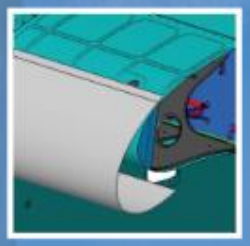
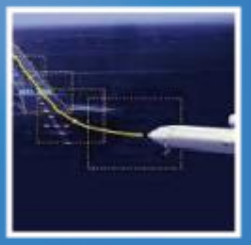










Innovation Takes Off

www.cleansky.eu

Clean Sky 2
Information Day dedicated to the 10th Call for Proposal Partners (CfP10)

LPA – IADP

Presented by
Marc Maurel, Airbus
Jens Koenig ; Airbus

Toulouse / France, 7th May 2019

Innovation Takes Off

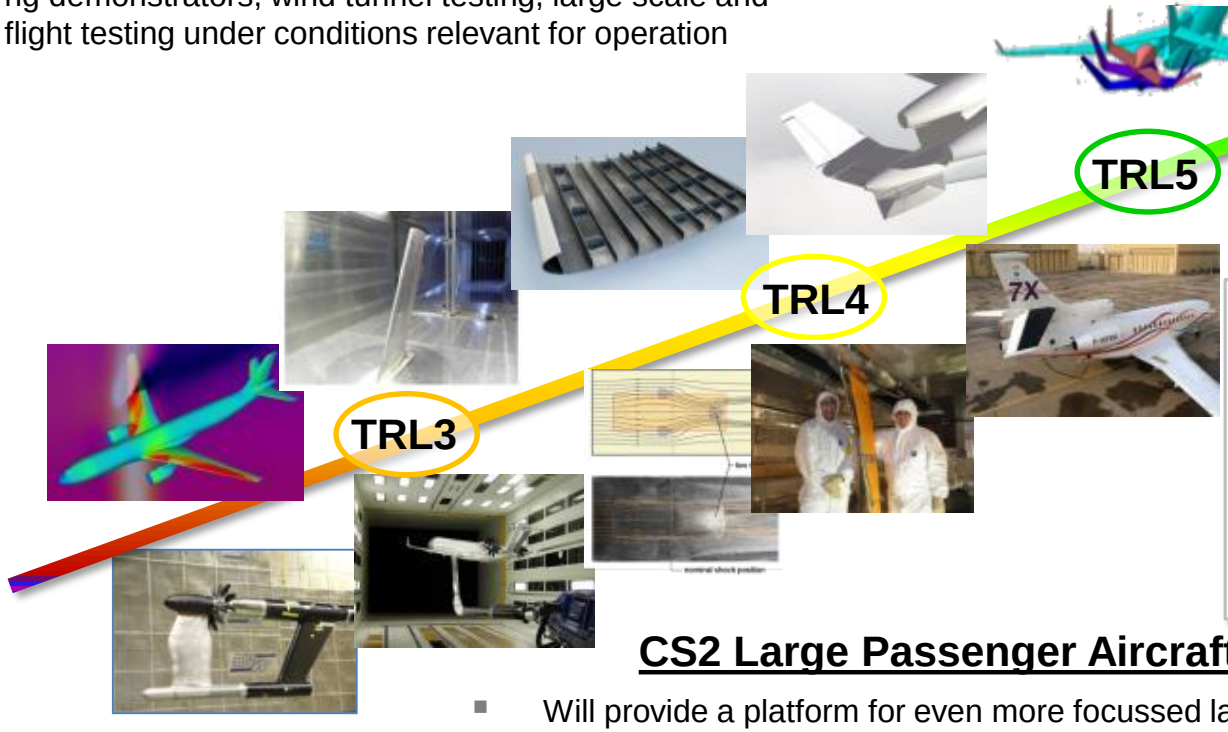
www.cleansky.eu

Clean Sky 2

From Clean Sky towards Clean Sky 2

CS1 Smart Fixed Wing Aircraft -ITD (SFWA)

- Is a unique environment for high TRL integrated Research and Development
- Provides the frame for well aligned objective driven R&T covering development and maturation through numerical simulation, rig demonstrators, wind tunnel testing, large scale and flight testing under conditions relevant for operation



SFWA key technologies

- NLF – wing for large transport aircraft and bizjets
- CROR engine integration
- Innovative empennage for next generation bizjets
- Innovative control surfaces
- Buffet Control Technologies
- Advanced load control architectures and function
- Advanced Flight Test instrumentation

Contribute to TRL - Scale

1	2	3	4	5	6

CS2 Large Passenger Aircraft IADP (LPA)

- Will provide a platform for even more focussed large scale, highly integrated demonstrators with core partners and partners
- Build on down best candidate technologies emerging from CleanSky 1 other national and EU R&T programs and additional technologies developed in CS2 ITDs

Clean Sky

Setup and Implementation

„Mature and validate disruptive technologies for next generation Large Passenger Aircraft through large scale integrated demonstration“

Platform 1
Advanced Engine and Aircraft Configuration

Platform 2
Innovative Physical Integration Cabin-System-Structure

Platform 3
Next Gen. A/C Systems, Cockpit Systems & Avionics

LPA-IADP WBS – “Platform 1”

Airbus with SAAB, Dassault, SNECMA and Partners

Large Passenger Aircraft Platform – integration topics

„Platform 1 - OAD“

Advanced Engine and Aircraft Configurations

„Platform 2 - OPD“

Innovative Physical Integration Cabin-System-Structure

„Platform 3 - OSD“

Next Gen. A/C Systems, Cockpit Systems & Avionics

TRL 4-6
Aircraft Level

Platform 1 Advanced Engine and Aircraft Configurations

WP 1.1 Advanced engine demonstrators (BLI, UHPE, Open Rotor)

WP 1.2 Advanced engine integration driven rear fuselage

WP 1.3 Validation of scaled flight testing

WP 1.4 Hybrid laminar flow control large scale demonstration

- HLFC applied on fin in long-term flight operation
- HLFC wing pre-flight demonstrator

WP 1.5 Applied technologies for enhanced aircraft performance

WP 1.6 Demonstration of radical aircraft configurations

Estimated Volume of Activities ~560M€

LPA-IADP WBS – “Platform 2”

Airbus with, Liebherr, Fraunhofer and Partners

Large Passenger Aircraft Platform – integration topics

„Platform 1 - OAD“

Advanced Engine and Aircraft Configurations

„Platform 2 - OPD“

Innovative Physical Integration Cabin-System-Structur

„Platform 3 - OSD“

Next Gen. A/C Systems, Cockpit Systems & Avionics

TRL 4-6
Aircraft Level

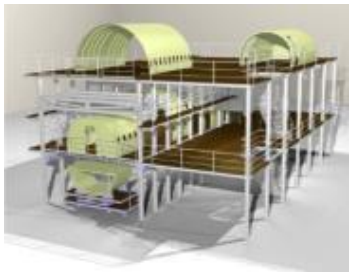
Platform 2 Innovative Physical Integration Cabin-System-Structure

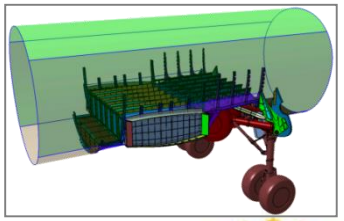
WP 2.1 Next generation fuselage, cabin and systems integration

WP 2.2 Next generation cabin & cargo functions

WP 2.3 Next generation lower centre fuselage

WP 2.4 Non-specific cross function





Estimated Volume of Activities ~290M€

LPA-IADP WBS – “Platform 3”

TRL 4-6
Aircraft Level

Airbus with Thales, Liebherr, SAFRAN and Partners

Large Passenger Aircraft Platform – integration topics

„Platform 1 - OAD“

Advanced Engine and Aircraft Configurations

„Platform 2 - OPD“

Innovative Physical Integration Cabin-System-Structure

„Platform 3 - OSD“

Next Gen. A/C Systems, Cockpit Systems & Avionics

Platform 3 Next Gen. Aircraft A/C Systems, Cockpits & Avionics

WP 3.1 Enhanced flight operations and functions — Light Weight Eye Visor system / system failures…

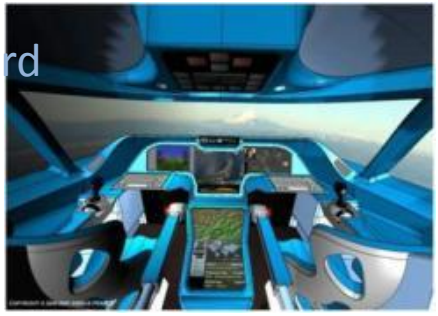
WP 3.2 Innovative enabling Technologies — Communication / Avionics components / A/C monitoring for grd support / IMAP

WP 3.3 Next generation cockpit functions flight demonstration

WP 3.4 Enhanced cockpit demonstration — LPA & regional A/C

WP 3.5 Disruptive Cockpit demonstration — V&V/ Test means, virtual platforms

WP 3.6 **ADVANCE** Maintenance — Prognostic / conditions-based maintenance / fleet data management & execution



Cockpit of the future (Fenics)

Estimated Volume of Activities ~220M€

CS2 Large Passenger Aircraft WBS

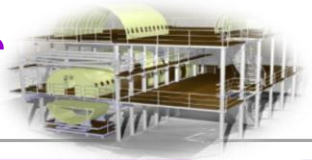
LPA (Airbus)

Overall Aircraft Design

Platform 1 – WP 0
Advanced Engine & Aircraft Configuration

- **WP1.1** Short/Medium Range Aircraft Power Plant System Integration
- **WP1.2** Advanced Rear-end
- **WP1.3** Validation of Scaled Flight Testing
- **WP1.4** Hybrid Laminar Flow Control Large Scale Demonstrator
- **WP1.5** Applied Technologies for Enhanced Aircraft Performance
- **WP1.6** Demonstration of Radical Aircraft Configurations

Structure Design



Platform 2 – WP 0
Innovative Physical Integration Cabin-System-Structure

- **WP 2.1** Next generation fuselage, cabin and systems integration
- **WP 2.2** Next generation cabin & cargo functions
- **WP 2.3** Next generation lower centre fuselage
- **WP 2.4** Non-specific cross functions

System Design

Platform 3 – WP 0
Next Generation Aircraft, Cockpits Systems & Avionics

- **WP 3.1** Enhanced flight operations & functions
- **WP 3.2** Innovative enabling technologies
- **WP 3.3** Next generation cockpit functions flight demonstration
- **WP 3.4** Enhanced cockpit demonstration
- **WP 3.5** Disruptive cockpit demonstration
- **WP 3.6** ADVANCE (Maintenance)

- **WP 0.1** Technology assessment
- **WP 0.2** EcoDesign
- **WP 0.3** ITD - Interfaces

Overview of the LPA-CfP10 topics

Platform 1

16 topics / 18,65M€ ind. funding

Identification Code	Title	Type of Action	Value (Funding in M€)	Topic Leader
JTI-CS2-2019-CfP10-LPA-01-72	Development of a distributed CFD platform for collaborative design	IA	0.6	Airbus
JTI-CS2-2019-CfP10-LPA-01-73	Innovative Thrust Reverser Actuator System (ITRAS)	IA	0.9	Airbus
JTI-CS2-2019-CfP10-LPA-01-74	UHBR Engine Studies for Aircraft Operations and Economics	IA	0.5	Airbus
JTI-CS2-2019-CfP10-LPA-01-75	Advanced solutions for 2030+ UHBR Core Noise reduction	IA	2.5	Safran Aircraft Engines
JTI-CS2-2019-CfP10-LPA-01-76	Supporting implementation of 2030+ UHBR low noise fan technology solutions through enhanced modeling capabilities	IA	1.4	Safran Aircraft Engines
JTI-CS2-2019-CfP10-LPA-01-77	Advanced Pitch Control Mechanism TRL4 Demonstration	IA	3.5	Safran Aircraft Engines
JTI-CS2-2019-CfP10-LPA-01-78	Innovative turbine cavity swirl control systems through Additive Manufacturing	RIA	0.9	GE Avio
JTI-CS2-2019-CfP10-LPA-01-79	Development of multidisciplinary design tools for rapid concept design for aero engine components	IA	0.5	GKN
JTI-CS2-2019-CfP10-LPA-01-80	Rear fuselage and empennage shape optimization including anti-icing technologies	RIA	1.5	Airbus
JTI-CS2-2019-CfP10-LPA-01-81	Fiber reinforced thermoplastics manufacturing for stiffened, complex, double curved structures	IA	0.7	German Aerospace Center, DLR
JTI-CS2-2019-CfP10-LPA-01-82	Development of Thermoplastic press forming Tool for Advanced Rear End Closing Frame Prototype and Tooling 4.0 for Assembly and transportation of the Advanced Rear End Prototype.	IA	0.75	Aernnova
JTI-CS2-2019-CfP10-LPA-01-83	Development and simulation of a forming process for LE HLFC wing outer skins	IA	1.3	Aernnova
JTI-CS2-2019-CfP10-LPA-01-84	Development of a manufacturing process and a manufacturing unit for production of a laser treated titanium panel with a 3D printed substructure	IA	1.5	Fraunhofer
JTI-CS2-2019-CfP10-LPA-01-85	Design and manufacturing of multi-functional Ice Protection System power feed/monitoring lines and Shielding/High-lift electrical actuation system for a HLFC Wing demonstrator	IA	0.7	SONACA
JTI-CS2-2019-CfP10-LPA-01-86	Develop and test Power Efficient Actuation Concepts for Separation Flow Control at large aerodynamic areas requiring very low actuation energy	IA	0.9	Airbus
JTI-CS2-2019-CfP10-LPA-01-87	Loop Heat Pipe development for severe environment	IA	0.5	Liebherr

Overview of the LPA-CfP10 topics

Platform 2

3 topics / 2,05M€ ind. funding

Identification Code	Title	Type of Action	Value (Funding in M€)	Topic Leader
JTI-CS2-2019-CfP10-LPA-02-30	Development of innovative welding systems for structural joints of Thermoplastic matrix based Composites	IA	0.75	AERNNOVA COMPOSITES ILLESCAS (ACI)
JTI-CS2-2019-CfP10-LPA-02-31	Development of short fibre reinforced thermoplastic airframe clips and brackets using factory waste	IA	0.5	Fokker
JTI-CS2-2019-CfP10-LPA-02-32	Innovative miniaturized sensing device for large wave length spectrum reception capability as a tool for quality control and aircraft maintenance	RIA	0.8	Airbus Operations

Platform 3

N/A

No topic in this Call

LPA total number of topics in CfP#10: 19 / total indicative funding 20,7M€

Overview of the LPA-CfP10 topics

Platform 2

3 topics / 2,05M€ ind. funding

Identification Code	Title	Type of Action	Value (Funding in M€)	Topic Leader
JTI-CS2-2019-CfP10-LPA-02-30	Development of innovative welding systems for structural joints of Thermoplastic matrix based Composites	IA	0.75	AERNNOVA COMPOSITES ILLESCAS (ACI)
JTI-CS2-2019-CfP10-LPA-	Development of short fibre reinforced thermoplastic	IA	0.5	Fokker

Important for Partner-Applicants to note:

Cooperation between the GAP Partners and LPA members acting in the „hosting“ work packages shall be done by means of an Implementation Agreement (IA) for all CfP#10 topics.

The IA shall be used as published with the CfP#10 Call documents.

Platform 3

N/A

LPA total number of topics in CfP#10: 19 / total indicative funding 20,7M€

LPA-IADP WBS – “Platform 1”

Airbus with SAAB, Dassault, SNECMA and Partners

Large Passenger Aircraft Platform – integration topics

„Platform 1 - OAD“

Advanced Engine and Aircraft Configurations

„Platform 2 - OPD“

Innovative Physical Integration Cabin-System-Structure

„Platform 3 - OSD“

Next Gen. A/C Systems, Cockpit Systems & Avionics

TRL 4-6
Aircraft Level

Platform 1 Advanced Engine and Aircraft Configurations

WP 1.1 Advanced engine demonstrators (BLI, UHPE, Open Rotor)

WP 1.2 Advanced engine integration driven rear fuselage

WP 1.3 Validation of scaled flight testing

WP 1.4 Hybrid laminar flow control large scale demonstration

- HLFC applied on fin in long-term flight operation
- HLFC wing pre-flight demonstrator

WP 1.5 Applied technologies for enhanced aircraft performance

WP 1.6 Demonstration of radical aircraft configurations

Estimated Volume of Activities ~560M€

CS2 Large Passenger Aircraft - WBS

LPA (Airbus)

Overall Aircraft Design

Structure Design

System Design

Platform 1 – WP 0
Advanced Engine & Aircraft Configuration

Platform 2 – WP 0
Innovative Physical Integration Cabin-System-Structure

Platform 3 – WP 0
Next Generation Aircraft, Cockpits Systems & Avionics

WP 0.1
Technology assessment

WP 0.2
EcoDesign

WP 0.3
ITD - Interfaces

WP1.1
Short/Medium Range Aircraft Powe Plant System Integration

WP1.2
Advanced Rear-end

WP1.3
Validation of Scaled Flight Testing

WP1.4
Hybrid Laminar Flow Control Large Scale Demonstrator

WP1.5
Applied Technologies for Enhanced Aircraft Performance

WP1.6
Demonstration of Radical Aircraft Configurations

LPA 01-72
LPA 01-74
LPA 01-75
LPA 01-76
LPA 01-77
LPA 01-78
LPA 01-79
LPA 01-80
LPA 01-81
LPA 01-82
LPA 01-83
LPA 01-84
LPA 01-85
LPA 01-73
LPA 01-86
LPA 01-87

WP 2.2
bin & cargo

WP 2.3
Next generation lower centre fuselage

WP 2.4
functions

WP 3.1
nt operations & ctions

WP 3.2
Innovative enabling technologies

WP 3.3
Next generation cockpit functions flight demonstration

WP 3.4
Enhanced cockpit demonstration

WP 3.5
Disruptive cockpit demonstration

WP 3.6
ADVANCE (Maintenance)

JTI-CS2-2019-CfP10-LPA-01-72

Development of a distributed CFD-platform for collaborative design

Innovation Takes Off

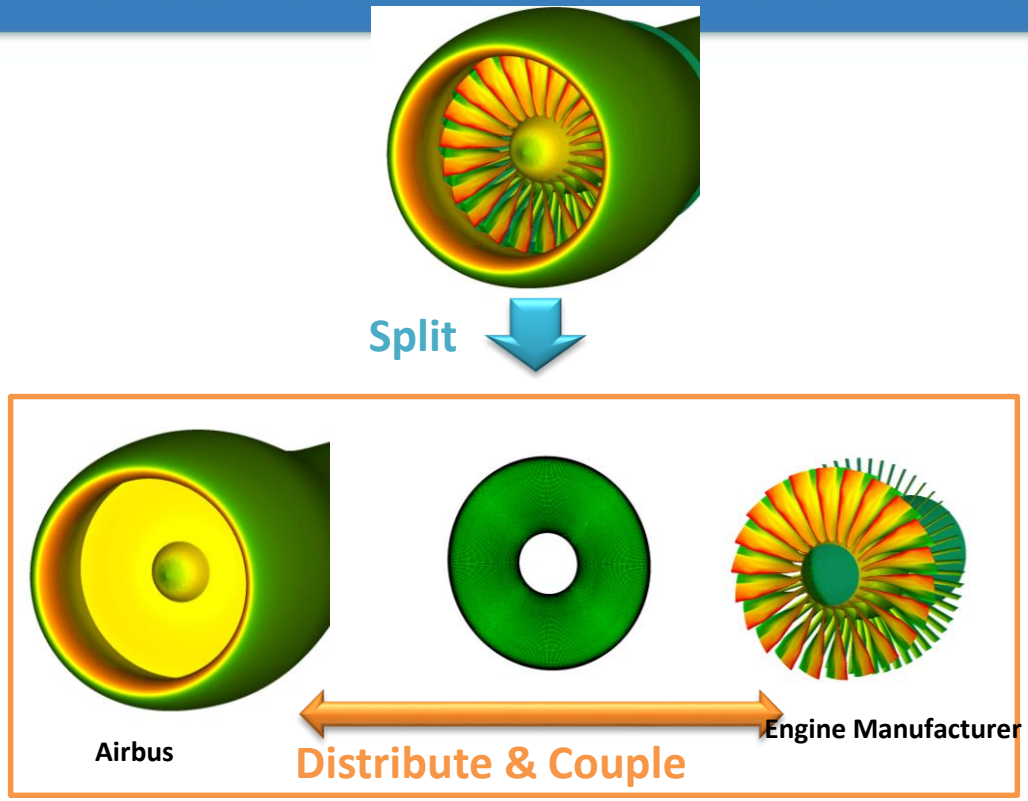
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

JTI-CS2-2019-CfP10-LPA01-72

- **JTI-CS2-2019-CfP10-LPA01-72**

- **Title:** *Development of a distributed CFD platform for collaborative design.*
- **Objective:** Development of an open-source CFD simulation platform and methodology to enable co-design between an airframe manufacturer and an engine manufacturer, while maintaining IP and IT security. This includes code-to-code coupling, communication between different simulation platforms, post processing of the simulation, and demonstration on industrial configuration.
- **Type of action**: IA
- **Volume:** 0.6 M€ funding



- Open source collaborative CFD co-simulation
- Simulate separate A/C component
- IP protection

JTI-CS2-2019-CfP10-LPA01-72

- **Schedule/Milestones**

Schedule		Year1				Year2				Year3			
	Task	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP1	**Code-to-Code coupling for co-simulation in a single organization**												
WP1.1	Coupling between two instances of a CFD solver (solver A)												
WP1.2	Coupling between CFD solver A and another CFD solver (solver B)												
WP1.3	Coupling between solver A or solver B and a CFD solver used in production at Airbus (different from solvers A and B)												
WP2	**Aerodynamic and Aeroacoustic post processing solutions for the analysis of the result of the cosimulation**												
WP2.1	Effect of the powerplant on the airframe												
WP2.2	Effect of the airframe on the powerplant installation												
WP2.3	Extension to co-processing												
WP3	**Demonstration of the co-simulation platform on an industrial configuration in multiple organizations**												
WP3.1	Generic preliminary works												
WP3.2	Feasibility Demonstration												
WP3.3	User interface												
WP3.4	Application to industrial configuration and design trade-study												

Tasks		
Ref. No.	***Title – Description***	***Due Date***
WP1	**Code-to-Code coupling for co-simulation in a single organization**	M0+18
WP1.1	Coupling between two instances of a CFD solver (solver A)	
WP1.2	Coupling between CFD solver A and another CFD solver (solver B)	
WP1.3	Coupling between solver A or solver B and a CFD solver used in production at Airbus different from solvers A and B	
WP2	**Aerodynamic and Aeroacoustic post processing solutions for the analysis of the result of the cosimulation**	M0+24
WP2.1	Effect of the powerplant on the airframe	
WP2.2	Effect of the airframe on the powerplant installation	
WP2.3	Extension to co-processing	
WP3	**Demonstration of the co-simulation platform on an industrial configuration in multiple organizations**	M0+36
WP 3.1	Generic preliminary works	
WP 3.2	Faisibility Demonstration	
WP 3.3	User interface	
WP 3.4	Application to industrial configuration and design trade-study	

- **Targeted applicant/Required Skills:**

The applicant(s) must have proven capabilities development experience in:

- Code-to-Code coupling
- Networks & IT
- Advanced high fidelity computational aerodynamic modelling for turbomachinery and aircraft simulations
- Advanced aerodynamic and aero-acoustic post processing
- Fan design and / or aircraft design
- Understanding of fan-airframe interactions

All the capabilities developed in the frame of this project should be generic enough to be readily usable by any entity and as such they should be compatible with Airbus environment, as Airbus will participate to the validation of the platform in WP 3

JTI-CS2-2019-CfP10-LPA-01-73

Innovative Thrust Reverser Actuator System (ITRAS)

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

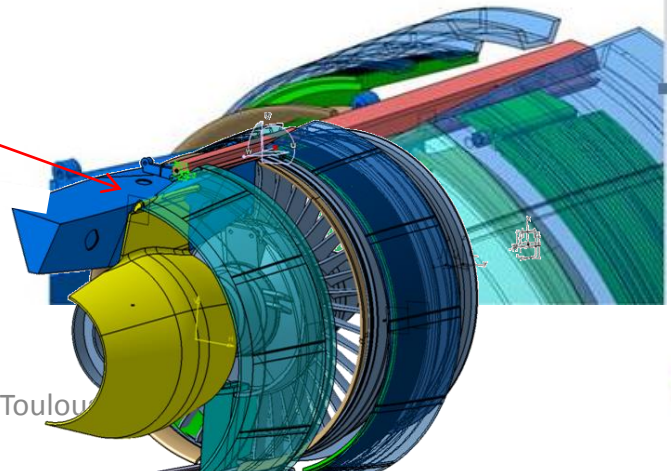
JTI-CS2-2019-CfP10-LPA-01-73

- **JTI-CS2-2019-CfP10-LPA-01-73**
- **WP1.1:**
  - **Airbus**

- **Title:** Innovative thrust reverser actuator system (ITRAS)
- **Objective:** The intent of this topic is to explore linear motor technologies (e.g. linear motors) applied to a Thrust reverser module of a short-middle range UHBR engines with further and deeper integration capability inside the Pylon & nacelle structure like the example presented below.

- **Volume:** 900 k€ funding

How to integrate the best electrical (linear) motor
(power below 10-15kw per nacelle) in the nacelle environment ?



JTI-CS2-2019-CfP10-LPA-01-73

- **Scope of work and schedule :** ITRAS work plan is typically spread 2 years in order to achieve **TRL3** demonstration

Deliverables			
Ref. No.	Title - Description	Type*	Due Date
WP1	-Linear motor technology benchmark status -Scope of possible architecture and linear actuators likely to be proposed for a TRAS SR	Report Report	T0+ 5months
WP2	-Comparison dossier and evaluation/presizing of linear actuators and choice of 1 solution -Release of the detailed linear actuator specifications (SRD, SIRD,DMU space alloc,…)	Report Report	T0+ 10months
WP3	-Design and stress analysis of the linear actuator selected solution (chosen at the end of WP2) -Status of the aircraft qualification of the linear actuator components (gap to aircraft standards) -Final evaluation of TRL3/4 criteria (Weight, Performances,…) with justification -Demonstrator co design and evaluation with TM -Demonstrator Manufacturing -Tests -Final dossier (tuning model/simulation-tests results, linear actuator final budgets,…)	Report Report Report Report Hardware Tests Report	T0+ 24months

Targeted applicant:

The applicant shall be able to challenge the Airbus initial design trades, specifications and standard guidelines regarding systems/structure integration within the aeronautic constraints (availability, safety, environment). Multi-disciplinary knowledge to develop solutions allowing to reach the performances of a Thrust reverser (loads and speed) taking into account the FDIR (Failure detection Isolation and Recovery) policy. Abilities to manufacture prototypes and conduct test demonstration at end of TRL3.

- **Required skills**
  - Relevant experience of 3D Structure/Systems integration (linear motors in a more complex System)
  - Strong knowledge of all linear motor technologies (benefits and limitations including recurring cost analysis)
  - Experience in Multifunctional (including motor control) and 3D Multiphysics (magnetic, thermal, kinematic/structural) modeling and simulation
  - Expertise in linear motor integration test and manufacturing in order to understand later discrepancies and implement correction between the simulation and the physical specimen
  - Ability to work in an Agile context (“continuous” control loop between requirement and design solution) with quick run design optimization tools

JTI-CS2-2019-CfP10-LPA-01-74

UHBR Engine Studies for Aircraft Operations and Economics

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

JTI-CS2-2019-CFP10-LPA-01-74

Type of action (RIA/IA/CSA)	IA		
Programme Area	LPA		
(CS2 JTP 2015) WP Ref.	WP 1.1.13		
Indicative Funding Topic Value (in k€)	500		
Topic Leader	Airbus	**Type of Agreement**	Implementation Agreement
Duration of the action (in Months)	36	**Indicative Start Date**[3]	Q2 2020

- **Objective:** The proposed project intends to secure the full potential of future UHBR engines by studying some of the threats to these architectures with respect to aircraft operations (for example descent capability), economic competitiveness (compromise between performance and durability) and robustness to energy source to ensure its ability to be operated within the constraints of the next few decades.

Tasks		
Ref. No.	***Title - Description***	***Due Date***
1.1	Compressor Stability	M0 + 6
1.2	Idle Prediction	M0 + 12
2	Impacts of New Materials on Engine Time on Wing	M0 + 18
3.1	Emissions Predictions for UHBR with Conventional Fuel	M0 + 12
3.2	Impact of Alternative, Non-Drop-In Fuels	M0 + 24
3.3	Dual fuel capability (kerosene + alternative fuel)	M0 + 36

High compressor loading, High T° => performance, durability, operability at Idle phases, descent/acceleration capability (e.g. go around) ?

JTI-CS2-2019-CfP10-LPA-01-74

- **Schedule/Milestones**

Deliverables			
Ref. No.	***Title - Description***	***Type****	***Due Date***
D1.1	Report establishing link between turbofan design parameters (OPR, FPR, core size etc.) and compressor stability	R	M0 + 6
D1.2	Report clarifying how to best monitor compressor stability	R	M0 + 12
D1.3	Report describing the process of establishing the need for stability margin	R	M0 + 18
D1.4	Validation report of the process	R	M0 + 24
D1.5	Report establishing the link between design blade loading and compressor stability	R	M0 + 30
D1.6	Report describing engine limits	R	M0 + 6
D1.7	Method to quantify / predict the "hard" limits	R	M0 + 12
D1.8	Idle limit establishment process validation report	R	M0 + 18

**Type: R=Report, D=Data, HW=Hardware*

D2.1	Overview on existing CMC materials, manufacturing processes and material properties	R	M0 + 12
D2.2	Life prediction model for CMCs.	R + D	M0 + 24
D2.3	Analysis of CMC component deterioration and impact of CMC usage on DMC	R	M0 + 36
D3.1	Literature review on emissions predictions	R	M0 + 6
D3.2	Emissions predictions model and assessment for reference UHBR engine	R + D	M0 + 12
D3.3	Evaluation of the impact of alternative, non-drop-in fuels on engine performance, weight and emissions	R	M0 + 18
D3.4	Combustor design and emission characteristic evaluation for the most promising alternative fuel	R + D	M0 + 24
D3.5	Report on feasibility and challenges of dual-fuel engine	R	M0 + 30
D3.6	Combustor design and emissions characteristics for dual-fuel engine	R + D	M0 + 36

- **Targeted applicant** & **Required skills**:
  - Aircraft gas turbine performance modelling and simulation
  - Multidisciplinary and complex systems simulation
  - Mechanical and electrical systems design
  - Gas turbine dynamics and transient simulations
  - Engine thermal management and simulations
  - Propulsor systems and subsystems modelling
  - 3D fluid dynamics simulations
  - Combustion and emissions modelling
  - Thermo-mechanical analysis
  - Failure mechanisms & life estimation

JTI-CS2-2019-CfP10-LPA-01-75

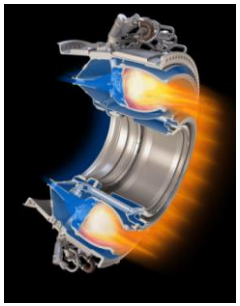
Advanced solutions for 2030+ UHBR Core Noise reduction

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

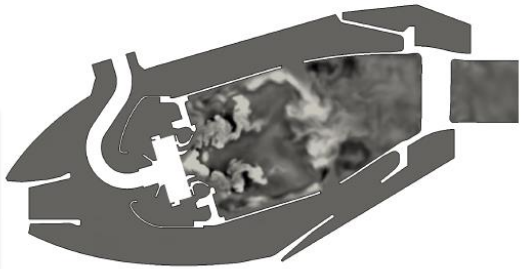
Clean Sky 2

JTI-CS2-2019-CfP10-LPA-01-75



- **JTI-CS2-2019-CfP10-LPA-01-75**
- **WP1.1**
  - **Topic leader : Safran Aircraft Engines**
- **Title:** Advanced solutions for 2030+ UHBR Core Noise reduction
- **Objective:** Develop advanced solutions to reduce core noise of 2030+ UHBR engines. This will imply Improvements of combustor models fidelity (incl. more realistic geometric and flow) and design of low noise treated Ceramic Matrix composites (CMC) exhaust concept based on new CMC manufacturing techniques. The different concepts will be validated with 2D/3D models parallel to the development of integrated combustor – turbine noise prediction techniques targeting an optimum design for both low and high frequency core nozzle and center body liners. Experimental campaign will be performed benefiting from improved test set-up and signal processing for better identification of core/combustor noise.
- **Volume:** 2500 k€ funding
- **Type of action**: IA

- Low and high frequency solutions
- Turbine noise modelling
- Low noise treated CMC



LES simulations

Lined plug prototype (1st generation)

JTI-CS2-2019-CfP10-LPA-01-75

- **Scope of work and schedule :** Advanced solutions for 2030+ UHBR Core Noise reduction work plan is spread over 42 Months

	Tasks		
	Ref. No.	***Title – Description***	***Due Date***
Managements & requirements	Task 1	Management and Risk reduction plan	T0+42
	Task 2	Requirements	T0+24
Advanced modelisationss solutions	Task 3	Improved LES prediction of turbulent combustion noise sources terms	T0+36
	Task 4	Improved aeroacoustics models for prediction of combustor-turbine-exhaust nozzle transfer function and calculation of combustor noise components	T0+36
	Task 5	Improved CAA prediction of combustor-turbine noise radiation through exhaust nozzle including low noise technology effects	T0+36
Advanced low noise CMC exhaust solutions	Task 6	CMC acoustic exhaust technology maturation support: advanced acoustic concept identification and assessment through partial tests	T0+30
	Task 7	CMC acoustic exhaust technology maturation support : improved integrated acoustic design and performance calculation at full scale	T0+38
Advanced experimental measurements & analysis	Task 8	Engine combustor noise signature analysis and advanced experimental set-up preparation	T0+36
	Task 9	Advanced engine combustor noise data acquisition and measurement analysis	T0+42
Full integrated simulations	Task 10	Calculations of bypass ratio and engine architecture/technological effects on combustor noise	T0+42

→ TRL3 aeroacoustic demo

→ TRL4/5 aeroacoustic measurements campaign

JTI-CS2-2019-CfP10-LPA-01-75

- **Targeted applicant**: Applicant will have advanced aeroacoustics knowledge in combustor engine field. Expertise in terms of high fidelity CFD & CAA core noise simulations and acoustic models developments. Multi-disciplinary abilities to develop advanced hot acoustic liners technologies for CMC primary exhaust, manufacture liners prototypes and conduct test demonstration at relevant TRL. Experience in advanced experimental techniques to conduct core noise measurements on full engine.
- **Full required skills**
  - Experience in combustor flow simulations with LES for aeroacoustics purposes, aeroacoustics models for combustor engine noise prediction and capacities to support advanced theoretical extensions and developments in the models
  - Experience in CAA prediction of combustor-turbine noise radiation, including noise source termes and Low noise technology effects
  - Experience in design, manufacturing, testing of advanced acoustic liners technologies (@TRL3)
  - Capability to model the performance of acoustic materials under high speed flow and high temperature conditions
  - Capacities to specify / identify / develop advanced low noise liners solutions for engine exhaust
  - Proven background, knowledge and capability to manufacture advanced acoustic panel structures.
  - Experience in acoustic structure integration and mechanics of aircraft engine components with knowledge in advanced composite material, specifically for CMC materials
  - Experience in liner tests characterization for aircraft engines. Availability of associated test benches
  - Experience in advanced experimental techniques for aeroacoustics. Ability to develop or provide specific sensors that can resist to high temperature & adverse environments (@TRL4/5 engine tests)
  - Experience in signal acquisition and post-processing for noise source separation and identification

JTI-CS2-2019-CfP10-LPA-01-76

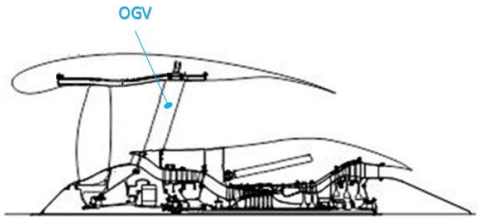
2030+ UHBR low noise fan technology solutions through enhanced modeling capabilities

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

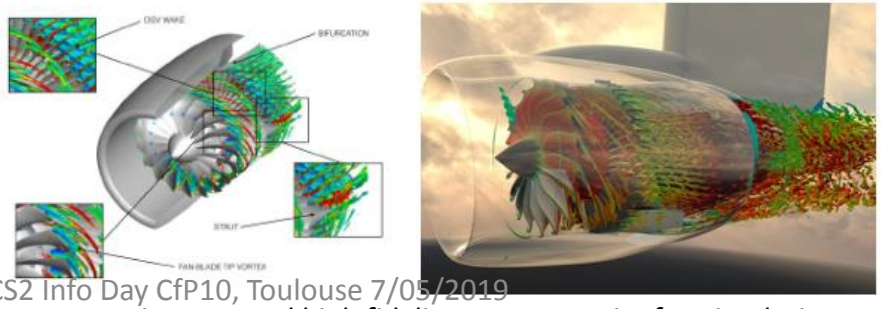
Clean Sky 2

JTI-CS2-2019-CfP10-LPA-01-76



- **JTI-CS2-2019-CfP10-LPA-01-76**
- **WP1.1.3.4**
  - **Topic leader : Safran Aircraft Engines**
- **Title:** 2030+ UHBR low noise fan technology solutions through enhanced modeling capabilities Short description
- **Objective:** Design of innovative low fan noise technologies for next generation UHBR engines is highly conditioned by aeroacoustics modelisations accuracy & related design tools. The aim of the topic is to exploit recent advances in numerical techniques to further guide UHBR Low fan noise design and noise reduction technologies concepts (such as fan frame liners and low noise OGV concepts). Advantages of more integrated approaches combined with more realistic high fidelity aeroacoustics simulations inc. technological effects will be in that purpose considered. Another aim of the topic is to develop new post processing solutions to be applied on numerical/experimental results to further identify 2030+UHBR fan noise sources components/mecanisms and provide guidelines for noise status improvement.
- **Volume:** 1400 k€ funding
- **Type of action**: IA

- Thinner and efficient acoustic treatments (less space available)
- More accurate design tools



Unstationnary and high fidelity aeroacoustics fan simulations

JTI-CS2-2019-CfP10-LPA-01-76

- **Scope of work and schedule :** ‘’2030+ UHBR low noise fan technology solutions through enhanced modeling capabilities’’ topic work plan is spread over 42 Months

	Tasks		
	Ref. No.	***Title – Description***	***Due Date***
Managements & requirements	Task 1	Management and Risk reduction plan	T0+42
	Task 2	Requirements	T0+24
High fidelity aeroacoustics fan simulations inc. extended domain	Task 3	High fidelity aeroacoustics simulation of a UHBR fan module	T0+42
	Task 4	High fidelity aeroacoustics simulation of an integrated UHBR propulsion system including environments and installation effects	T0+36
	Task 5	High fidelity aeroacoustics simulation of a UHBR fan module large scale demonstrator inside wind tunnel environment including inflow and out of flow measurements comparison and extrapolation	T0+42
Innovative aeroacoustics post-processing solutions	Task 6	Innovative aeroacoustics numerical and experimental signal/data base treatments for advanced noise source diagnostic	T0+30
	Task 7	Innovative aeroacoustics numerical simulations for advanced antenna instrumentation signal correction and data correlation	T0+36
High fidelity low fan noise concepts simulations	Task 8	Development of advance aeroacoustics simulation abilities for innovative fan frame noise reduction concepts and partial tests assessments	T0+36
	Task 9	High fidelity aeroacoustics modelisation of a UHBR fan module including conventional and advance fan frame noise reduction concepts	T0+42

JTI-CS2-2019-CfP10-LPA-01-76

- **Targeted applicant**: Applicant will have advanced aeroacoustics knowledge. Expertise in terms of high fidelity CFD simulations, acoustic models for fan noise predictions are required. Capacity to develop advance numerical boundary conditions/specific domains for low fan noise damping concepts CFD simulations. Abilities to develop new post-processing solutions to identify and better understand fan noise sources. Experience in aero and noise corrections to apply on experimental wind tunnel measurements and numerical datas.
- **Required skills**
  - Experience of high fidelity flow simulations for fan noise aeroacoustics purposes
  - Experience in fan noise sources mechanisms, aeroacoustics models and post-processing
  - Experience in aerodynamic calculation for fan module performance purpose
  - Experience of high fidelity flow simulations for integrated propulsion systems including installation effects
  - Experience of high fidelity wind tunnel flow simulations for aeroacoustics purposes
  - Acoustic measurements in wind tunnel environments
  - Experience in advance signal post processing to separate and identify noise components, perform modal analysis and beamforming treatments
  - Advance signal processing, deep learning/big data base solutions for CFD and physics analysis
  - Knowledge in measurements and noise corrections for in-flow/out of flow wind tunnel datas
  - Experience in large scale fan rig tests and acoustic / aerodynamic post-treatments
  - Capacity to develop & implement advance CFD fluid/structure damping/absorbing solutions

JTI-CS2-2019-CfP10-LPA-01-77

Advanced Pitch Control Mechanism TRL4 demonstration

Innovation Takes Off

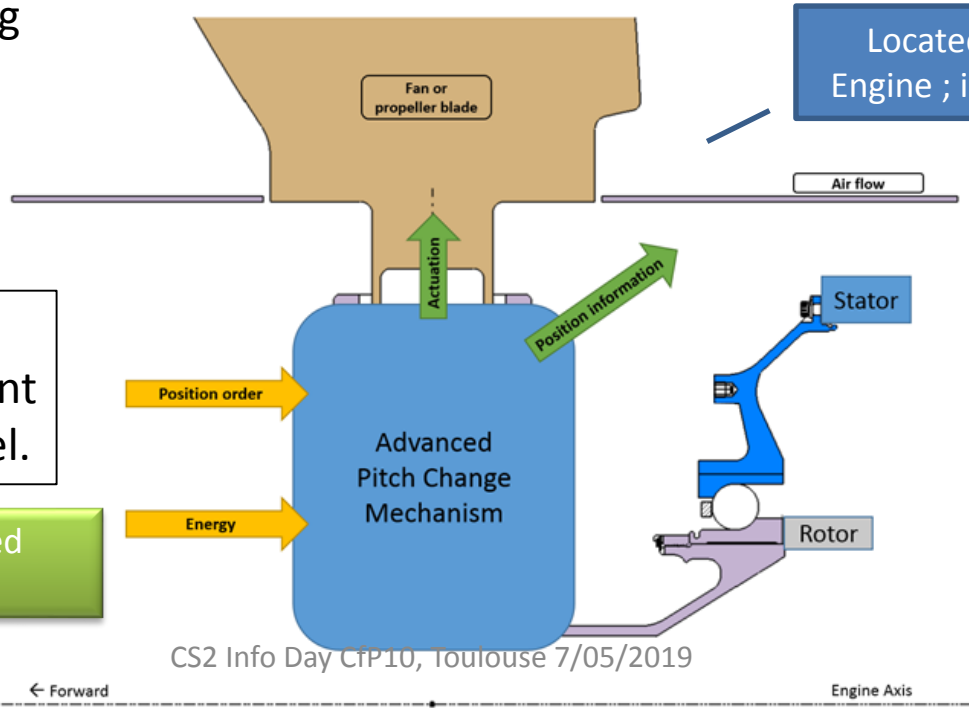
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

CfP10-LPA-01-77

- **JTI-CS2-2018-CfP10-LPA-01-77**
- **WP1.1.3.4 : 2030+ Engine Techno Bricks**
  - **Leader : Safran Aircraft Engines**
- **Title:** Advanced Pitch Control Mechanism TRL4 demonstration
- **Objective:** This topic aims at developing a new PCM technology with advanced performance pitch control mechanism featuring reduced mass; enhanced stiffness; improved maintainability; high accuracy and increased actuation capability.
- **Volume:** 3500 k€ funding

Located at the front of the Engine ; in cold environnement



TRL4 démonstration :
PCM tested at a relevant lab environnement level.

- High potential of PCM for ducted
- or unducted fans

CfP10-LPA-01-77

- **Milestones**

Milestones (when appropriate)			
Ref. No.	***Title - Description***	***Type****	***Due Date***
PCM_MS_01	Specification Review	R	Q2 2020
PCM_MS_02	COR	R	Q3 2020
PCM_MS_03	PDR	R	Q2 2021
PCM_MS_04	CDR	R	Q4 2021
PCM_MS_05	TRL3 review	R	Q4 2021
PCM_MS_06	Manufacturing Review	R	Q3 2022
PCM_MS_07	Component Testing Review	R, HW	Q2 2022
PCM_MS_09	Assembly Review (PCM and PCM rig)	R	Q4 2022
PCM_MS_11	PCM Rig Commissioning Review	R	Q2 2023
PCM_MS_12	Acceptance and Qualification Test Review	R	Q3 2023
PCM_MS_13	TRL4 Review	R	Q3 2023
PCM_MS_14	Tested PCM Commissioning	R, HW	Q3 2023
PCM_MS_15	PCM investigations; lessons learned and way forward analysis review	R	Q4 2023

**Type: R=Report, D=Data, HW=Hardware*

- **Targeted applicant**:

The applicant will be able to understand and challenge the specifications to develop an advanced Pitch Change Mechanism in a **aeronautical environment**. This PCM can be powered by an **high range of energies** : hydraulic, electric, mechanic, hybridation… **Creativity and innovation are expected.**

- **Required skills or subjects to deal with** :
  - Architecture design
  - Mechanical design
  - Hydraulic design
  - Electrical design
  - Manufacturing and assembly
  - Testing and inspecting

JTI-CS2-2019-CfP10-LPA-01-78

Innovative turbine cavity swirl control systems through Additive Manufacturing

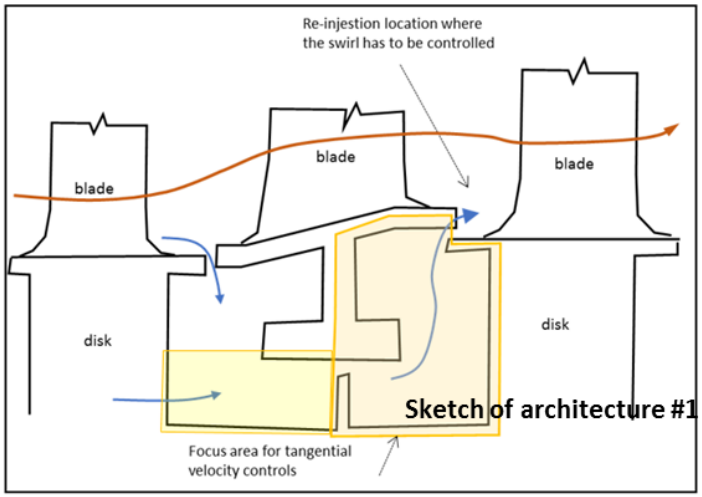
http://www.cleansky.eu/content/homepage/about-clean-sky-2

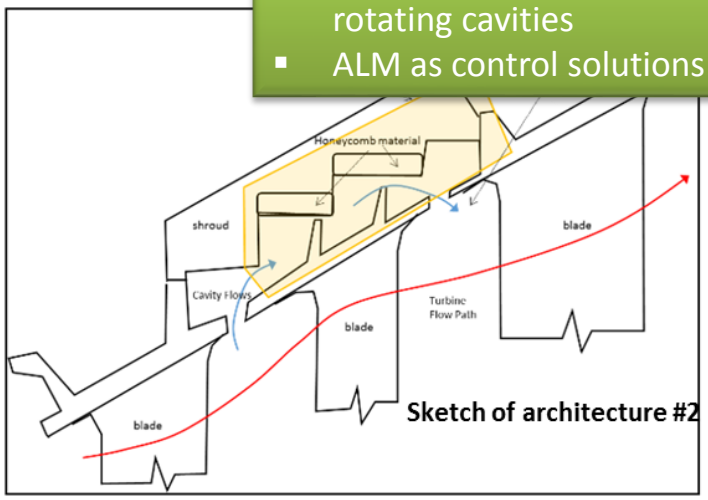
Clean Sky 2

JTI-CS2-2019-CfP10-LPA-01-78

- **JTI-CS2-2019-CfP10-LPA-01-78**
- **Title:** Innovative turbine cavity swirl control systems through Additive Manufacturing .
- **Objective:** Up to 15% of total losses in turbine efficiency can be related to leakages flow through the flow path seals, hence their knowledge and control is a crucial point in the turbine design. Main goal of this proposal is to understand the development of the flow field within specific rotating cavities (two different architectures) and develop specific features able to control it for a better interaction with the main flow path. Additive manufacturing process could be the key technology to allow such rotating cavities architecture revision. The activity will involve both numerical and experimental activities.
- **Volume:** 900 K€ funding

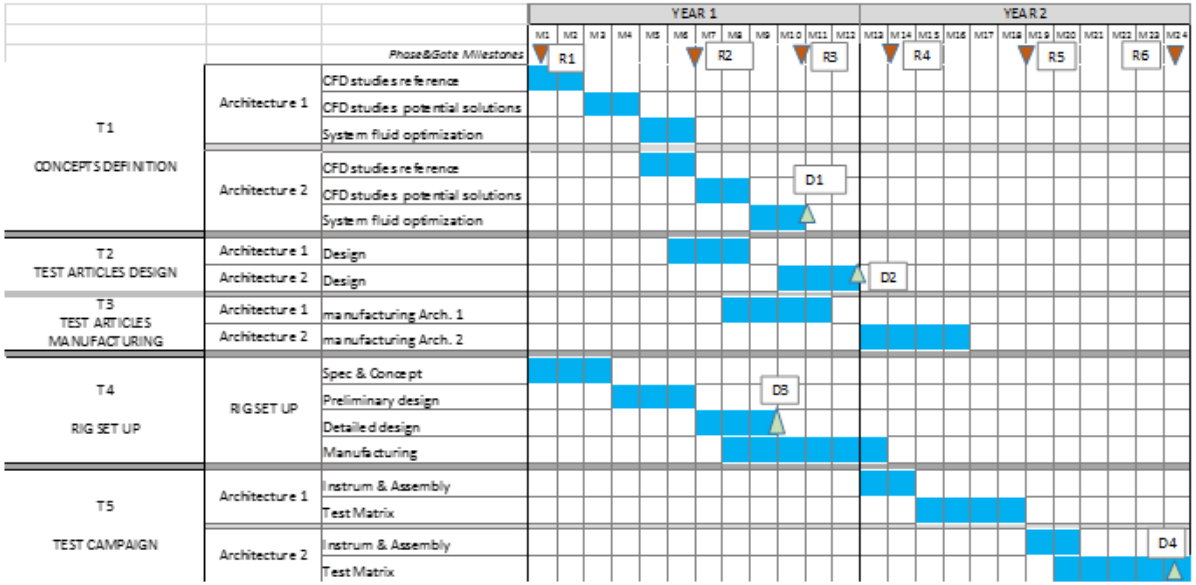
- Avoid leakages in flow path seals
- Flow field modelling in turbine rotating cavities
- ALM as control solutions





JTI-CS2-2019-CfP10-LPA-01-78

High level tentative plan



Deliverables	
Ref. No.	***Title - Description***
D1	Concepts design - Report with activity description, solutions comparison and ranking for both Architectures 1 and 2. Numerical models used are part of the deliverable.
D2	Designs release - Final design of Architectures 1 and 2, related drawings and/or CAD models suitable for manufacturing; report with final predicted performances, stress and dynamic assessment.
D3	Rig Design - Report with functionality description, instrumentation, structural assessment; drawings and/or CAD models suitable for manufacturing.
D4	Test Results - Report with Architectures 1 and 2 testing campaign description and results. Organized database with all recorded data and their reduction

Targeted applicant/Required Skills:

- Extensive and proven experience in CFD methodologies application and validation.
- Specific skills in CFD applied to rotating cavities simulations will be considered as additional preference
- Proven experience in physical modelling definition, numerical implementation and validation.
- Proven experience in experimental testing with measurements of fluid-dynamics behaviour in rotating condition (flow fields, windage losses, flow visualization)
- The applicant needs to demonstrate to be in the position to have access to the test facilities required to meet the topic goals.
- Experience in rig design and supply chain management (for T/As procurement and relative measurements & inspections)
- Experience in aerospace R&T and R&D programs, program management.
- Applicant needs to demonstrate to have access to expertise for “design to additive” components and 3D printing.

JTI-CS2-2019-CfP10-LPA01-79

Development of multidisciplinary design tools for rapid concept design for aero engine components

GKN AEROSPACE

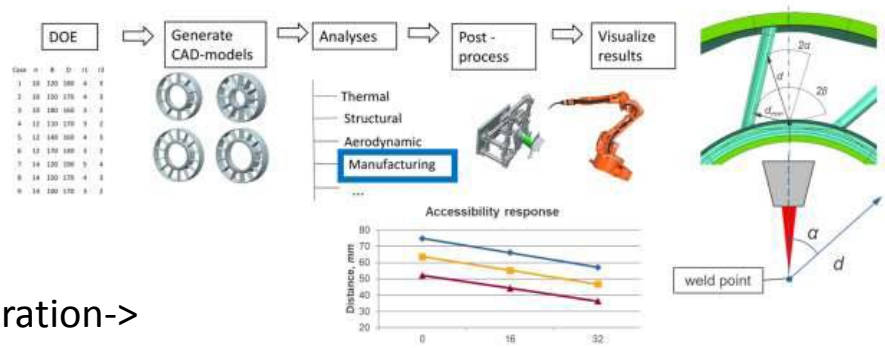
Clean Sky 2

JTI-CS2-2019-CfP10-LPA01-79

Type of action (RIA/IA/CSA):		IA	
Programme Area:		LPA	
(CS2 JTP 2015) WP Ref.:		WP 1.1.3	
Indicative Funding Topic Value (in k€):		500	
Topic Leader:	GKN	**Type of Agreement:**	Implementation Agreement
Duration of the action (in Months):	24	**Indicative Start Date (at the earliest)[20]:**	> Q1 2020

This CfP aims at developing multidisciplinary tools for structural engine components with specific focus on methods analyzing manufacturing tools' geometrical accessibility.

- Develop methods for automated evaluation of accessibility.
- Develop methods for multidimensional assessment and visualization of design space.
- Validation of the methods appropriateness in digital experiments.
- A specific use case will be provided by the Topic Leader, as illustrated by the analysis flow illustration->



Improve components accessibility via assessment and visualization of design space

JTI-CS2-2019-CfP10-LPA01-79

The application is the complex rotating frames of the Counter Rotating Open Rotor (CROR) engine

A rotating frame

Open Rotor engine test in Cleansky 1

JTI-CS2-2019-CfP10-LPA-01-80

Rear fuselage and empennage shape optimization including anti-icing technologies

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

JTI-CS2-2019-CfP10-LPA-01-80

- JTI-CS2-2019-CfP10-LPA-01-80
- **Title:** Rear fuselage and empennage shape optimization including anti-icing technologies
- **Objectives:** the following lines of work will be covered in this proposal:

- Numerical simulation of ice accretion processes, with and without surface protection, for three dimensional shapes

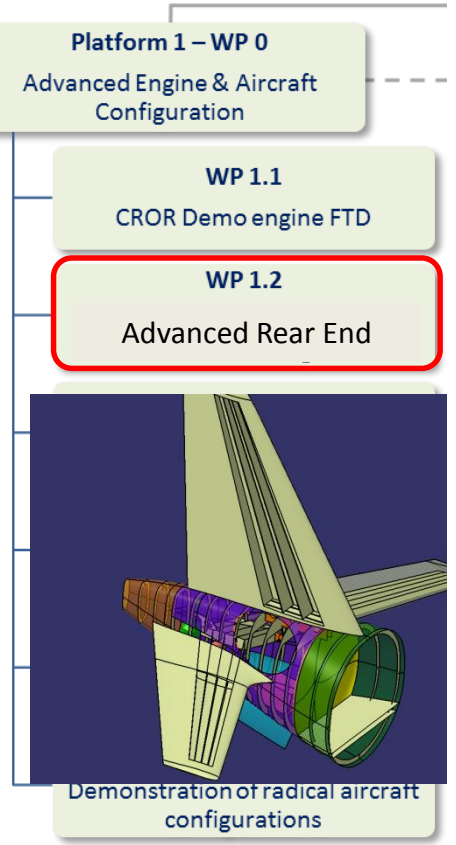
- Evaluation and integration of anti-ice coatings and devices for three-dimensional shapes

- Development of aerostructural optimisation methods including aeroelastic and flight mechanics constraints, embodying anti-ice solutions.

- Large scale experimental validation in a wind tunnel of the ice accretion process with and without anti-ice protections

The performance improvement objectives sought in the Clean Sky 2 project call for a departure of the conventional empennage configurations and technologies that constitute the state of the art in aircraft design.

- **Volume:** 1500 k€ funding
- **Type of action**: IA



- Simulation of ice accretion
- Integration of anti-ice coatings including aero-structural constraints

JTI-CS2-2019-CfP10-LPA-01-80

- **Targeted applicant:**

Partner(s) with research background and experience in aerospace R&TD programs.

- **Required skills:**

The applicant(s) shall be able to demonstrate sound technical knowledge in the following areas:

- Advanced geometric modelling, CFD analysis, adjoint-based aerodynamic shape optimization
- Aeroelastic modelling, analysis and optimization
- Numerical modelling of ice accretion on lifting surfaces
- Aerostructural optimisation
- Wind Tunnel Testing: low speed and icing applications
- Wind Tunnel Model design and build. In-house model manufacturing capability
- Excellent mechanical design capability applied to aeronautical projects. Knowledge of design standards, materials and tolerancing.
- Demonstrated mechanical design capability to design WT models and mechanisms

The applicant shall, as minimum requirements, use the following equipment for aerodynamic and aeroelastic design and testing:

- High Performance Computing (HPC) and state of the art CFD solvers.
- Icing wind tunnel with the following characteristics:
- suitable for aeronautical testing,
- minimum test speed 80 m/s,
- surface flow visualisation
- infra-red thermographic cameras

JTI-CS2-2019-CfP10-LPA-01-81
Fibre reinforced thermoplastics manufacturing for stiffened, complex, double curved structures

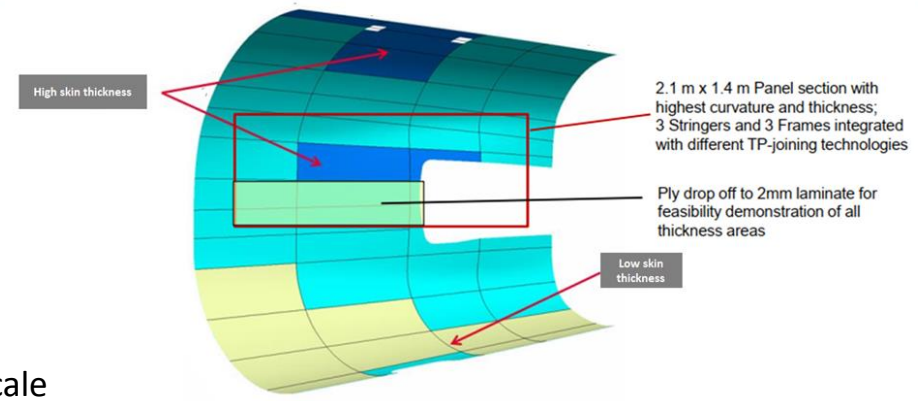
Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

JTI-CS2-2019-CfP10-LPA-01-81

Topic Leader: **DLR**
Type of action: **IA**
Indicative Funding: **700k€**
Indicative Start Date: **> Q1/2020**
Duration: **30 months**



Short description:

The main objective of this call is the contribution to a mid-scale demonstration of a thermoplastic rear-end part. Therefore the work is divided into the following tasks.

Tasks & Objectives

Task 1: Optical-Thermal-Simulation model for TP-AFP with Xenon heating

- Simulation model for Xenon heating device layup process in combination with heated tooling
- Pre-definition of layup parameters on optical material properties, heating source design and machine properties
- Power/Speed sequence generation for direct machine implementation

Task 2: Process development and manufacturing of TP-Stiffeners

- Manufacturing process for double curved CF- thermoplastic stiffener & Clips
- Part delivery for overall manufacturing process demonstration

Task 3: Design and Manufacturing of a heated Tooling:

- Thermal management to ensure the needed consolidation temperatures and pressures
- Part design and process driven heating zones
- Self-heating capabilities up to 400°C and integrated sensors

- Thermo-plastic technology
- Optical –Thermal simulation model
- Double –curved TP stiffeners
- D&M of heated tooling

JTI-CS2-2019-CfP10-LPA-01-81

(M) Mandatory skill

Timeline:

Task	2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1: Optical-Thermal-Simulation model for TP-AFP with Xenon heating												
Task 2: Process development and manufacturing of TP-Stiffeners												
Task 3: Design and Manufacturing of a heated Tooling:												

Targeted applicants/Required skills:

The consortium shall consist of Partners with experience in aerospace R&TD programs. The Partner(s) should have proven experience, strong knowledge and capabilities in the following fields:

- Development of realistic simulation of manufacturing processes of composites (M)
- Optical characterization of radiative heating sources (M)
- Thermal simulation models (M)
- Manufacturing of fibre reinforced thermoplastic profiles with processing temperatures of 340°C to 410°C (M)
- Hot stamp forming and Continuous Compression Moulding (M)
- In design and manufacturing of curing and layup moulds for composites (M).The applicant must have the capability to do functionality tests with (M).

JTI-CS2-2019-CfP10-LPA-01-82

Development of Thermoplastic press forming Tool for Advanced Rear End Closing Frame Prototype and Tooling 4.0 for Assembly and transportation of the Advanced Rear End Prototype

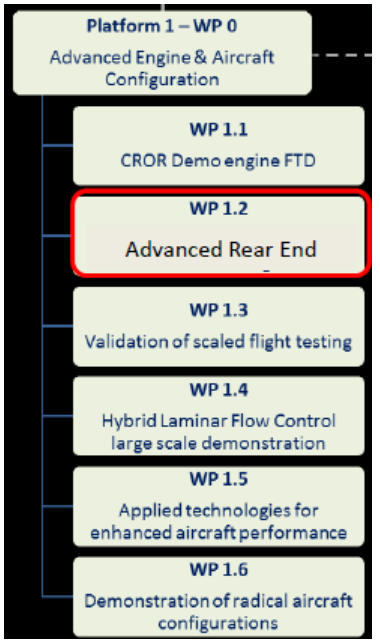
AERnnova

Clean Sky 2

JTI-CS2-2019-CfP10-LPA-01-82

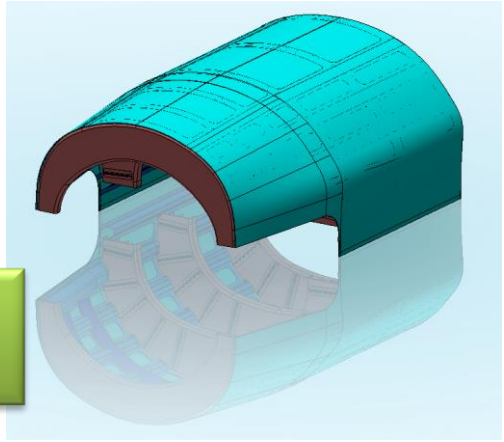
Type of action (RIA/IA/CSA):		IA	
Programme Area:		LPA	
(CS2 JTP 2015) WP Ref.:		WP 1.2	
Indicative Funding Topic Value (in k€):		750	
Topic Leader:	Aernnova	**Type of Agreement:**	Implementation Agreement
Duration of the action (in Months):	24	**Indicative Start Date (at the earliest)[26]:**	> Q1 2020

Topic Identification Code	**Title**
JTI-CS2-2019-CfP10-LPA-01-82	**Development of Thermoplastic press forming Tool for Advanced Rear End Closing Frame Prototype and Tooling 4.0 for Assembly and transportation of the Advanced Rear End Prototype**
Short description	
Development of innovative press-forming tool for Thermoplastic Closing Frame, including consolidation of stiffeners and press-forming of frame caps considering variable frame thickness and innovative Tooling Set (including Drilling templates, Handling devices, Assemblies and Transportation) for the Advanced Rear End Prototype Specimen, including ALM techniques and strengths/deformations sensorization.	



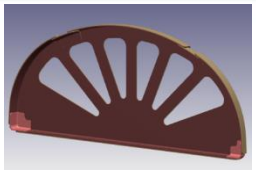
The overall dimensions of the ARE Prototype Specimen are approximately 3 meters x 2,2 meters x 1,2 meters. The Prototype integrates five main parts:

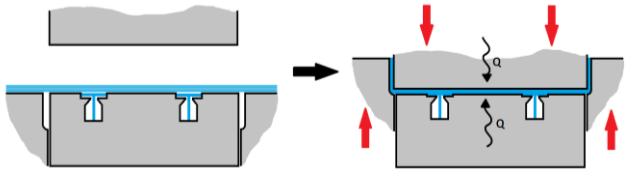
- High integrated composite skin, including cocured omega stringers, cocured beams and cocured countour frames.
- Three (3) high load composite frames.
- One (1) Closing Frame.



- Thermo-plastic technology
- Innovative press-forming tooling set

JTI-CS2-2019-CfP10-LPA-01-82



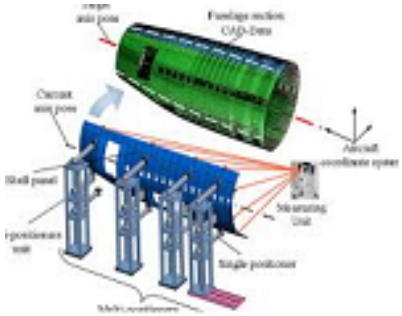


Scope of work.

Thermoplastic Frame Tooling: The frame will be made of thermoplastic with carbon fiber reinforcement. The "T" pre-consolidated stiffeners will be welded to the frame at the same time that the frame web is formed. Thermoplastic matrix will require temperatures up to 400ºC.

Assembly Tooling: The selected partner shall develop, design, manufacture and deliver to the Topic Manager all the prototype tooling including all the "secondary tooling" as handling jigs, frames for composite placement, drilling templates, locating templates, and the "manipulation tooling", like work platforms, slings, turning devices.
The assembly build up stresses are key for the final part geometrical compliance. "Sensitive" jigs (sensor/detectors) that could record "on line" during the assembly shall provide information to adapt the jig to subsequent operations to correct assembly stresses.

Thermoplastic Frame Tool Milestones		
Ref. No.	Title - Description	Due Date
M1.1	Device and tooling specification	T0+4M
M1.2	Device and press-forming tooling manufactured	T0+8M
M1.3	Curing tooling manufactured	T0+11M
M1.4	Tooling reception	T0+12M
Assembly Tool Milestones		
Ref. No.	Title - Description	Due Date
M2.1	Technology screening, materials and trade-offs	T0+6M
M2.2	Tooling Set PDR	T0+8M
M2.3	Tooling Set CDR	T0+12M
M2.4	Assembly tool delivery	T0+16M
M2.5	Final reports, Lessons learnt and project closure	T0+24M



Expected skills:

- The consortium should have proven experience in aeronautic tools design, manufacturing and quality.
- Experience in former CleanSky European or collaborative programs.
- Reinforced Thermoplastic processing experience, especially for press-forming process and high temperature (400ºC) consolidation.
- CAD-CAM software license compatible with project DMU: CatiaV5R21.
- Temperature, strains and deformations sensor knowledge, artificial intelligence (AI) means, as digital twins (DT), machine learning (ML), algorithms and/ or big data techniques.
- ALM technology knowledge.

AERnnova

JTI-CS2-2019-CfP10-LPA-01-83

Development and simulation of a forming process for LE HLFC wing outer skins

Clean Sky 2

JTI-CS2-2019-CfP10-LPA-01-83

Type of action (RIA/IA/CSA):		IA	
Programme Area:		LPA	
(CS2 JTP 2015) WP Ref.:		WP 1.4	
Indicative Funding Topic Value (in k€):		1300	
Topic Leader:	Aernnova	**Type of Agreement:**	Implementation Agreement
Duration of the action (in Months):	26	**Indicative Start Date (at the earliest)[28]:**	> Q1 2020

Topic Identification Code	**Title**
JTI-CS2-2019-CfP10-LPA-01-83	**Development and simulation of a forming process for LE HLFC wing outer skins**

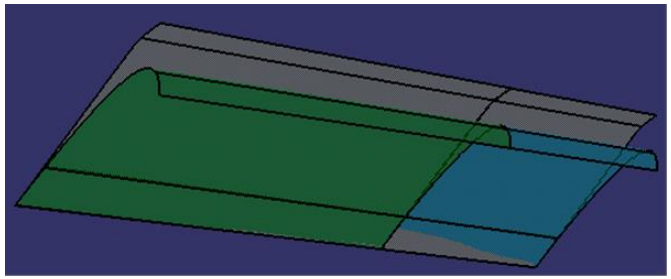
Short description

Development and simulation a forming process adequate for manufacturing microperforated outer skin for leading edges of HLFC wings with double curvature and variable micro-perforation density.
Stretching and hot forming will be developed and compared with small-scale demonstrators, in order to define the more adequate technology for manufacturing of final demonstrators. Preliminary studies could consider also other alternative forming technologies proposed by partners.
Chosen forming method will be simulated and validated with several large-scale demonstrators up to 5 meter long.

- Search for new forming process for micro-perforated outer skin
- Simulation and validation via large scale demo (5 m long)

JTI-CS2-2019-CfP10-LPA-01-83

- **This topic aims at:**
  - Study of alternative forming technologies applicable to variable density microperforated sheet metals (Titanium Gr2 (CP40) or Titanium G5 (Ti6Al4V))
  - Development of stretch forming for variable microperforated sheet of Titanium CP40 with thickness between 0,6 and 1,2 mm
  - Development of a precise FEM simulation tool for stretch forming of variable microdrilled Titanium CP40.
  - Adjust and correlation of FEM simulation tool by mean of small-scale demonstrators.
  - Validation of process and simulation tool with large-scale demonstrators.



- **Large scale demonstrator approximated dimensions:**
  - 970 mm (H) x 145 mm (W) x 4,700 mm (L). Approximate Flat pattern 4,800 mm x 1,200 mm
  - 870 mm (H) x 107 mm (W) x 2,400 mm (L). Approximate Flat pattern 2,500 mm x 1,000 mm

- **Tasks & Milestones**

Tasks		
Ref. No.	***Title - Description***	***Due Date***
Task 1	Process development of technologies applicable for forming of variable microperforated sheet metals	T0+7
Task 2	Development of a precise FEM simulation tool for stretch forming of variable microdrilled Titanium CP40.	T0+11
Task 3	Adjust and Correlation of FEM simulation tool with small-scale demonstrators.	T0+14
Task 4	Design and manufacturing of forming tools for large scale demonstrators	T0+17
Task 5	Manufacturing of large-scale process demonstrators.	T0+20
Task 6	Definition of equipment and investments required for a high production rate.	T0+26

Milestones (when appropriate)			
Ref. No.	***Title - Description***	***Type****	***Due Date***
M1	Forming process selection	R	T0+7
M2	Forming simulation tool available and optimized	D	T0+11
M3	Small scale demonstrators formed and available	HW	T0+11
M4	Detailed design review of forming tooling (CDR)	R	T0+14
M5	Forming tools available	HW	T0+17
M6	Outer skins for GBD demonstrator formed and available	HW	T0+20

- **Targeted applicant skills:**
  - Proven technological background, technical capabilities and equipment to stretch forming and hot forming titanium components for aerospace sector (up to 5 meters)
  - Previous experience and background in the metallurgical metallography and forming properties characterization. In addition, large experience in simulation of forming processes (ABAQUS, PAMSTAMP…) would be valuable.
  - A demonstrated ability to protect new intellectual property.
  - A demonstrated ability to industrialize developed technology related with forming technologies.
  - A demonstrated experience from collaborative R&D of manufacturing technologies within European projects.

JTI-CS2-2019-CFP10-LPA-01-84

Development of a manufacturing process and a manufacturing unit for production of a laser treated titanium panel with a 3D printed substructure

Innovation Takes Off

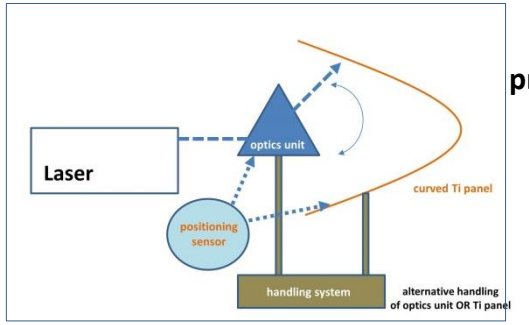
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

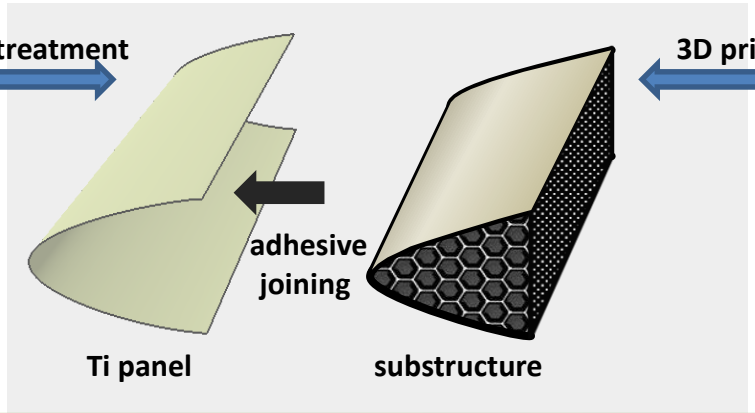
JTI-CS2-2019-CFP10-LPA-01-84

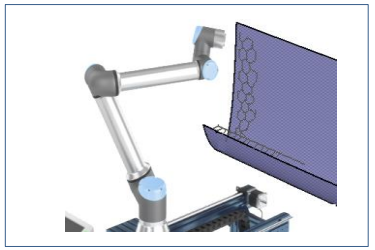
- **Title:** *Development of a manufacturing process and a manufacturing unit for production of a laser treated titanium panel with a 3D printed substructure.*
- **Objective:** For the HLFC demonstrators a micro-perforated titanium panel is bonded to a support sub-structure with HTP/wing geometry. It is required to develop a manufacturing cell for the laser pretreatment of titanium panels with an optics unit that is able to provide good bonding properties homogeneously over the whole surface, and to develop and build 3D printed support sub-structures to which the titanium panel is bonded to.

- **Demonstrator**: HLFC ground demonstrator for HTP and wing (LPA WP 1.4.1 & 1.4.4)
- **Volume:** 1.5 M€ funding ; **Duration:** 24 months ; **Topic leader:** Fraunhofer ; **Action:** IA



IR laser cell for pre-treatment of curved titanium panel (inner side)





3D printing unit for honeycomb structure

- Pre-treatment of a micro-perforated curved titanium panel
- Development of a IR laser cell

JTI-CS2-2019-CFP10-LPA-01-84

- **Schedule/Key Tasks**

Tasks		
Ref. No.	***Title - Description***	***Due Date***
T1	Basic concept for treatment unit	M2
T2	Design of laser treatment system	M7
T3	Design of a positioning system	M7
T4	Design of laser cell and handling system	M7
T5	Manufacture, delivery, installation of the laser treatment tool set	M10
T6	Assistance during assembly and functional test	M10
T7	Development of a 3D printing head and bed for complex surfaces	18M
T8	Infill Shape and Material characterisation and process definition (case study)	12M
T9	3D-Printing-Tool Manufacture, Delivery, installation of the complete tooling set	20M
T10	Assistance during assembly and functional test	24M

laser cell

3D print unit

- **Targeted applicant/Required Skills:**

  The applicant(s) should have proven experience in lasers and 3D printing. Experience in aeronautic equipment design, manufacturing and quality is helpful.

  - Profound knowledge of laser optics and laser guidance in complex geometries (M).
  - Sound knowledge of combination of lasers with individual optics to enable high process rates (M).
  - CAD-CAM software license compatible with project DMU: CatiaV5R21 (M).
  - ALM technology knowledge (M).
  - Internal management of the project (with single focal-point) (M).

(M) – Mandatory; (A) – Appreciated

JTI-CS2-2019-CFP10-LPA-01-85

Design and manufacturing of multi-functional Ice Protection System power feed/monitoring lines and Shielding/High-lift electrical actuation system for a HLFC Wing demonstrator.

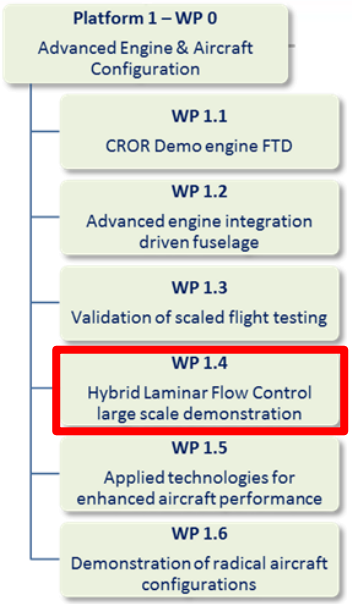
Innovation Takes Off

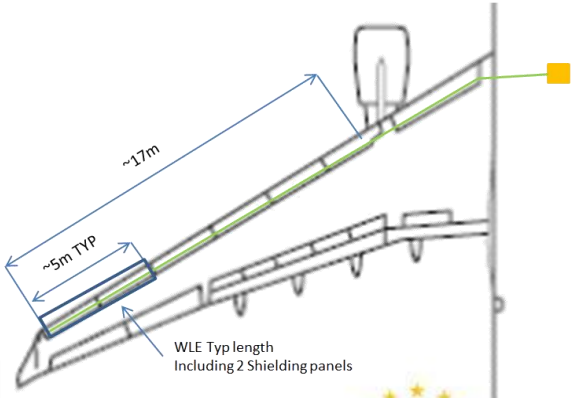
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

JTI-CS2-2019-CFP10-LPA-01-85

- **JTI-CS2-2019-CFP10-LPA-01-85**
- **Title:** *Design and manufacturing of multi-functional Ice Protection System power feed/monitoring lines and Shielding/High-lift electrical actuation system for a HLFC Wing demonstrator.*
- **Company managing the topic:** SONACA SA
- **Objective:** The main purpose of this topic is to design and manufacture innovative concepts of a HLFC Wing Ice Protection System power feed lines, aiming at a high structure/system integration and multi-functional design. The second purpose of this topic is to design and manufacture the electrical devices (wiring, motors) of the Shielding/High-lift device with the same innovative context.



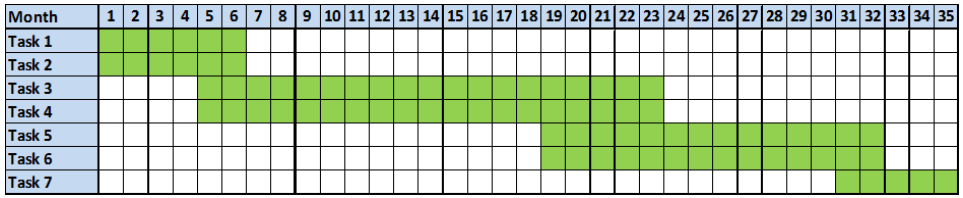


- Search for Innovative power feed lines for ice protection system
- D & M the associated electrical devices (wiring, motors)

JTI-CS2-2019-CFP10-LPA-01-85

- **Volume:** 700 k€ funding
- **Type of action:** IA
- **Schedule (35 months action):**

Tasks		
Ref. No.	***Title - Description***	***Due Date***
T1	IPS power feed/monitoring lines and their support: conceptual design and trade-off analysis	T0 + 6M
T2	Shielding power feed/monitoring lines, actuation and their supports: conceptual design and trade-off analysis	T0 + 6M
T3	IPS power feed/monitoring lines and their supports design	T0 + 23M
T4	Shielding power feed/monitoring lines, actuation and their supports design	T0 + 23M
T5	IPS power feed/monitoring lines and their support manufacturing and tests	T0 + 32M
T6	Shielding power feed/monitoring lines, actuation and their manufacturing and tests	T0 + 32M
T7	Support during final assembly and GBD tests	T0 + 35M



- **Targeted applicant/Required skills** :
  - The Applicant(s) must have proven experience in electrical wiring design and manufacturing.
  - The Applicant(s) must have proven experience in pipe work design and manufacturing.
  - The Applicant(s) must have proven experience in actuation components design and manufacturing.
  - The Applicant(s) must have experience in inspection and testing of electrical and mechanical systems.
  - The Applicant(s) must have experience in manufacturing of electrical and mechanical systems.
  - Experience in aeronautic design would be appreciated.
  - Experience in former collaborative programs would be highly appreciated.
  - An international standard quality management system would be appreciated.

JTI-CS2-2019-CFP10-LPA-01-86

Develop and test Power Efficient Actuation Concepts for Separation Flow Control at large aerodynamic areas requiring very low actuation energy

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

JTI-CS2-2019-CFP10-LPA-01-86

Type of action (RIA/IA/CSA)	IA		
Programme Area	LPA		
(CS2 JTP 2015) WP Ref.	WP 1.5.3		
Indicative Funding Topic Value (in k€)	0,9 M€		
Topic Leader* **full name, no abbreviation*	Airbus Operations GmbH	**Type of Agreement**	Implementation Agreement
Duration of the action (in Months)	36	**Indicative Start Date**	Q2 2020

Topic Identification Code	**Title**
JTI-CS2-2019-CFP10-LPA-01-86	Develop and test Power Efficient Actuation Concepts for Separation Flow Control at large aerodynamic areas requiring very low actuation energy.

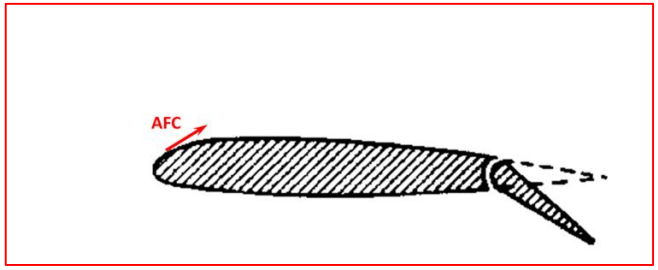
Short description

The objective is to develop and realize advanced actuation concepts for flow separation control which are more power efficient compared to state of the art actuators (pulsed jet actuators) reducing considerable the net mass flow (by factor higher 5). After being developed and designed the actuators shall be manufactured, tested and fully characterized in a small scale wind tunnel test, followed by a representative scale wind tunnel test. Numerical simulations of the flow shall support the design phase of the actuators and shall be applied for a comprehensive understanding of the occurring flow phenomena, paving the way for representative scale aircraft integration.

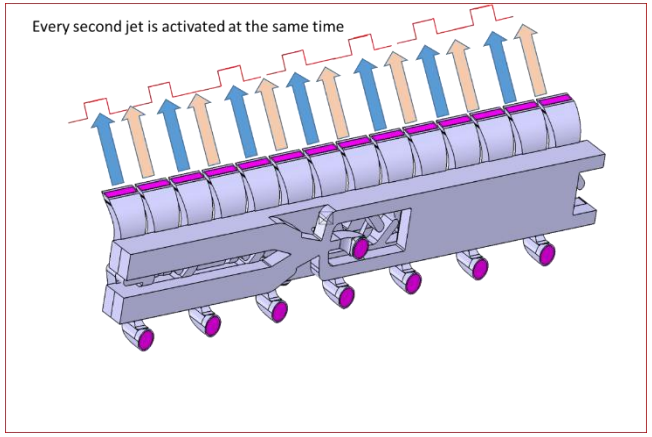
- Search fo r an innovative actuation system for active flow control application
- Validation in WT

JTI-CS2-2019-CFP10-LPA-01-86

Duration	36 months
Start	Q2/2020



Main wing element with installed flow control technology



Example of a baseline pulsed jet actuator switching pattern

Tasks		
Ref. No.	**Title - Description**	**Due Date**
T1	Adaption of the WT model, including the integration of the pulsed jets actuator system (PJA).	M6
T2	Numerical studies and wind tunnel tests on the wing geometry with and without the baseline PJ actuation patter.	M12
T3	Investigating the advanced PJ actuation patterns on the wing geometry using numerical studies and small scale wind tunnel tests.	M20
T4	Design, manufacturing and integration of an pulsed jet actuator system at representative scale. Pre-testing in silent conditions (Ground Test).	M26
T5	Investigating the advanced PJ actuation patterns on an airfoil in a wind tunnel at representative aircarft scale.	M34
T6	Evaluation of the advanced actuation methods, recommendations and delivery of the final report.	M36

Deliverables			
Ref. No.	**Title - Description**	**Type***	**Due Date**
D1	Small scale WT model with an integrated systsem of pulsed jet actuators.	HW Report	M7
D2	Results of numerical studies and wind tunnel tests on the small scale wing geometry with and without the baseline PJ actuation patter.	Report Data	M13
D3	Results of numerical studies and wind tunnel tests with advanced PJ actuation patterns on the small scale wing geometry.	Report Data	M21
D4	Pulsed jet actuator system integrated in the representative scale WT model. Ground test report.	HW Report	M27
D5	Results of numerical studies and wind tunnel tests with advanced PJ actuation patterns on the representative aircraft scale airfoil.	Report Data	M35
D6	Final report of numerical results and wind tunnel test with the advanced actuation methods.	Report Data	M36
*Types: R=Report, D- Data, HW=Hardware			

JTI-CS2-2019-CFP10-LPA-01-86

- **Targeted applicant**:
- Experienced specialist in developing, testing and maturing active flow technology.
- **Detailed required skills:**
- Expertise in the area of wind tunnel model modification and model instrumentation, as well as in the area of wind tunnel testing, data post processing and flow visualization (PIV, tufts).
- The applicant will provide the wind tunnel model including the needed system to feed the actuators with required amount of pressurized air flow for the flow control system.
- Sound R&T background in testing and demonstration of flow control techniques in wind tunnel facilities suitable for models of the size mentioned above.
- Expertise in the area of PIV measurement technique applied during the wind tunnel tests.
- Profound knowledge and experience in developing and maturing of active flow control technology with net mass flow, being familiar with the actuation method of pulsed jet actuators (PJA).
- Sound expertise in conducting unsteady numerical flow simulations of internal and external flow.

JTI-CS2-2019-CfP10-LPA-01-87

Loop Heat Pipe development for severe environment

Innovation Takes Off

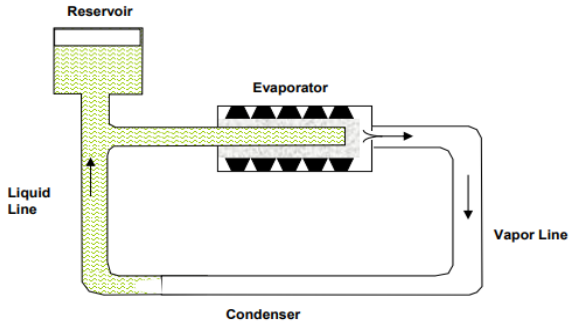
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

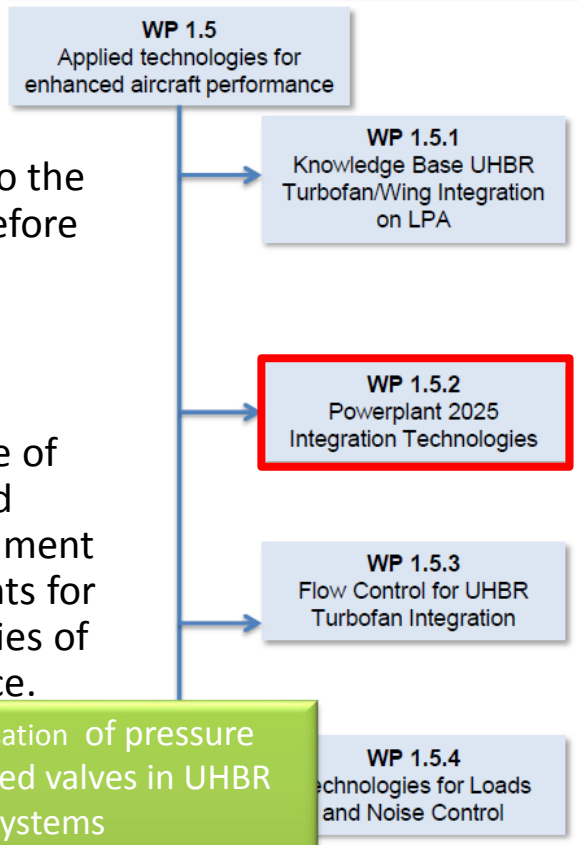
JTI-CS2-2018-CfP10-LPA-01-87

- **JTI-CS2-2018-CfP10-LPA-01-87**
- **Title:** Loop Heat Pipe development for severe environment
- **Objective:** This topic is focused on a passive cooling device dedicated to the thermal management of valves located inside the A/C engine and therefore exposed to very harsh radiative and convective environment:
  - Motor radiative temperature up to 800°C;
  - Air through the valve up to 650°C (continuous);
  - Local air surrounding the valve up to 300°C.

  The objective of this topic is to develop and manufacture the prototype of such a high temperature apparatus and therefore show advantages and drawbacks of the technology in such environment. The specific environment needs an identification of the working fluid that can gather requirements for cooling and satisfy aeronautical safety issues. Thermo-physical properties of this fluid would therefore drive the design of the adapted cooling device.
- **Volume:** 500k€ funding
- **Duration:** 24 months
- **Type of action**: IA



Two-phase loop description



- Optimisation of pressure regulated valves in UHBR bleed systems
- Valve protection vs hars environment (transient over heating)
- Development of a passive cooling technology

Clean Sky
JOINT UNDERTAKING

JTI-CS2-2018-CfP10-LPA-01-87

- **Scope of work**

Tasks		
Ref. No.	**Title - Description**	**Due Date**
1	Selection of best working fluid candidates for two-phase loops in harsh environment	**T0+3**
2	Full characterization of thermo-physical properties of the selected fluids	**T0+9**
3	Two-phase loop demonstrator design and manufacturing	**T0+21**
4	Demonstrator test and validation in partially representative environment	**T0+24**

- **Deliverables**

Deliverables			
Ref. No.	Title - Description	Type*	Due Date
D1	Working fluids overview and trade-off report	R	T0+3
D2	Fluid thermo-physical properties characterization report	R	T0+9
D3	Prototype design justification and definition and heat loop demonstrators	R+HW	T0+21
D4	Prototype test results report	R	T0+24

*Types: R=Report, D-Data, HW=Hardware

- **Milestones**

Milestones (when appropriate)			
Ref. No.	Title - Description	Type*	Due Date
M1	Selection of 2 working fluids for the given environment	D	T0+3

*Types: R=Report, D-Data, HW=Hardware

JTI-CS2-2018-CfP10-LPA-01-87

- **Targeted applicant**: The applicant shall demonstrate their skills detailing their activities, own bibliographic references and description of past projects linked to the present topic.

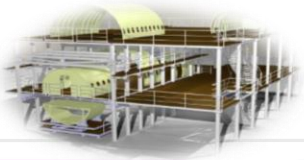
- **Required skills & capabilities**:
  - ✓ Skills:
    - LHP designing and manufacturing
    - Thermodynamics applied to capillary pumped loops
    - Experimental skills for LHP
  - ✓ Capabilities:
    - Computing facilities for two-phase loops design
    - Experimental capabilities to test LHP

CS2 Large Passenger Aircraft - WBS

LPA (Airbus)

Overall Aircraft Design

Structure Design



System Design

Platform 1 – WP 0
Advanced Engine & Aircraft Configuration

- **WP1.1** Short/Medium Range Aircraft Power Plant System Integration
- **WP1.2** Advanced Rear-end
- **WP1.3** Validation of Scaled Flight Testing
- **WP1.4** Hybrid Laminar Flow Control Large Scale Demonstrator
- **WP1.5** Applied Technologies for Enhanced Aircraft Performance
- **WP1.6** Demonstration of Radical Aircraft Configurations

Platform 2 – WP 0
Innovative Physical Integration Cabin-System-Structure

- **WP 2.1** Next generation fuselage, cabin and systems integration — LPA 02-30, LPA 02-31, LPA 02-32
- **WP 2.2** Next generation cabin & cargo functions
- **WP 2.3** Next generation lower centre fuselage
- **WP 2.4** Non-specific cross functions

Platform 3 – WP 0
Next Generation Aircraft, Cockpits Systems & Avionics

- **WP 3.1** …erations & …s
- **WP 3.2** Innovative enabling technologies
- **WP 3.3** Next generation cockpit functions flight demonstration
- **WP 3.4** Enhanced cockpit demonstration
- **WP 3.5** Disruptive cockpit demonstration
- **WP 3.6** ADVANCE (Maintenance)

- **WP 0.1** Technology assessment
- **WP 0.2** EcoDesign
- **WP 0.3** ITD - Interfaces

JTI-CS2-2019-CfP10-LPA-02-30

Development of innovative Welding systems for structural joints of Thermoplastic matrix based Composites

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

JTI-CS2-2019-CfP10-LPA-02-30

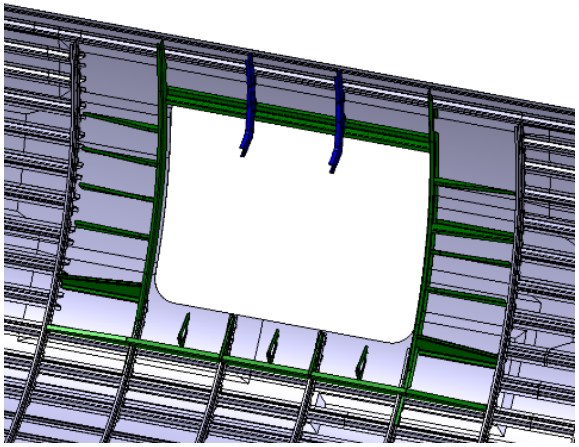
Type of action (RIA/IA/CSA):		IA	
Programme Area:		LPA	
(CS2 JTP 2015) WP Ref.:		WP 2.1.4	
Indicative Funding Topic Value (in k€):		750	
Topic Leader:	Aernnova Composites Illescas	**Type of Agreement:**	Implementation Agreement
Duration of the action (in Months):	18	**Indicative Start Date (at the earliest)[38]:**	> Q1 2020

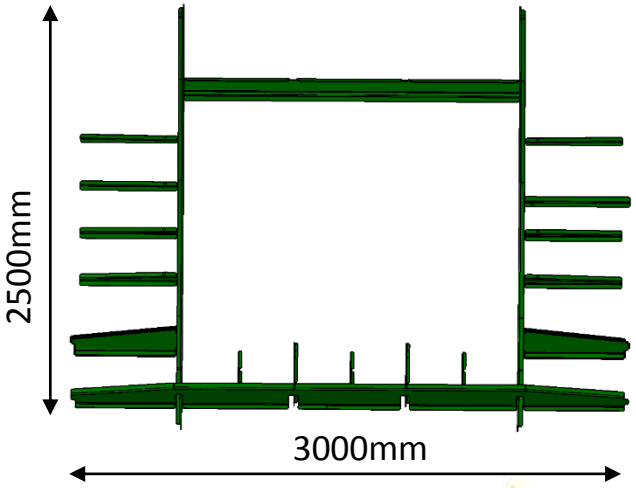
Topic Identification Code	**Title**
JTI-CS2-2019-CfP10-LPA-02-30	**Development of innovative welding systems for structural joints of Thermoplastic matrix based Composites**

Short description

The objective of the topic is to achieve a structural bond of small/medium reinforcement parts to the primary structural elements to achieve highly integrated subassemblies. Reinforcement is made of Carbon fibre with thermoplastic matrix. The welding systems shall be capable of welding different types of Thermoplastics and shall be energy efficient, quick in execution, minimal tool dependant and able to be inspected with current state of the art non-destructive technologies.

- Thermo plastic technology
- Development of an energy efficient & quick welding system





Thermoplastic structure (green)

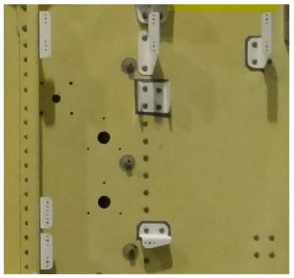
JTI-CS2-2019-CfP10-LPA-02-30

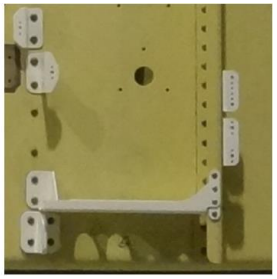
- **Tasks & Schedule**

Tasks		
Ref. No.	**Title – Description**	**Due Date**
T1	Concurrence engineering and design composites development for system, tooling and test plan definition. Welding Technology section.	T0+6
T2	Manufacture the tools, jigs, end-effectors and devices.	T0+8
T3	Coupons manufacturing and test.	T0+10
T4	Validation of the system as agreed with the TM.	T0+12
T5	Delivery of the system to the TM facilities and support to set up and DSS prototypes welded assembly.	T0+18

- **Targeted applicant**: Partner(s) with experience in thermoplastic welding and testing, and end effectors design and manufacturing capability.

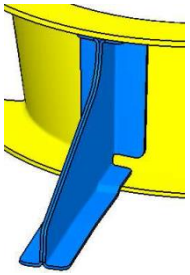
- **Special skills, Capabilities, Certification expected from the Applicant(s)**:
- *(M) – Mandatory; (A) – Appreciated.*
  - Carbon/Glass Reinforced Thermoplastic processing experience. (M)
  - Experience in aeronautic (A) tools design, manufacturing and quality.(M)
  - CAD-CAM software license compatible with project DMU: CatiaV5R21 (M) / Catia V6 (A)
  - Temperature, strains and deformations sensor knowledge, artificial intelligence means, as digital twins, machine learning, algorithms and/or big data techniques (M)
  - Into the eco design field, the Partner shall have the capability to monitor and decrease the use of hazardous substances regarding REACH regulation (M)
  - Experience in former Clean Sky European or collaborative programs (A).
  - An international standard quality management system (i.e. EN 9100:2009/ ISO 9001:2008/ ISO 14001:2004). (A)
  - Capacity to repair or modify “in-shop” the prototype manufacturing tooling for components due to manufacturing deviations. (A)
  - Qualification as strategic supplier of manufacturing tooling on aeronautical elements. (A)

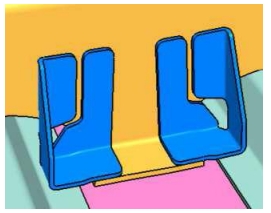




<u>In the past</u>: Typical small/medium parts riveted to metallic/thermo-set composite structure.

<u>CfP</u>: Reinforced thermoplastic parts welded to composite thermoplastic structure.





JTI-CS2-2019-CfP10-LPA-02-31

Development of short fibre thermoplastic airframe clips and brackets using factory waste

Innovation Takes Off

http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

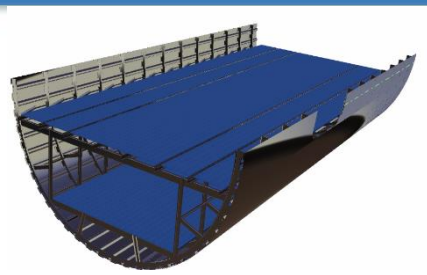
JTI-CS2-2019-CfP10-LPA-02-31

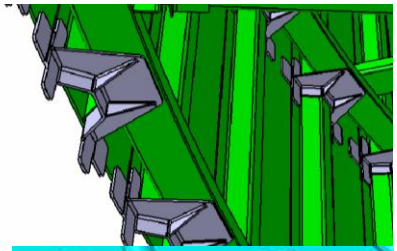
Type of action (RIA/IA/CSA)	IA		
Programme Area	LPA		
(CS2 JTP 2015) WP Ref.	WP 2.1.5		
Indicative Funding Topic Value (in k€)	500 k€		
Topic Leader* **full name, no abbreviation*	Fokker	**Type of Agreement**	Implementation Agreement
Duration of the action (in Months)	24 Months	**Indicative Start Date**	Q1 2020

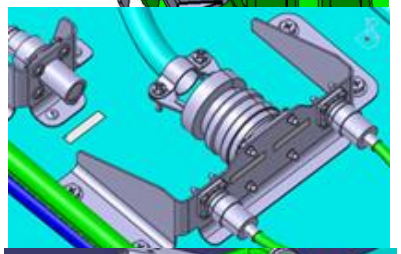
Topic Identification Code	**Title**
JTI-CS2-2019-CfP10-LPA-02-31	Development of short fibre reinforced thermoplastic airframe clips and brackets using factory waste

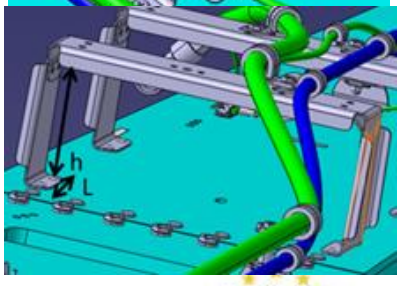
Short description

Thermoplastic composites offer great potential to recycle factory waste by reusing it in the form of short fibre compounds for products such as airframe clips and system brackets. Key aspects of this topic are the development, manufacturing and structural validation of frame clips and system brackets to be installed in a fuselage demonstrator together with an environmental, economical, and technical assessment of the technology.









- Thermoplactic technology
- Airframe clips and brackets from recycling factory waste

JTI-CS2-2019-CfP10-LPA-02-31

Overview of tasks:

Tasks		
Ref. No.	***Title - Description***	***Due Date***
T1	Technical specification and validation	M18
T2	Development and manufacturing of all frame clips	M12
T3	Development and manufacturing of all system brackets	M15
T4	Environmental and economical evaluation of the technology	M22

Extract of Special skills / Capabilities:

- The applicant should have proven capabilities to design tooling and to re-design parts if needed. Catia releases compatible to the Topic leader are required
- The applicant should have a sound knowledge of the processing of short fibre thermoplastic composites
- The applicant should have a sound knowledge in structural testing of these structures as well as the capability to join these type of structures.

JTI-CS2-2019-CfP10-LPA-02-32

Innovative miniturized sensing device for large wave length spectrum reception capability as a tool for quality control and aircraft maintenance

JTI-CS2-2019-CfP10-LPA-02-30

Type of action (RIA/IA/CSA)	RIA		
Programme Area (LPA/REG/FRC/AIR/ENG/SYS/SAT/ECO/TE)	LPA		
(CS2 JTP 2015) WP Ref.	WP 2.4.2		
Indicative Funding Topic Value (in k€)	800		
Topic Leader* *full name of the organisation, no abbreviation	Airbus Operations	**Type of Agreement**	Implementation Agreement
Duration of the Action (in Months)	36	**Indicative Start Date (at the earliest)[1]**	Q1 2020

Topic Identification Code	**Title**
JTI-CS2-2018-CFP08-LPA-02-32	Innovative miniaturized sensing device for large wave length spectrum reception capability as a tool for quality control and aircraft maintenance.
Short description	
The project will develop an innovative miniature camera with an electronic system sensitive to all visible, infrared and X-ray waves that will be the reception element from an inspection feature dedicated to quality control and in aircraft maintenance for damage detection in small cavities of structure assemblies with a proper spatial resolution, weight and compactness.	

- Miniaturized sensing device for quality control and damage detection
- Application to multifunctional fuselage
- Online/NDI process monitoring in composite man.

To be inserted into typical assemblies shown hereunder

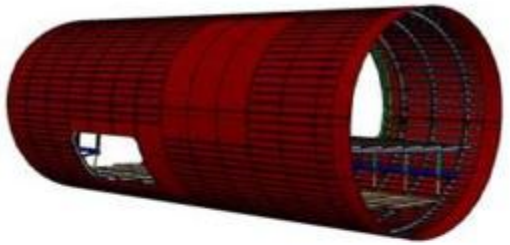


Figure 1 – Typical Multifunctional fuselage

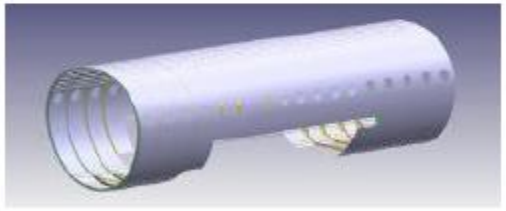


Figure 2 – Typical Lower Centre Fuselage Next generation- Shell structure

JTI-CS2-2019-CfP10-LPA-02-30

- **Tasks & Schedule**

Tasks		
Ref. No.	*Title - Description*	*Due Date*
Task 1	Configuration definitions – Identification of all physics that will drive the sensing capabilities. Targeting an optimized set up identifying integration constraints. Identify and define specific requirements from the industrial contexts (Structural and Electrical Systems) and automatic process specifications, all with topic leader inputs. The outcome of this task will be definition of the concept and of the final evaluation.	T0+3
Task 2	Define and make preliminary evaluation of the sensing technology for all spectrum detections.	T0+7
Task 3	Design and develop detector based on task 1 and 2 outcome.	T0+22
Task 4	Integration and evaluation of the prototype in laboratory environment by the project partner(s).	T0+30
Task 5	Validation - Tests on demonstrator and validation of detection capabilities (delamination, de-bonded surface) and functionalities (data transfer, self testing) will be defined and realized with topic leader contribution.	T0+36

- **Special skills, Capabilities, Certification expected from the Applicant(s)**:
  - Experiences in the different disciplines of various optical sensing technologies including specific automated measurement systems;
  - Likely experience in the field of aircraft production and assembly including all main aspects of a production processes and industrialization constraints;
  - Demonstrated capability to design and to produce innovative connecting devices with integration of optoelectronics such as transceivers, bolometers, interrogating devices;
  - Experience in system reliability testing standards;
  - Knowledge in wireless technologies applicable to optoelectronics systems;
  - Experience in interdisciplinary research and development team/consortium management.

Questions?

Any questions on the 9th Call for Proposals can be addressed to the following mailbox:

Info-Call-CFP-2018-02@cleansky.eu

Last deadline to submit questions – check CS2 website

Thank you !

Thank You

Disclaimer

- The content of this presentation is **not legally binding and subject to modifications and evolution over the info days on Clean Sky 2** until the adoption of the Regulation on *Clean Sky 2 JU*. **Any updated version will be regularly advertised on the website of the Clean Sky JU.**
- The selection of Partners will be based on Horizon 2020 Rules for Participation **(already in force)**, the rules for submission of proposals, evaluation and selection of Partners as adopted by the Governing Board of Clean Sky 2 JU .
- The proposed content/approach is based on the consultation with the "National States Representative Group" and the "Task Force " of the *Clean Sky 2* Programme
- A dedicated functional mailbox is available to any interested applicants for any further questions related to this Call: XXXX to be inserted.