



PASSION FOR
TECHNOLOGIES

AKKA UAM / UAV EXPERTISE & REFERENCES

May 2021



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AKKA INTRODUCTION



PASSION FOR
TECHNOLOGIES

AT A GLANCE



€ 1,8 Billion



22 000 employees



26 countries

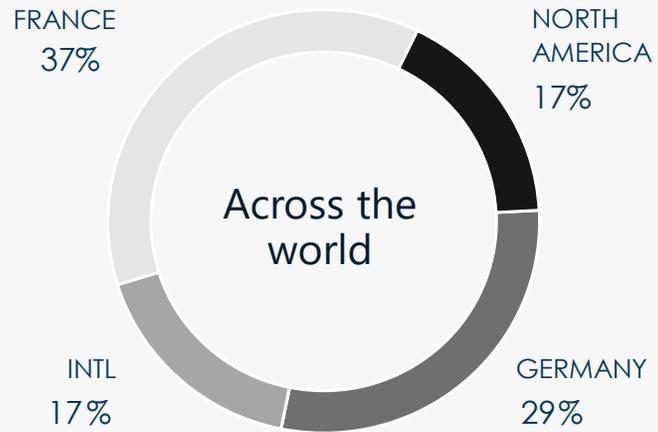
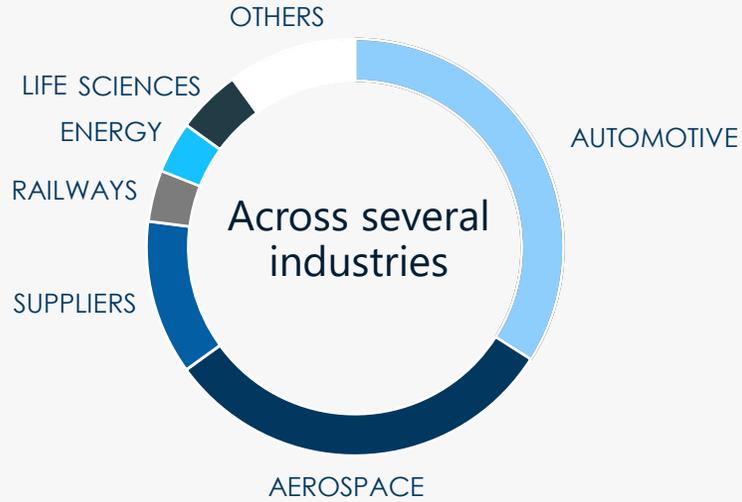


BELGIUM | CHINA | GERMANY | FRANCE | GREAT BRITAIN | INDIA | ITALY | JAPAN | CANADA | MOROCCO | THE NETHERLANDS | AUSTRIA |
ROMANIA | RUSSIA | SWITZERLAND | SINGAPORE | SPAIN | THE CZECH REPUBLIC | TURKEY | HUNGARY | UNITED ARAB EMIRATES |
UNITED STATES | DENMARK | NORWAY | SWEDEN | TAIWAN

CONFIDENTIAL



DIVERSIFICATION



A SOLID CUSTOMER LIST



CONFIDENTIAL

A full-fledged
AEROSPACE ENGINEERING PARTNER for R&D,
systems/equipment design,
certification and after-market.

 **+5 000** Aerospace Engineers

We are **PRESENT ALL ALONG THE AIRCRAFT LIFE CYCLE** making us a one stop shop.

A UNIQUE EXPERIENCE

AEROSPACE

SPECIALIST CONSULTING | AGILE TEAMS | R&D PROJECTS | FULL SOLUTION



For more than 30 years, AKKA has been successfully involved in many aircraft programs worldwide, in relation with many civil aviation authorities thanks to a unique combination of resources and skills, together with contract modes adapted to its customer needs

CONFIDENTIAL

AKKA

AIRCRAFT & SYSTEMS ENGINEERING OVERALL CAPABILITIES

For more than 30 years, AKKA has developed its own design office **(CENTRE OF EXPERTISE)**, able to work on turn key projects thus allowing unique engineering flexibility for its customers



Avionics (SW/HW) & Cockpit Design



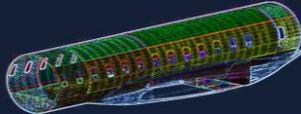
Flight Control & Guidance



Power System & Green Energy



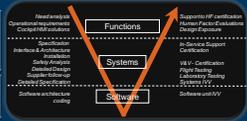
Multi-Physics & Data Science



A/C Architecture & Mechanical Eng.



Ground & Flight Testing



Certification & Safety

VARIOUS DELIVERY MODELS

- Consultancy, specialists, R&D projects
- Strategic collaboration partner
- Top selected talents & specialists
- Multi discipline specialist teams

PRODUCT DEVELOPMENT



STRATEGIC PARTNERSHIP



LONG TERM PROJECTS



Customised delivery models adapted to customer needs

SPECIALIST SERVICES

WORK PACKAGES

R&D PROJECT

FROM STAFFING TO GLOBAL SERVICES



Customer refocusing on core activities

transferring some program management responsibilities to AKKA



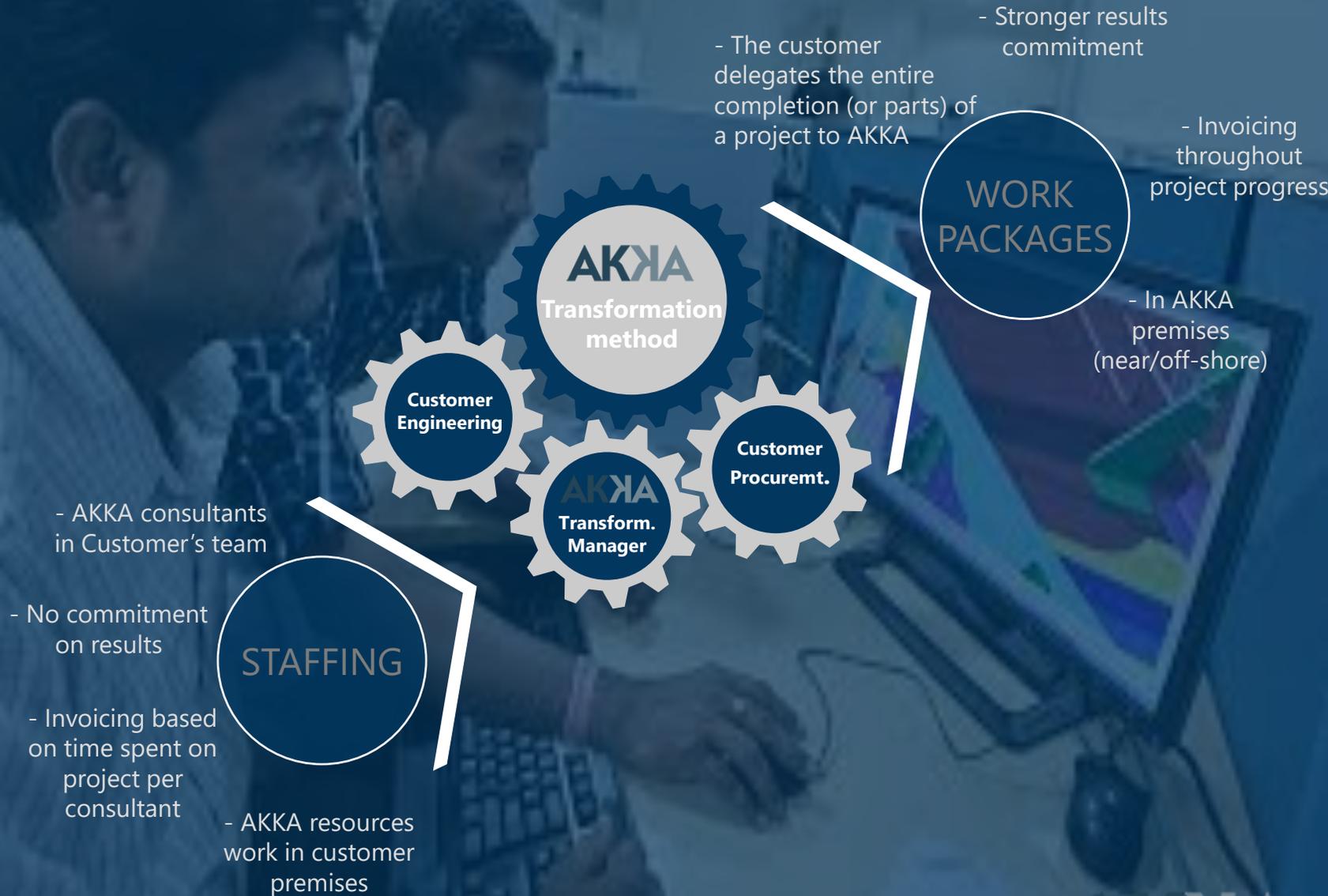
Benefit from innovative support



Procurement budget monitoring & control

KPIs

Work Units & Services contract help manage customer budget



INNOVATION is our DNA and AKKA RESEARCH our innovation catalyst



50 Dedicated Experts



+500 Engineers Involved



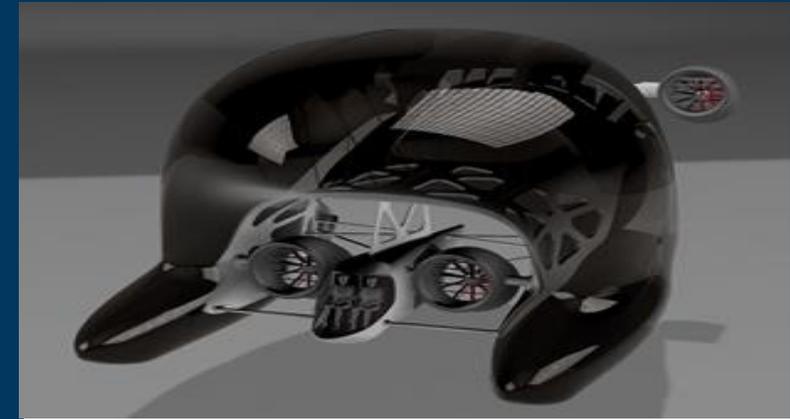
30 Projects Developed

Our goal is to keep our engineers skills at the highest levels by allowing them to work on innovative projects internally (but also in collaboration with our customers) together with **THE SUPPORT OF SENIOR ADVISORS**



AKKA

LINK & FLY: A green A/C concept proving AKKA aerospace innovation & prototyping capabilities



AIRLIUM: AKKA partnership with Airbus Helicopters to develop a new flying vehicle



INTEGRAL E: AKKA partnership with AURA AERO to develop an electric aerobatic plane



AKKA

LINK & GO: Development of a fully autonomous vehicle up to a scale 1 prototype

BEYOND THE CONSULTING & ENGINEERING MODEL

Transforming Mobility thus
Aerospace through **A
COMBINED EXPERTISE** in
Digital & Engineering



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AKKA EXPERTISE

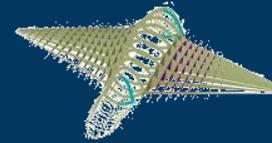
For UAMs/UAVs Design & Development

FLIGHT PHYSICS

AKKA SKILLS OVERVIEW

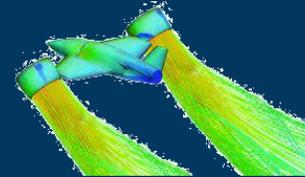
Preliminary design:

First evaluation of a new design addressing new constraints or disruptive concepts



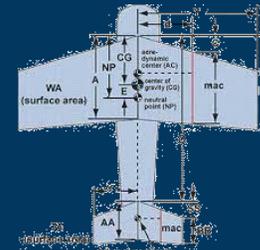
Performance :

- HS& LS Performance
- Engine performance
- Flight Applications



Ground & Flight tests :

Ground & Flight tests preparation, follow-up and exploitation



Loads & Aeroelasticity:

- Static & Dynamic Loads and Aeroelasticity

Flight Dynamics :

- A/C Model Simulation
- Flight Test Identification
- Ground Model identification

Aerodynamics, thermal & acoustic:

- Aerodynamics Design
- Aerodynamic Data
- Wind Tunnel Testing
- Computational Fluids Dynamics

Mass properties:

- Mass distribution/matrices derivation
- Reduction of mass on structures and systems

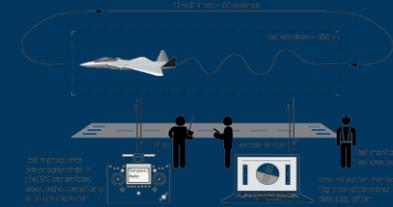
AKKA consolidates and develops skills in the long term on the complete flight physics scope to propose end-to-end service solutions, to follow products developments from preliminary design to in-service support

FLIGHT CONTROL & GUIDANCE

AKKA SKILLS OVERVIEW

Architecture Definition and Safety Analysis:

- Preliminary design (architecture, technologies assessment)
- Functional and operational specification
- Functional failure analysis



Rigs & Flight Testing:

- Evolution and validation of test means
- Multi-systems integration and validation
- Functional Test-cases elaboration
- Analysis of test results

System Design:

- Detailed system description/conception
- Detailed software specification
- Validation on desktop simulator
- Supplier follow-up
- System, interfaces, ... configuration management



CERTIFICATION

- Preparation of certification plan
- Coordination of certification deliverables
- Certification summary

AKKA provide to its customers full services in the flight control and guidance sector, from the early system design to the certification of these systems directly with the authorities

PROPULSION

AKKA SKILLS OVERVIEW

Engine / Nacelle system integration:

- Propulsion systems specification
- Optimization, Validation & Verification of the design
- Management of the physical and functional interfaces Engine/Nacelle/Aircraft
- Systems qualification follow-up

Certification & Safety Analysis

- Certification dossier preparation (Test & Analysis report, Dispatch report, QTP, QTR...)
- Safety of flight preparation (Flight Readiness Review → Flight clearance & limitations)
- Systems Safety Analysis
- Support to UERF, & FESRA Particular Risk Analysis



Powerplant test :

- Management of Powerplant integration test (Ground Test, FTB/FTD, Flight test)
- Test procedures & instrumentation definition
- Test follow-up & test result analysis (incident report, SNAG)

Propulsion control:

- Software (OS & AS) / Hardware Design Specification
- Software / Hardware design validation, test & verification
- FADEC A/C System Interfaces management : FMS, NAI, Fuel, AICU, IRPS-FWS...
- Configuration management

Support & In-service follow-up:

- In service continuous development
- Coordination of problems report (ISRO, daily query)
- Support to airlines / MAP

AKKA is able to develop a tailored / bespoke approach to maximize value for their customer thanks to its Centre of Expertise

ELECTRIC SYSTEM

AKKA SKILLS OVERVIEW

Electrical technologies still need to be refined (ex. weight and battery autonomy must be optimized : with the current energy generation capacity of today's batteries)

Research programs, functional prototype & technological prototype:

- TRL1-2: State of the art, conceptual formalization, development plan & V&V
- TRL3: pre-design study, modeling & characterization, system integration in simulation
- TRL4-5: prototype specification, definition by testing

UAV system architecture, power electronics equipment & electronics

- Write the EAS (Electrical Aircraft System)



System specification, V&V, Architecture and equipment

- Write LTR/TRA & perform tests on equipment or simulator

System responsible design

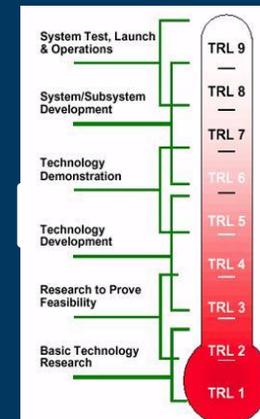
- Modelling electric system at FAI level (First Article Inspection)

System integration flight tests, Ground/lab integration tests

- Modelling of electric environmental Control System

In service support:

- Retrofit: integration of fuel cell-based system in replacement of the Ram Air Turbine



STRUCTURAL DESIGN

For 20 years, AKKA has acquired a significant assets and background in terms of design & stress, especially in aeronautic domain both structure and system installation by being involved in major aircraft programs.

AKKA SKILLS OVERVIEW

Structure Mechanical Design:

- Primary and Secondary Structural Parts
- Doors/Movable parts
- Metallic and Composite elements
- 3D Tolerancing



Mechanical Stress and Thermal Analysis

- Static, Dynamic, Fatigue, Damage, Tolerance
- Thermal impacts
- Modelling (FEM)
- Test and Certification dossier

Electrical Systems Installation

- Electrical installation rules
- 3D design routing
- Electrical schematics
- Electrical Harness design, protection and qualification



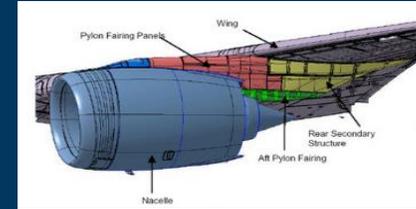
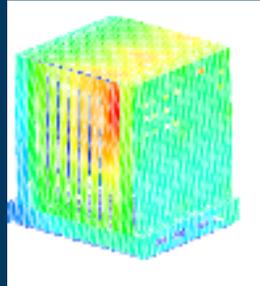
Seats & Cabin Integration:

- Design and integration
- VIP Seats
- Cabin monuments, cabinets ...
- STC capabilities

MECHANICAL EQUIPMENT DESIGN & INSTALLATION

Our development has been driven by a continuous strategy to build a comprehensive capability (Specific and Non-specific design) on all major aircraft components and on all major systems.

AKKA SKILLS OVERVIEW



Equipment Design:

- Detailed equipment description/conception
- Electro-Mechanical Actuators (EMA) & E-Taxing specification and development
- Detailed software specification
- Validation on desktop simulator
- Supplier follow-up
- System, interfaces, ... configuration management

Mechanical System/Equipment Installation:

- System Physical Architecture
- Installation rules
- Fixed brackets
- 3D routing
- Drawings
- Tubes, pipes, valves ...

Tooling Offer

- Tooling design and support to manufacturing (workshop platform, GSE ...)
- Test bench architecture and definition
- Space Solutions for satellite, antenna, MLI ...

CERTIFICATION, SAFETY & PROCESS ASSURANCE

AKKA is able to support its customers from the very beginning of their project by defining their STRATEGY, ensuring adequate means are in place to DEPLOY the process. AKKA also support its customers in the MONITORING of their project. Finally, AKKA support the COMPLIANCE demonstration with the certification dossier

AKKA SKILLS OVERVIEW

Define Compliance Strategy

- Situation assessment
- Actions plan definition
- Challenge schedule & organization
- Exchanges with Authorities

Deploy

- Training (standards & regulations)
- Dedicated Workshop (requirements management, V&V etc.)
- Process Improvement



Compliance Verification

- Liaison with Authorities
- Audits
- Certification dossier

Monitor & Document Compliance

- Data review (documents, code, tests, etc.)
- Quality activities
- Audits
- Recovery support

ARP4754
ARP4761
DO254
DO178
DO33x

ISO 26262
IEC 61508
MIL-STD-882E

EN 50128
ED153
DO278A

IEC 62304
ISO 13485
ECSS

OTHER EXPERTISE*

AKKA can support its customer all along the design and development cycle of its product on all technical activities domain

AKKA SKILLS OVERVIEW

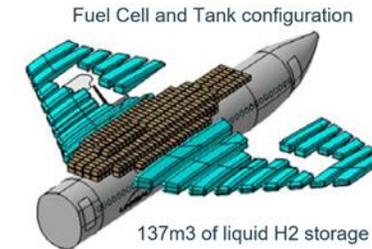
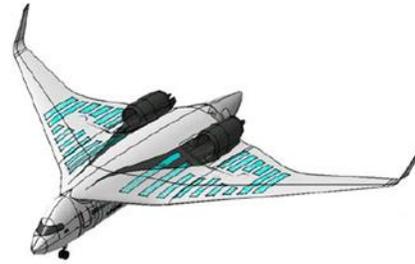
AKKA can also support its customer on following topics:

- Radio Com & Air Traffic Management (ATM)
- Cyber Security
- Human Factor
- Integrated Logistic Support
- Maintenance Engineering
- Data Science & Data Processing
- Methods and Tools for Simulation

*These solutions could be detailed on request

AKKA ASSET FOR UAV/UAM MARKET

Based on its expertise, AKKA considers that the following technological bricks already investigated could be useful for UAV/UAM market



- Hybridization/Electrification
- Single Pilot Operations
- Thermal Management Energy System Activities
- Computer / Software development
- IoT / Communication
- HUMS / Health Monitoring
- Aerodynamic Lines
- Hydrogen
- Battery Management System
- Electrical Landing Gear

MAJOR EUROPEAN AIRCRAFT MANUFACTURER FLIGHT TEST AIRCRAFT CONTINUING AIRWORTHINESS

OBJECTIVES Flight test aircraft maintenance and configuration management to ensure the continuing airworthiness and Permit to Fly renewals in a Part 21 environment.



- RECORDING INTO AMASIS OF FLIGHT TEST AIRCRAFT TECHNICAL AND FLIGHTS ACTIVITIES
- MAINTENANCE PLAN, PERMIT TO FLIGHT, AIRCRAFT STATUS
- OPERABILITY TASK CARDS (OTC) PLANNING AND TECHNICAL COORDINATION WITH AIRBUS PRODUCTION AND QUALITY TEAMS, MAP AND MANUFACTURING ENGINEERING FOR EMBODIMENT ON AIRCRAFT



- ✓ Team composed with a combination of experienced CAMO Technicians and Engineers
- ✓ Substantial knowledge of the tools, methods and processes of CAMO activity and Airbus Flight Test environment
- ✓ Flexibility to adapt to workload depending of A/C Phase In and Phase Out



KEY POINTS

2013-2020 | 13 FTE + 1 Support IT
Saint Martin du Touch (Customer In-situ)
Workpackage

REGULATION ENVIRONMENT

Customer Flight Test, AMASIS, FTA, e-TLB...

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AKKA REFERENCES
UAV/UAM projects references

LILIUM JET

SAFETY ANALYSIS

CONTEXT

- Conduct safety analysis for FCS, autopilot and Navigation to support SC VTOL certification
- CS25/CS23 aircraft safety approach transposed to E-VTOL vehicle



ACTIVITIES

- ARP standards application to System Engineering
- Finalize System Design Documents in accordance with ARP standards
- Contribute to the development of the safety analysis and documentation for the system safety assessment (SSA)

LILIUM JET

ATA27 V&V Analysis



CONTEXT

- Conduct Validation & Verification activities for the Flight Control System to support SC VTOL certification

ACTIVITIES

- Take the ownership of critical aspects of the system and manage its whole validation and verification cycle
- Participate in functional development, validation and verification of the system
- Plan the integration, validation and verification activities at system and sub-system level
- Write certification documents
- Define verification reuse concept across multiple levels (System, Item, Software)

SAFRAN - PATROLLER

Support for proposal a new
Flight Control architecture

CONTEXT

- New architecture co-definition
- Capitalizing on UAV regulations



ACTIVITIES

- Raise awareness the customer concerning different flight control computers functioning
- Trade off on architecture solutions (safety, technology, weight ...) considering all the systems connected to the flight control computers

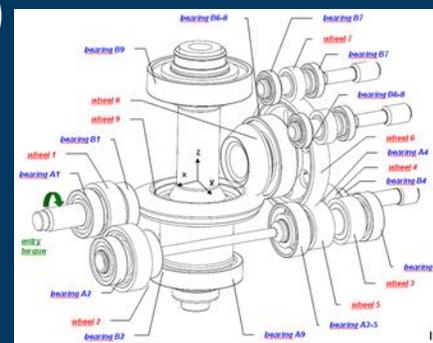


CONTEXT

Redesign for a MGB with 35% power capability increase without weight and space occupation evolution

ACTIVITIES

- Kinematic chain and bearings installation analysis
- Efficiency and thermal analysis
- Kinematic chain evolution and bearings installation
- 3D creation and BOM creation (weight analysis)
- Lubrication system integration (reliability and efficiency improvement)
- Stress analysis (FEM and analytic methods)
- Manufacturing analysis including manufacturing methods evolution as high speed machining



TPI

Drone MGB
Re-Engineering

AIRBUS DEFENCE & SPACE

BATTERY MANAGEMENT SYSTEM

CONTEXT

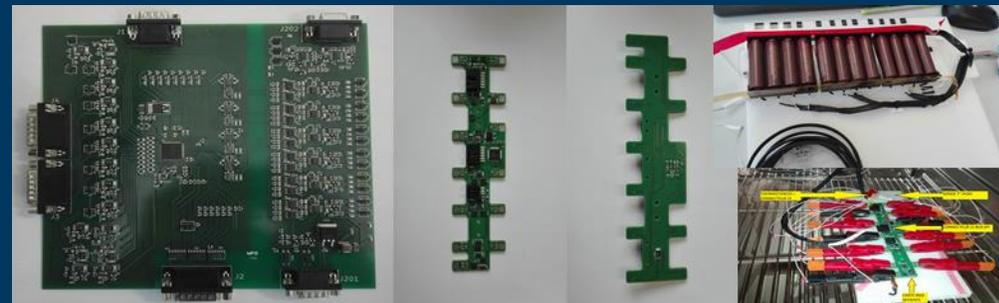
Test of battery management system (BMS) for Skyways and CityAirbus



ACTIVITIES

Test procedure definition

- Procurement and development of test mean
- Test realization
- Results analysis



AIRBUS

ELECTRICAL AIRCRAFT SYSTEMS (EAS)

CONTEXT

- Hybrid electric propulsion
- Electric propulsion
- Low, medium and high power platform demonstrators development



ACTIVITIES

- Electrical architecture modelling and pre-integration by simulation
- Support to architecture design (electric protection, control, energy management, pre-sizing, filtering)

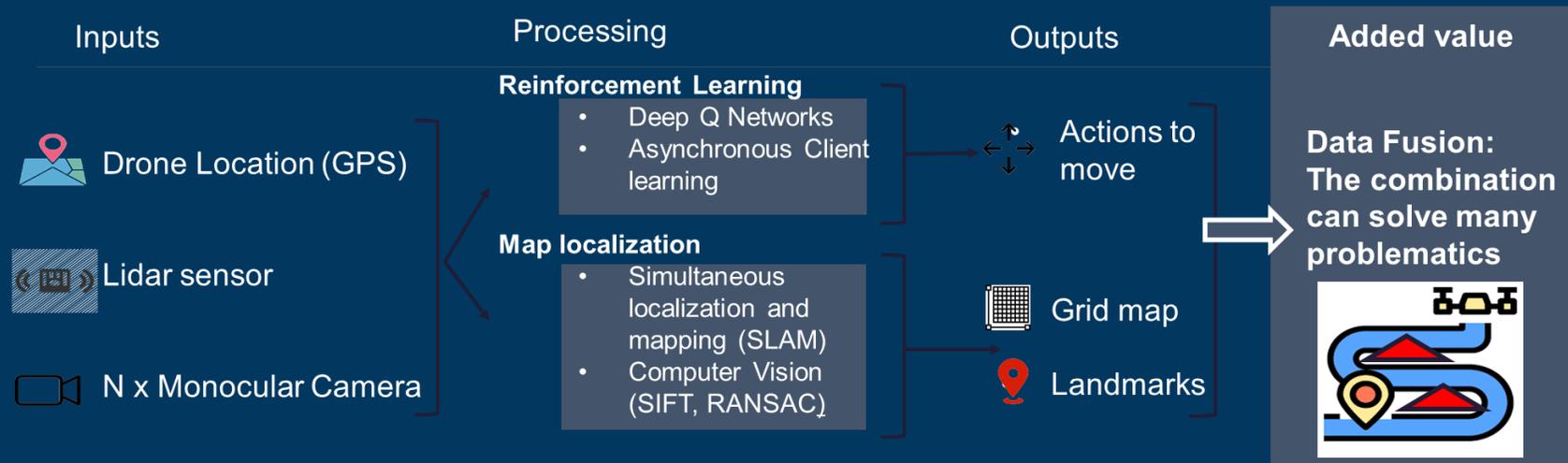
AKKA RESEARCH – INNOVATIVE SOLUTION

Autonomous Guidance

CONTEXT

AKKA develop a complete solution for autonomous guidance

ACTIVITIES

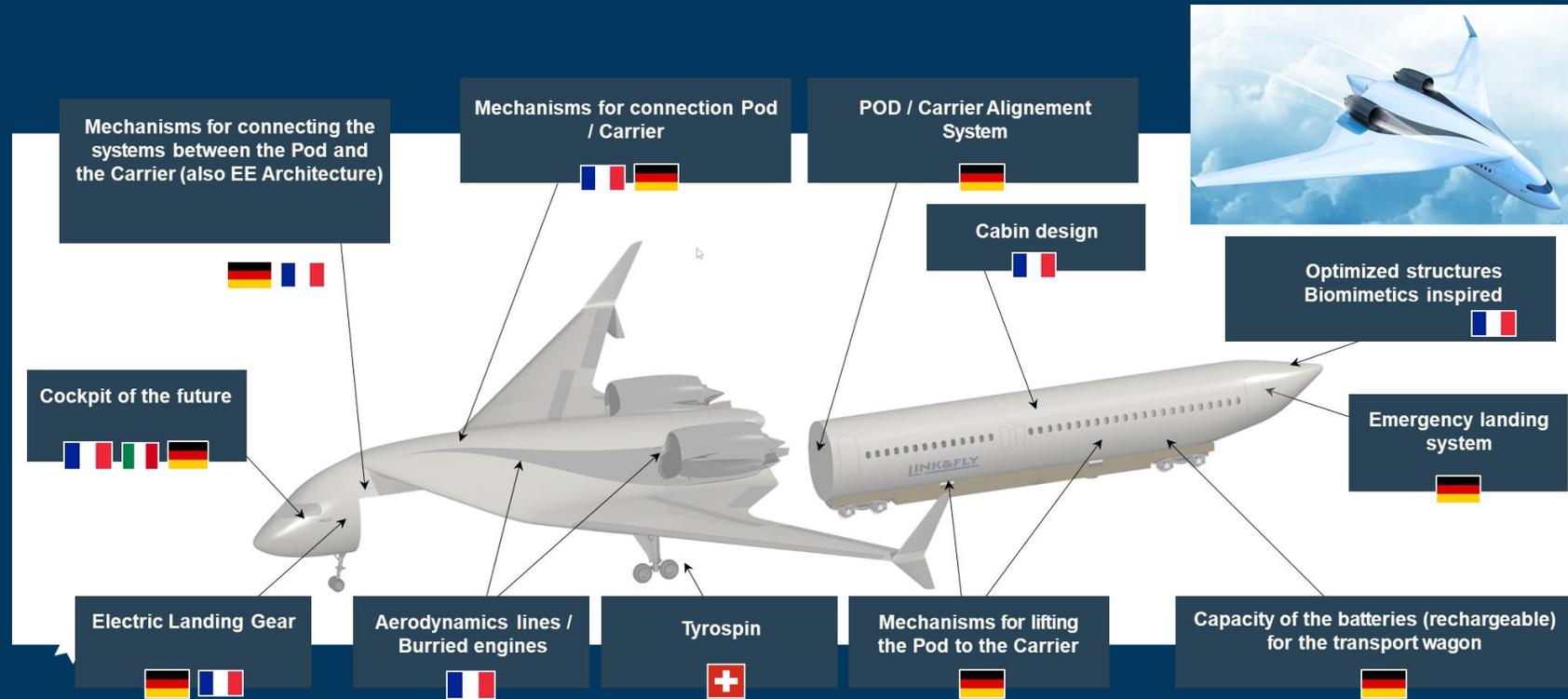


AKKA RESEARCH – INNOVATIVE SOLUTION

LINK & FLY Project

CONTEXT

Development of technological breaks

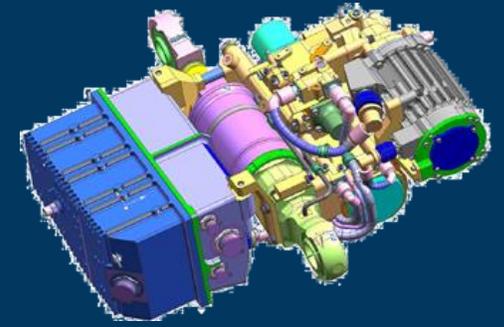


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AKKA REFERENCES For UAMs/UAVs Design & Development

AIRBUS

Flight Control Actuators &
EMA



CONTEXT

Works on the whole Primary Flight Control Actuator activity covering all serial programs, development programs including incremental developments of the serial products, research activities (EMA)

ACTIVITIES

- Functional & operational specification including modeling and simulation (Matlab, SCADE, electric and thermal modeling)
- Preliminary System Safety & Risk analysis
- System & Interface specification
- V&V strategy plan (Ground/Flight tests, Fatigue and endurance tests, tests reports)

AIRBUS

E-TAXIING

CONTEXT

Design & development of e-taxiing function

ACTIVITIES

- Functional & operational specification
- Preliminary System Safety & Risk analysis
- System & Interface specification
- V&V strategy plan



Electrical Landing Gear for AW169 Program

MAGNAGHI

CONTEXT

Electrical landing gear system qualification for AW169 helicopter as per DO-160



ACTIVITIES

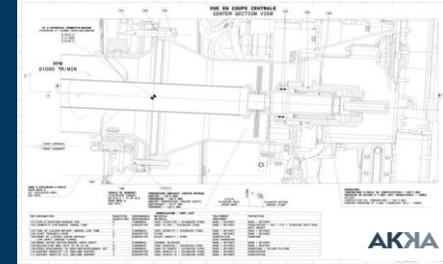
- Analysis of the system regarding DO160 requirements
- Proposing a test strategy
- Producing the qualification test procedure
- Number Optimization of items for tests
- Qualification tests at system level accepted by "MAGNAGHI" and "AGUSTA WESTLAND"

AIRBUS HELICOPTER

BTP interface Definition

CONTEXT

Interface definition between MGB and power engine



ACTIVITIES

- Integration of engine supplier engine definition in DMU
- Verification of adequation between locating and fixation devices
- Tolerance analysis in order to ensure assembly and functional clearances
- Drawing creation for interface definition and supplier acknowledgement
- Strong commitment between helicopter and engine suppliers by drawing signature
- Drawing becomes part of supplied engine statement of work

THALES

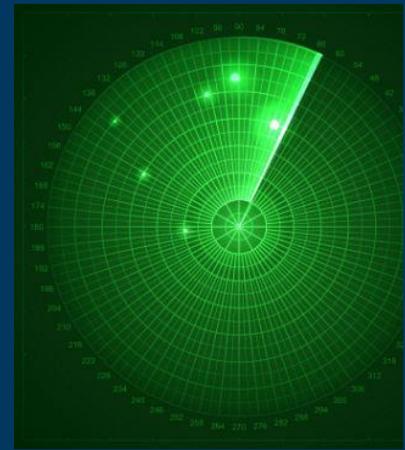
Safety-Critical Software
Development

CONTEXT

Support existing / new software development activities based on C++ / ADA development

ACTIVITIES

- Software development
- Software integration
- Software Testing
- Delivery of software components and products

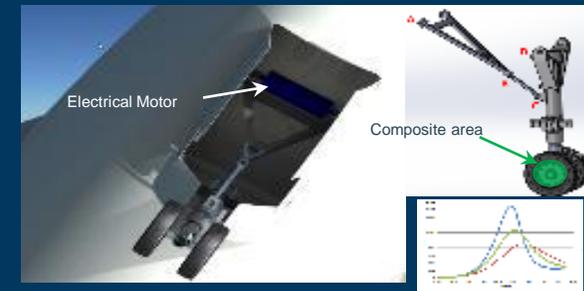


AKKA RESEARCH – INNOVATIVE SOLUTION

LINK & FLY Project
New Landing Gear concept

CONTEXT

To design a landing gear driven by electric motor, and to design a composite wheel



ACTIVITIES

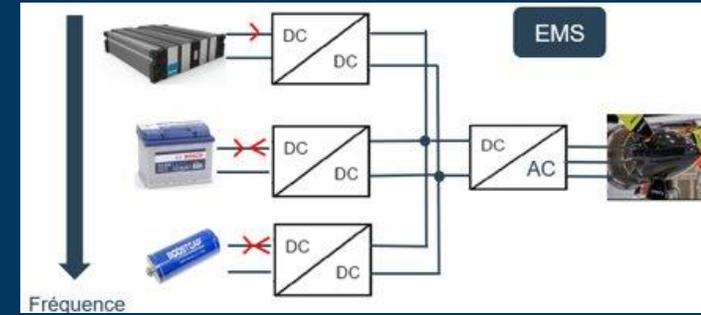
- Demonstrator forecasted for the Electrical Landing Gear , as a proof of Concept, in partnership with SOBEN Company
- Sizing of motor coupled to reducer performed considering the torque to be applied. The landing gear was adapted to such a concept.
- All the interfaces (mechanical / electrical aspects) are managed to build a bench test in partnership with Czech Republic.
- The sizing of the composite wheel is performed thanks to structural and wheels experts.

AKKA RESEARCH – INNOVATIVE SOLUTION

Green & Fly Project
Hybrid Propulsion

CONTEXT

Perform hybrid propulsion studies



ACTIVITIES

- State of the art of technologies:
 - Batteries, supercapacitors, fuel cells, ammonia
 - Electrical motors
 - Converters: DC/DC, AC/DC
- Architecture:
 - Definition of electrical architectures
 - Safety analysis
- Optimization Tools:
 - Static hybridation optimization
 - Dynamic hybridation optimization
 - Energy Management Control Systems
 - Thermal Management Optimization

LEONARDO HELICOPTERS

Fluid Dynamics Simulation
and Test Proposal



CONTEXT

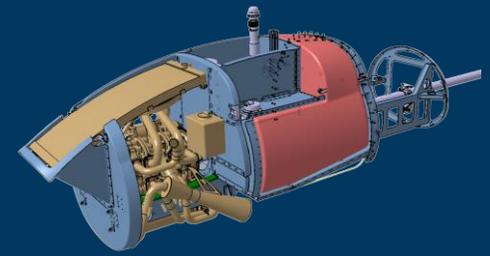
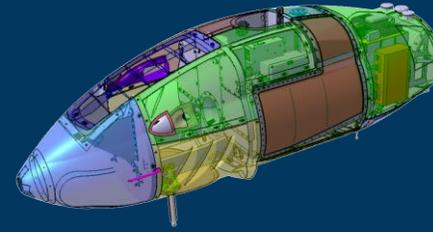
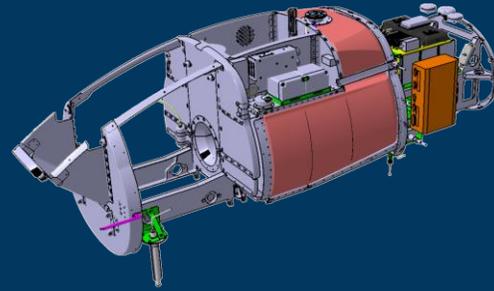
Analysis, Design and CFD Simulation of the Helicopter's On-Board Systems, for new projects and Certified machines

ACTIVITIES

- Aerothermal & Marine Design and CFD Simulation (1D/3D CFD)
- Test and Validation of different system as Air Distribution, pressure ducts or bay ventilations

LEONARDO HELICOPTERS

AWHERO Program



CONTEXT

Analysis, Design and CFD Simulation of the Helicopter's On-Board Systems, for new projects and Certified machines

ACTIVITIES

- Modeling of the hull surfaces
- Modeling, engineering and supplier interface for Airframe / equipment details
- Modeling and supplier interface for the engine and support structure with the fuselage
- Modeling and supplier interface for the tank and its parts

LEONARDO HELICOPTERS

AWHERO Program



CONTEXT

Avionic system design improvement, ground test coordination & execution

ACTIVITIES

- Design and development:
 - writing of technical specifications including customer requirements and applicable standards.
 - definition of electrical interfaces, functional and physic characteristics, equipment performances
- Test management:
 - test schedule planning
 - problem analysis and solving of AWHERO avionic systems integration
 - writing of test procedure and test report



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