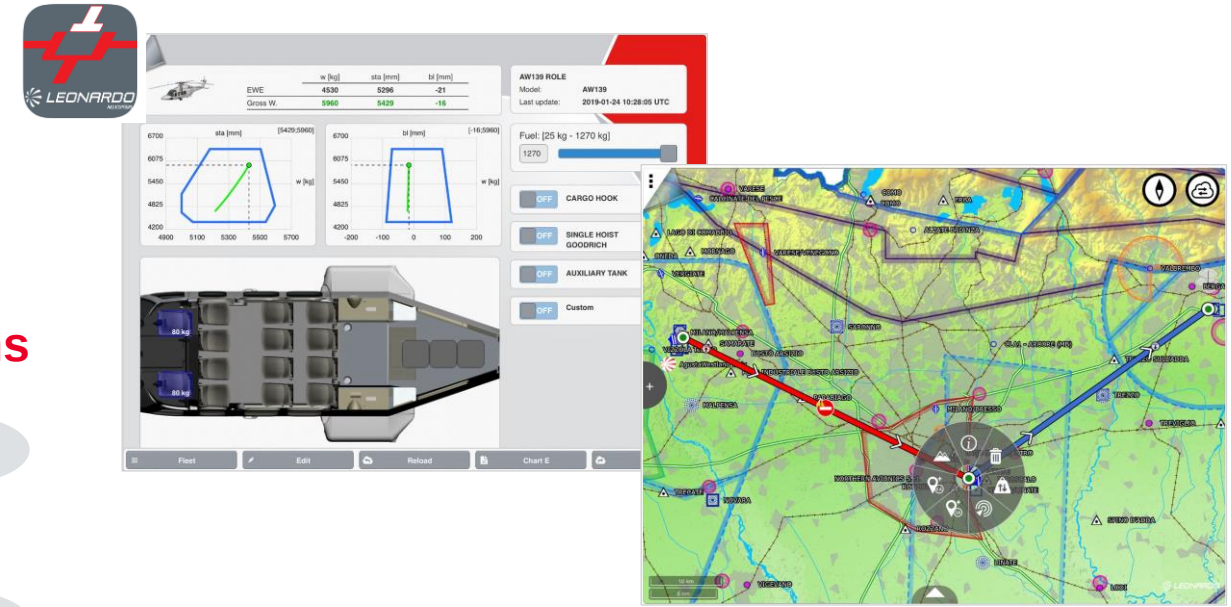
- *Fuel Consumption Efficiency*
- *Ground Noise Impact*

LHD helicopters OPEN ARCHITECTURE DESIGN is KEY to implementing DFMC SBAS standards for future RNP 0.3 and RNP 0.1 Helicopter Navigation

Skyflight evolution - acoustic emissions planned along the flight paths through Surrogate Models

Surrogate Models: Fast and Reliable calculations





Surrogate acoustic predictions

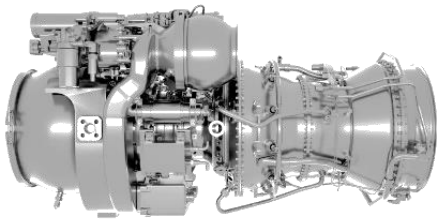
Enable a **new feature** of predicting **acoustic emissions** along the **planned flight path**

Ground noise prediction - **increase attractiveness of the app** and be **unique in the industry**

ADVANCED PROPULSION

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 CO2 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 (e.g. transmission, volumes, …)

Leonardo Approach to Sustainable Aviation Fuel (SAF)

Issues for SAF fast pace introduction:

- *Feedstock supply / SAF refinery capacity*
- *SAF cost not competitive if no carbon taxes applied (EU & rest of the world)*
- *No engines/helos still certified for 100% SAF usage*

LHD helicopters approach is also on:

- ***SAF «Recipe»***
- ***Infrastructure***
- ***Operational Capabilities***

Environment impact mitigation

LEONARDO HELICOPTERS DIVISION

TECHNICAL INFORMATION LETTER

TIL N°	**T-GEN-21-005**
DATE:	**September 21, 2021**
REV.:	**/**

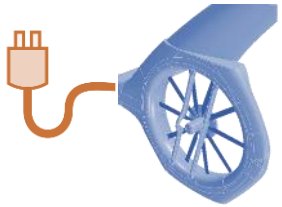
To:	Leonardo Helicopters products Owners / Operators
SUBJECT:	**Environment impact mitigation**
Helicopters Affected:	AW139, AW169, AW189, AW149, A109S, AW109SP, AW119MkII, A109A/AII, A109C, A109K2, A109E, A119

Beyond SAF: LHD Approach to Hybridization and New Propulsion Technologies

HIGHER SAFETY STANDARDS

- **New operational scenarios** (e.g., singles operating congested / hostile areas)
- Mitigate operational risks (power boost)
- Simplify training procedures

HeDrive
Helicopter electric Drive



eTail
electric Tail Rotor

Hybrid single

The BRAND NEW AW09 is the LHD «Incubator» to developing innovative technologies, aiming at higher degrees of sustainability (both for customers and the environment)

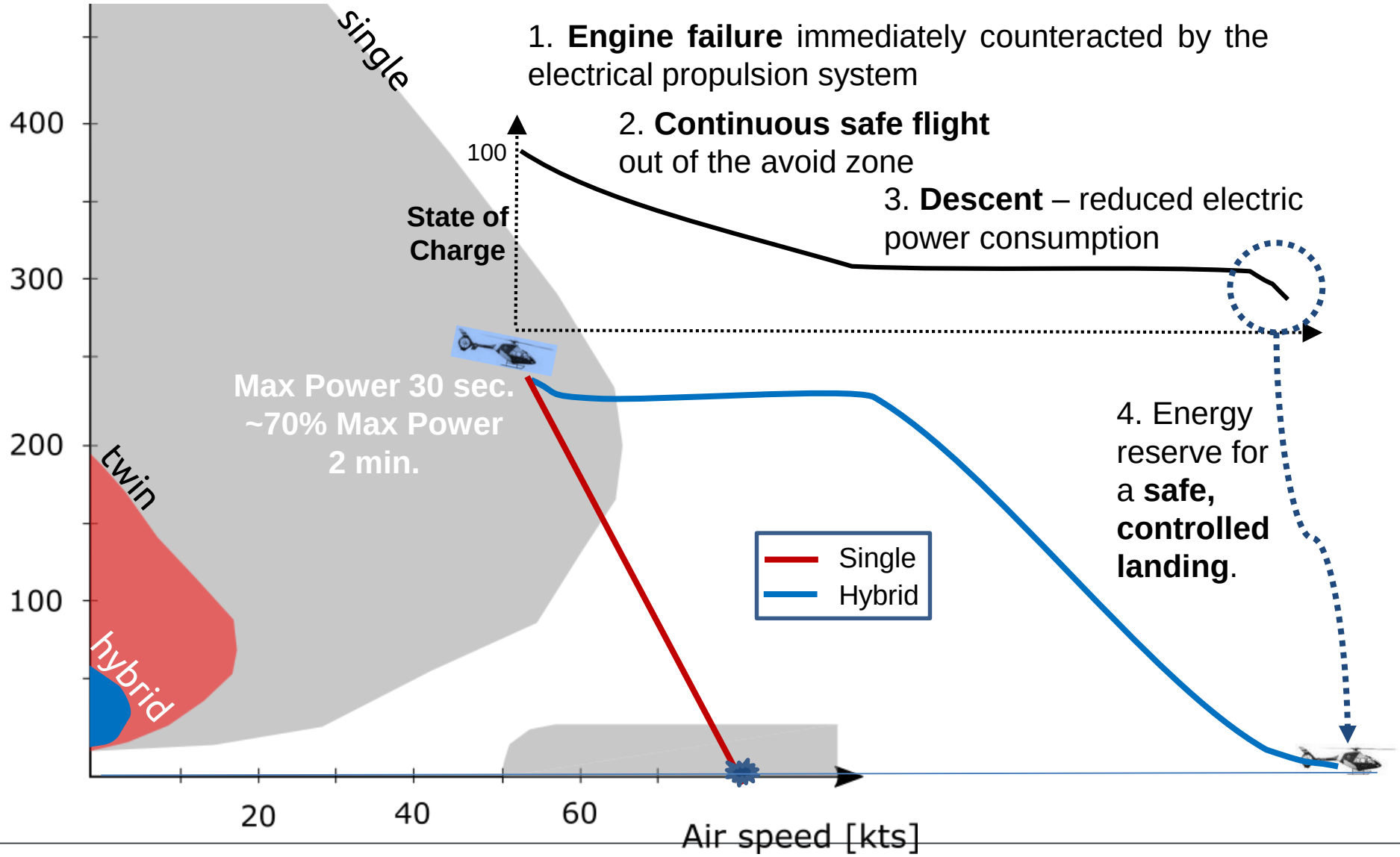
INCREASED EFFICIENCY

- **Higher efficiency propulsion** (e.g., lower operating costs)

GREENER OPERATIONS

- **Lower CO2 output** (e.g., lower operating costs)
- Noise Footprint Reduction
- **Singles** instead of **Twins**

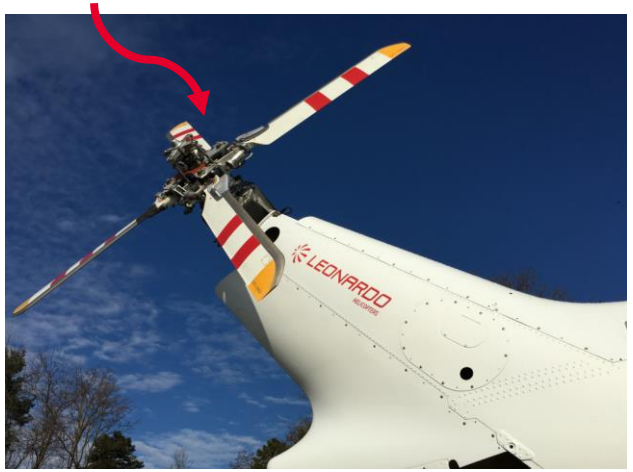
LHD Approach to Hybridization: Singles for Twins over Congested Areas



Electrification and new architectures

2010-2015

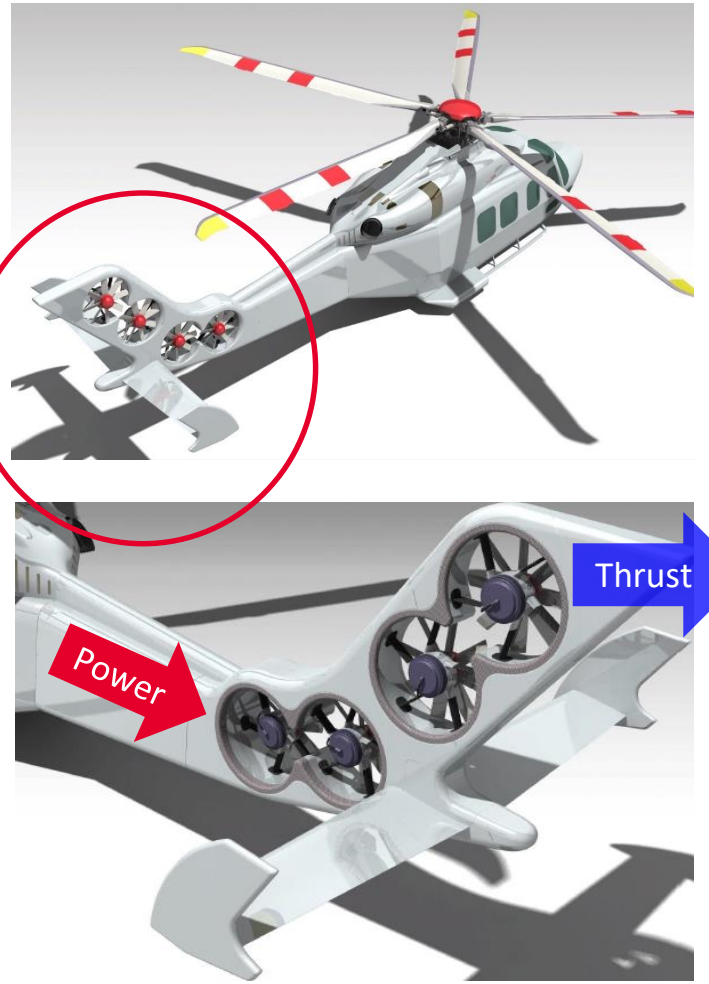
Air-cooled tail motor unit



… tail gearbox F³, *but 3.5x heavier*

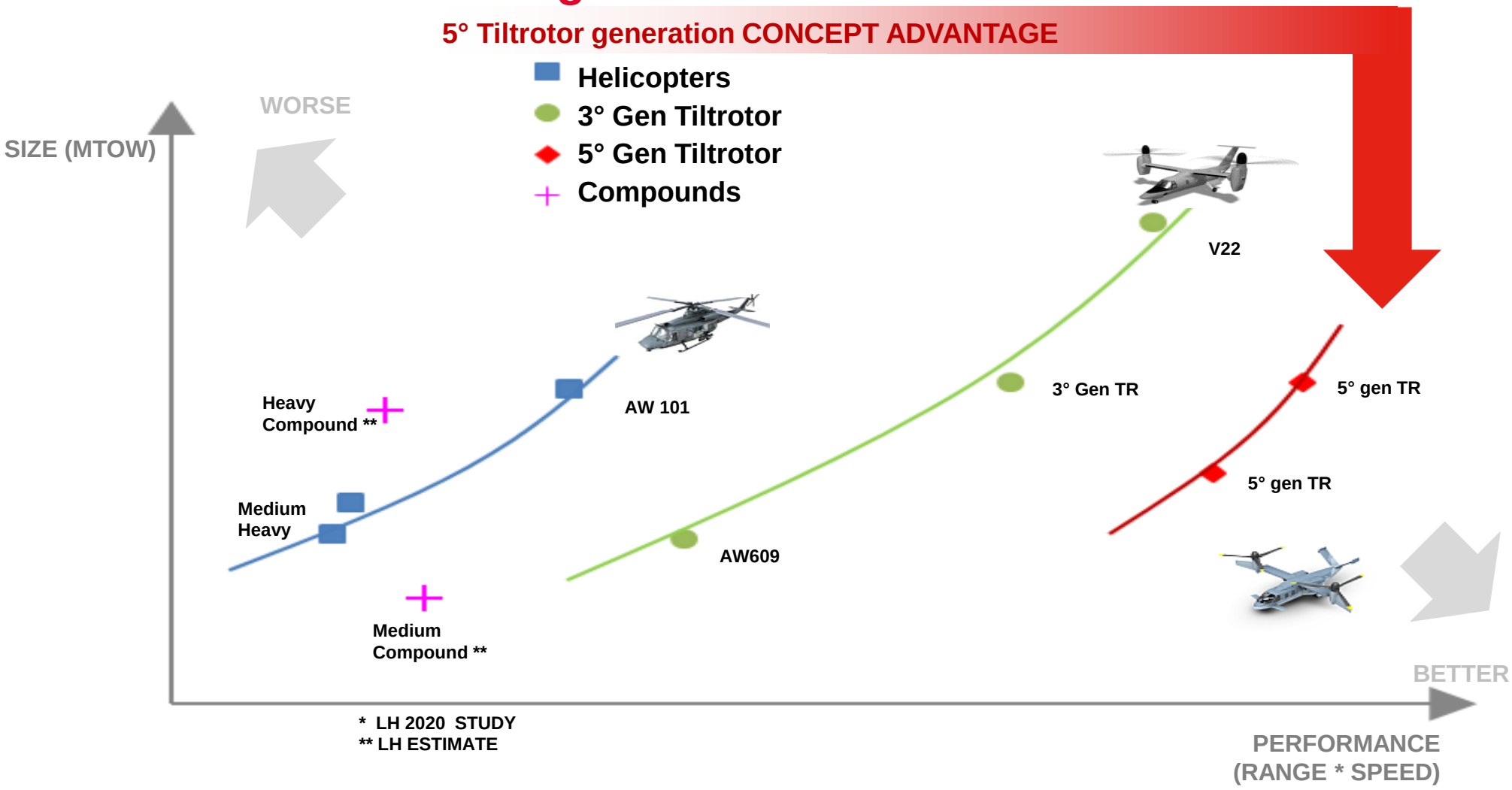
2020 - on

Streamlined, sheltered and redundant



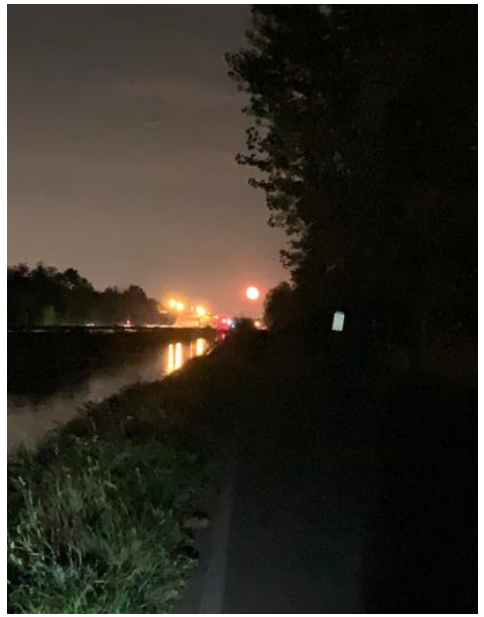
… with fixed-pitch rotors (*i.e. fans*)

LHD view on future configurations



Recapping

- SUSTAINABILITY is a **need** to be approached in all possible arenas
- Everyone inside Leonardo is aware of the importance and challenge offered by this **need** and is pushing to improve it
- SUSTAINABILITY is a culture that has to be spread and applied at all levels
- My daily work in the design of improvements and new machine is based on this view
- And….



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THANK **YOU**
FOR YOUR ATTENTION

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