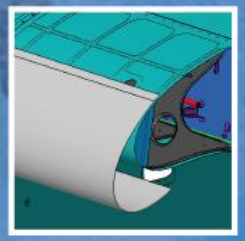













Innovation Takes Off

Clean Sky 2

Clean Sky 2
Information Day dedicated to the 4th Call for Proposal (CfP04)

LPA – IADP

Presented by

Jens Koenig, AIRBUS

Brussels, 22 June 2016

Innovation Takes Off

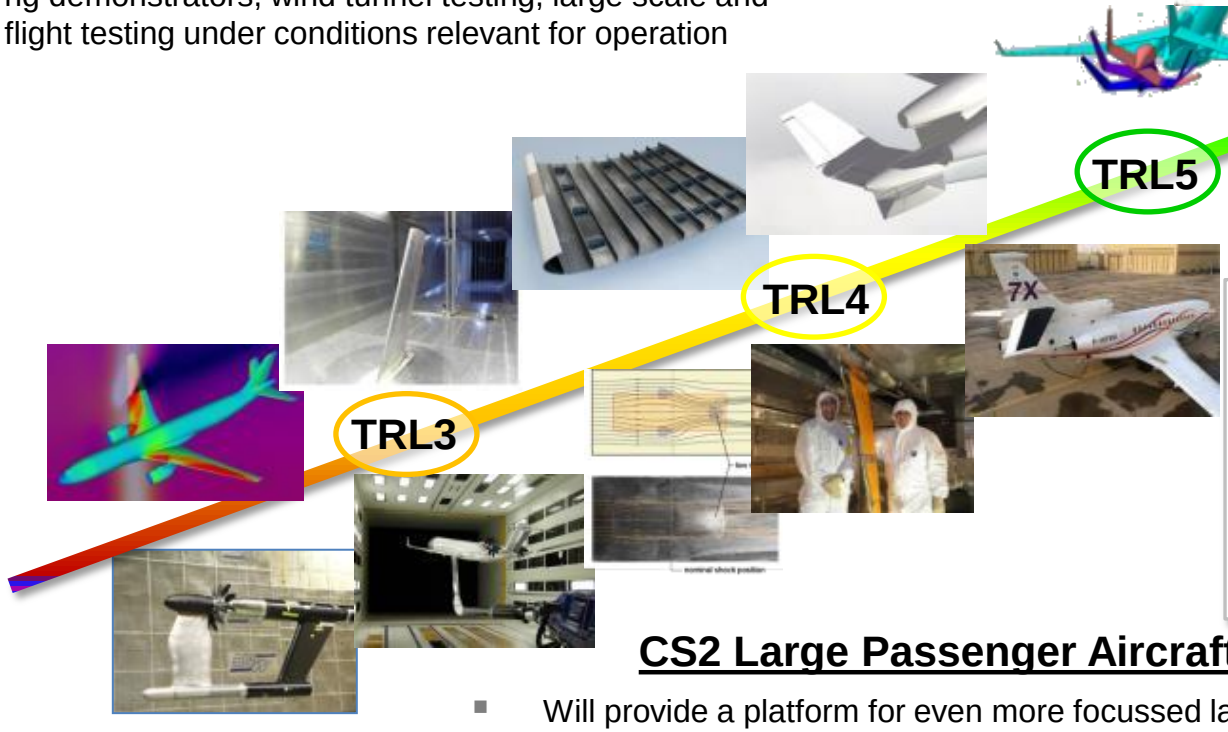
www.cleansky.eu

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

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

Contribute to TRL - Scale

1	2	3	4	5	6

Clean Sky

Setup and Implementation

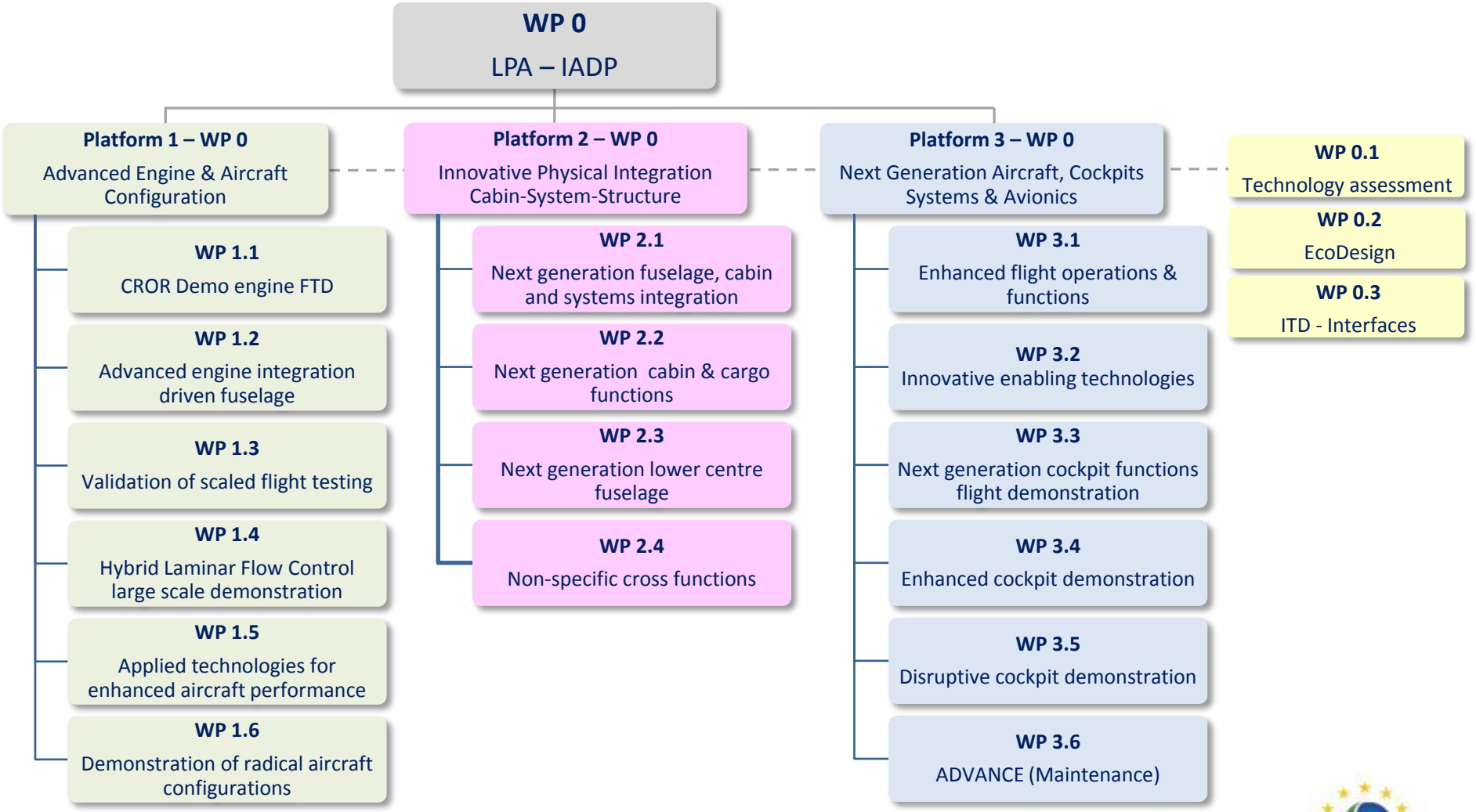
„Mature and validate disruptive technologies for next generation Large Passenger Aircraft through large scale integrated demonstration“

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 Work Breakdown Structure



Overview of the LPA-CfP04 topics

	Identification Code	Title	Type of Action	Value (Funding in M€)	Topic Leader
Platform 1	JTI-CS2-2016-CFP04-LPA-01-18	New Acoustic Signal Processing Methods	RIA	0,350	Airbus
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	JTI-CS2-2016-CFP04-LPA-01-28	Divergent Aircraft Configurations	RIA	1,500	Airbus (DLR / Onera)
Platform 2	JTI-CS2-2016-CFP04-LPA-02-15	Development of a Multi-scale method to predict large aircraft component failure taking into consideration Manufacturing Uncertainties for Predictive Virtual Simulations	RIA	0,800	Airbus
Platform 3	JTI-CS2-2016-CFP04-LPA-03-08	Active Cockpit Simulator/Ground Station Facility and Test Environment enhancement	IA	1,500	Airbus
	JTI-CS2-2016-CFP04-				

13 topics / 10,6M€

Clean Sky JOINT UNDERTAKING

Overview of the LPA-CfP04 topics

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JTI-CS2-2016-CFP04-				

Platform 1

Platform 2

Platform 3

Important for Partner-Applicants to note:

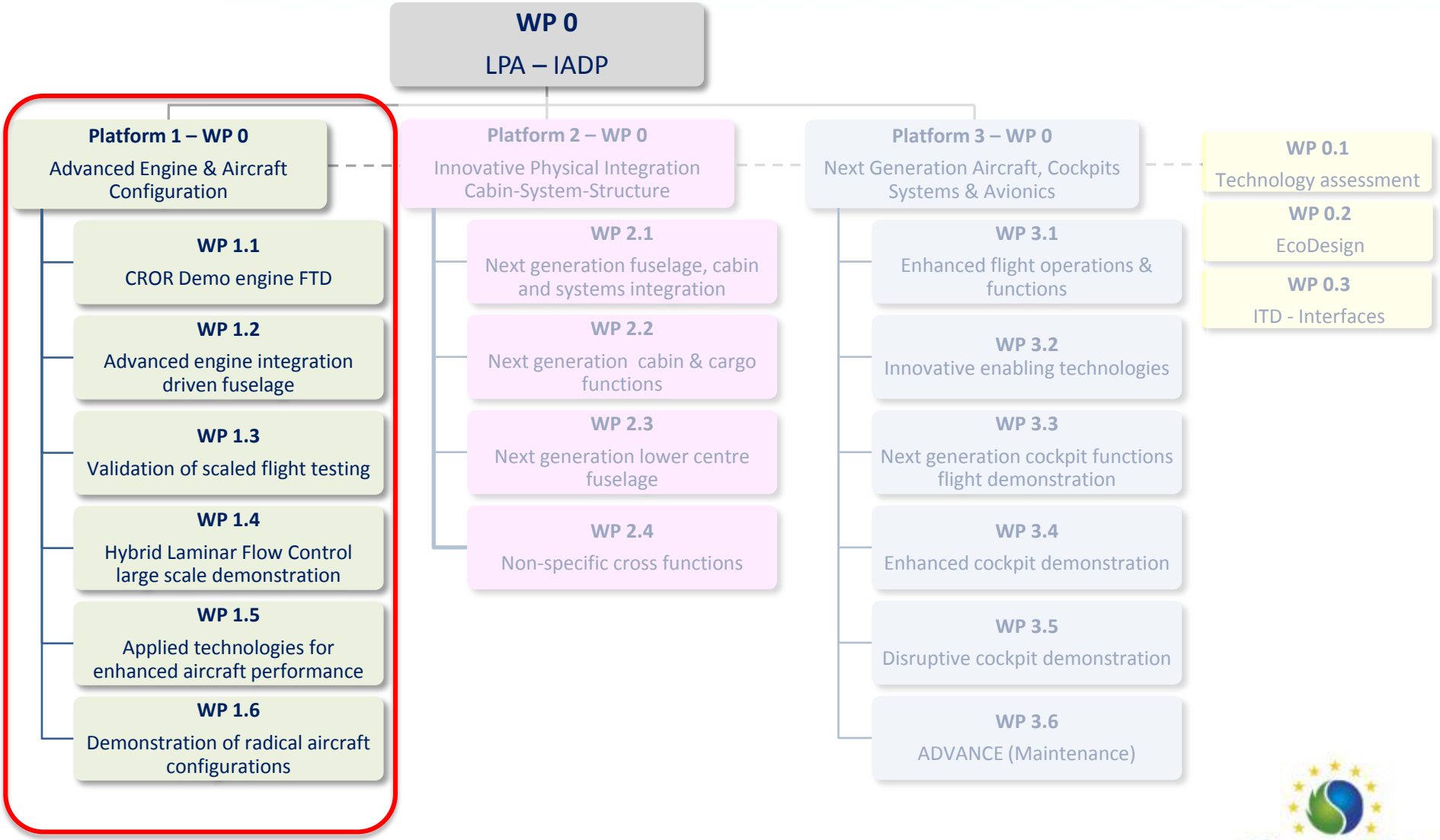
Cooperation between the GAP Partners and LPA members acting in the „hosting“ work packages shall be done by means of an Implementation Agreement (IA) for all CfP#04 topics.

The IA shall be used as published with the CfP#04 Call documents.

13 topics / 10,6M€

Clean Sky JOINT UNDERTAKING

LPA-IADP WBS – “Platform 1”



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 CROR demo engine FTD

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

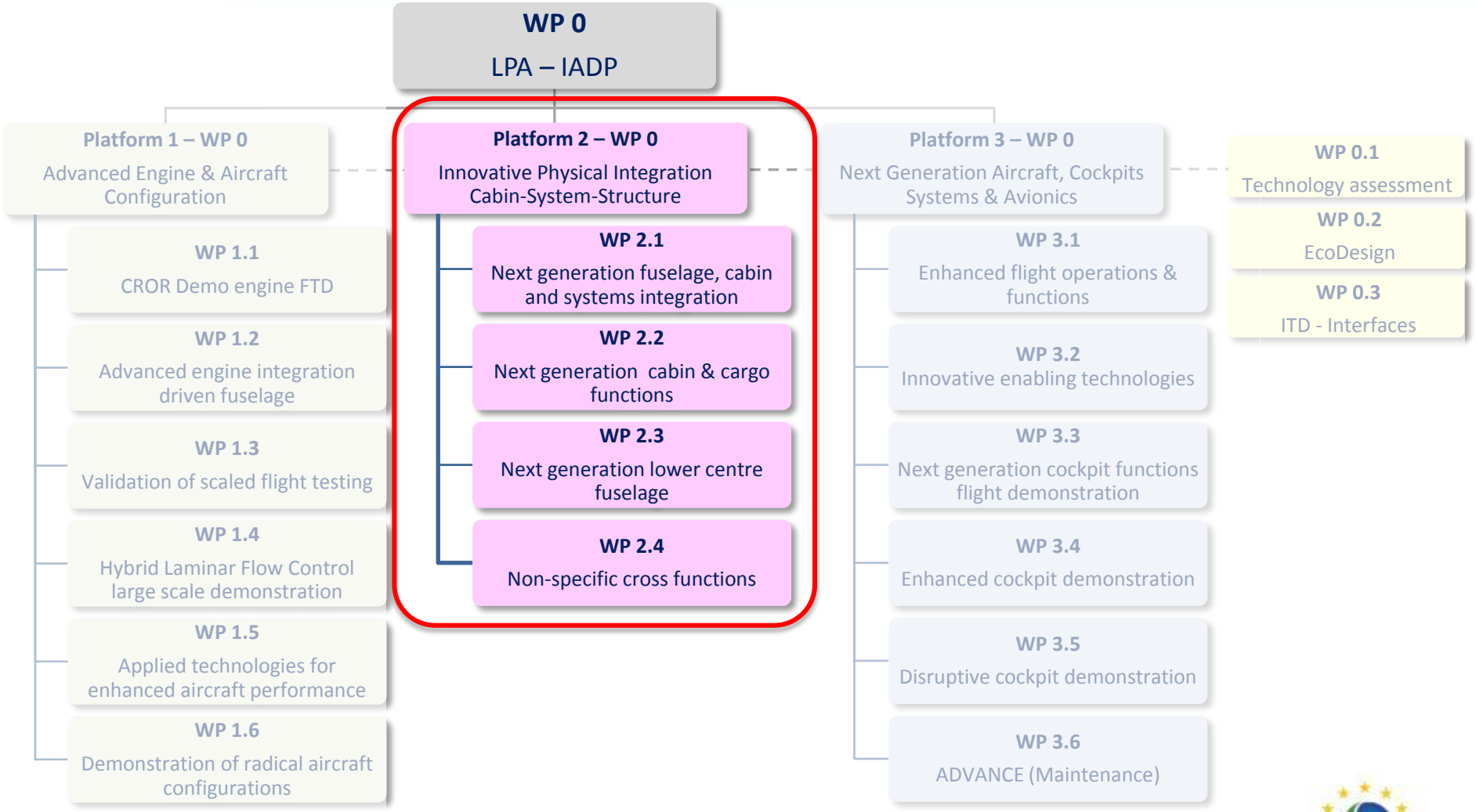
WP 1.5 Applied technologies for enhanced aircraft performance

WP 1.6 Demonstration of radical aircraft configurations

Estimated Volume of Activities ~560M€

Clean Sky JOINT UNDERTAKING

LPA-IADP WBS – “Platform 2”

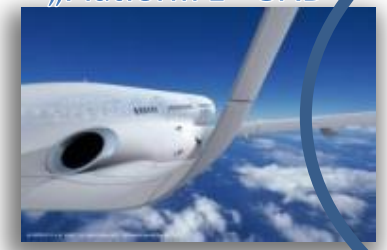


LPA-IADP WBS – “Platform 2”

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-Structure

„Platform 3 - OSD“

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

TRL 4-6
Aircraft Level

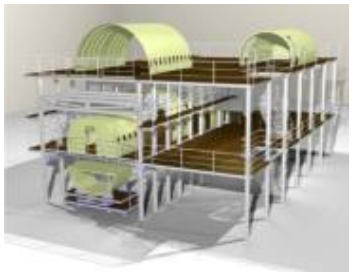
Platform 2 Innovative Physical Integration Cabin-System-Structure

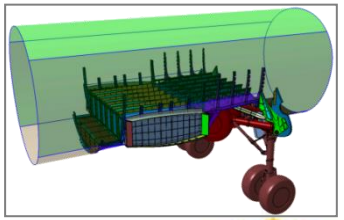
WP 2.1 Next generation fuselage, cabin and systems integration

WP 2.2 Next generation cabin & cargo functions

WP 2.3 Next generation lower centre fuselage

WP 2.4 Non-specific cross function

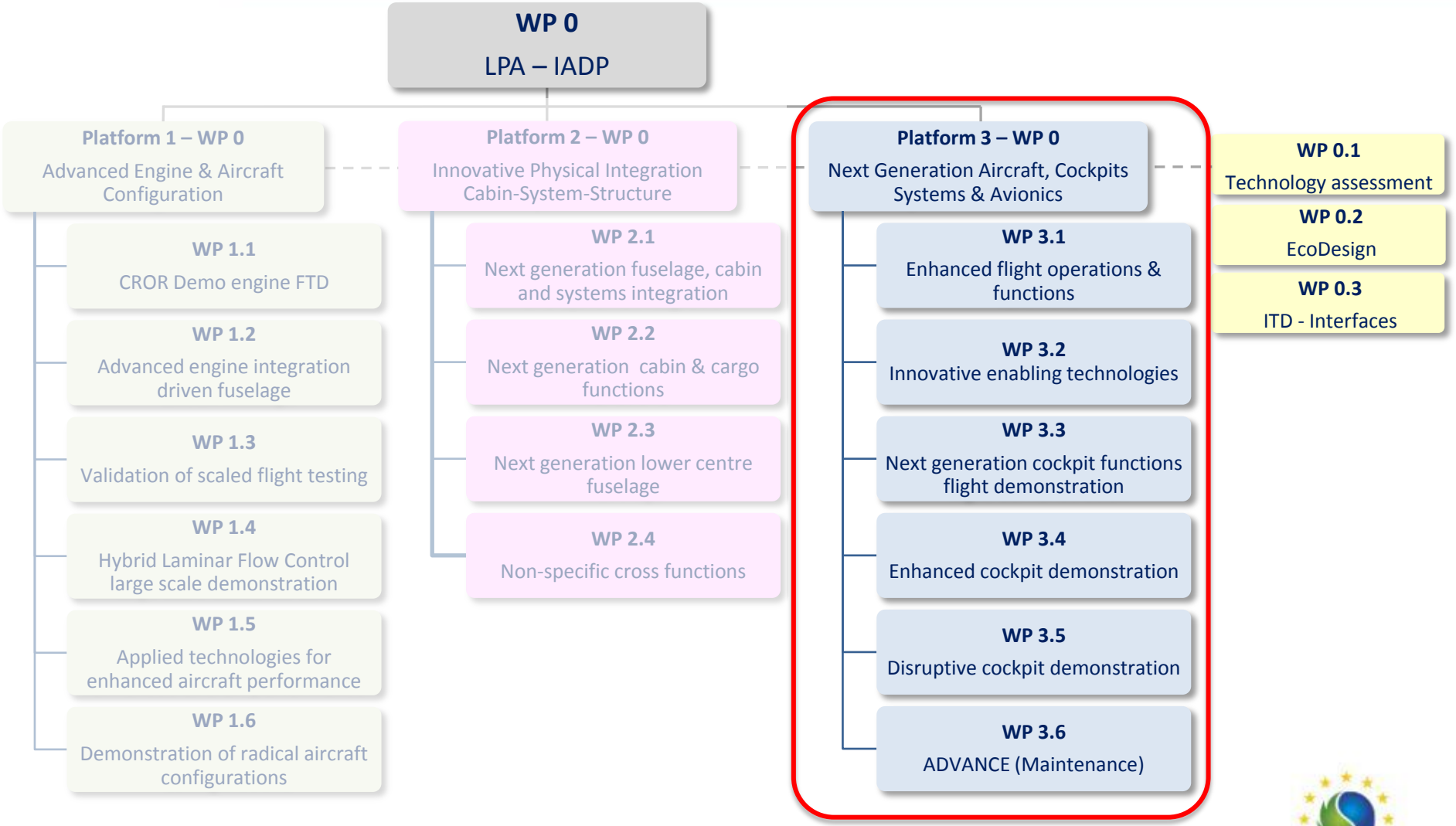




Estimated Volume of Activities ~290M€

Clean Sky
JOINT UNDERTAKING

LPA-IADP WBS – “Platform 3”



Setup and Implementation LPA Platform 3

Airbus with Thales, Liebherr, SAFRAN and Partners

TRL 4-6
Aircraft Level

Large Passenger Aircraft Platform – integration topics

„Platform 1 - OAD“

Advanced Engine and Aircraft Configurations

„Platform 2 - OPD“

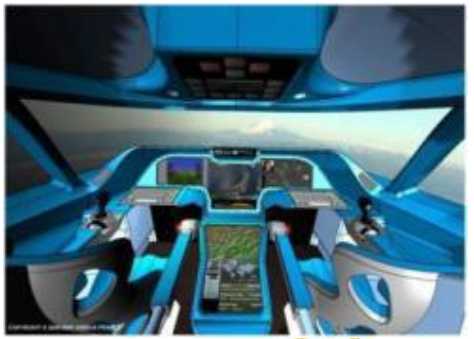
Innovative Physical Integration Cabin-System-Structure

„Platform 3 - OSD“

Next Gen. A/C Systems, Cockpit & Avionics

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

- **WP 3.1** Enhanced flight operations and functions
- **WP 3.2** Innovative enabling technologies
- **WP 3.3** Next generation cockpit functions flight demonstration
- **WP 3.4** Enhanced cockpit demonstrator
- **WP 3.5** Disruptive cockpit demonstration
- **WP 3.6** Maintenance



Cockpit of the future (Fenics)

Estimated Volume of Activities ~222M€

Clean Sky
JOINT UNDERTAKING

Overview of the LPA-CfP04 topics

Platform 1

11 Topics

Total funding 8,3 M€

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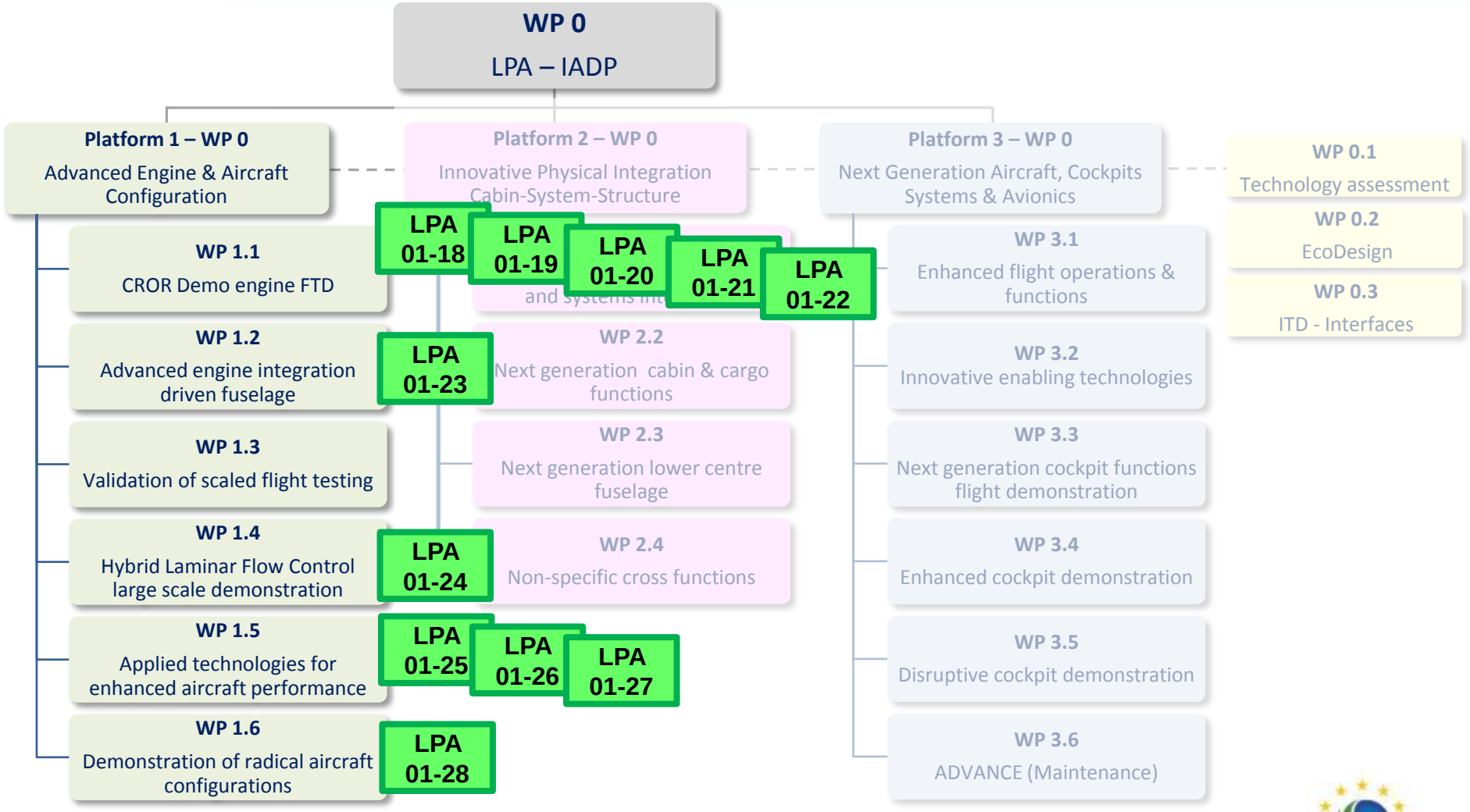
JTI-CS2-2016-CFP04-			13 topics / 10,6M€	

Platform 2

Platform 3

Assignment of the LPA-CfP03 topics to the LPA-IADP WBS



JTI-CS2-2016-CFP04-LPA-01-18

New acoustic signal processing methods

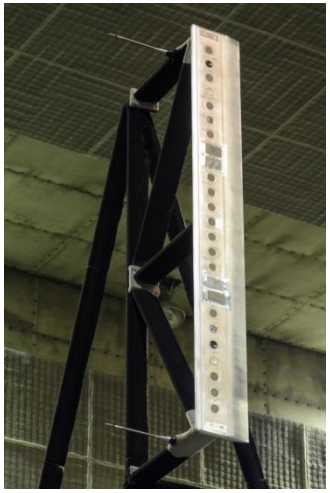
Innovation Takes Off

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

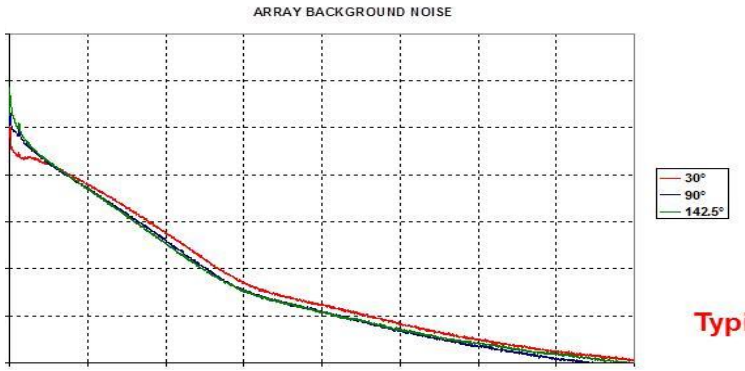
Clean Sky 2

CFP04-LPA-1-18 ‘New Acoustic Signal Processing Methods’

- **<u>WP1.1.1</u>.: JTI-CS2-2016-CFP04-LPA-1-18 (RIA actitivity)**
- **Title:** *New Acoustic Signal Processing Methods*
- **Objective:** The task aims at developing new signal processing methods able to separate accurately different acoustic sources and to de-noise acoustic signals (tonal and broadband contribution from an acoustic source) from turbulent boundary layer and background noise. Three main approaches shall be explored:
  - Aeroacoustics sources separation by the use of spatial filtering
  - De-noising by the use of cyclo-stationarity
  - Acoustic sources localization by the use of Bayesian approach.
- **Volume:**350k€ funding



Example of typical in-flow microphones rail in wind-tunnel



Typical background noise shape in the flow on microphones

Typical TBL @ M0.2

CFP04-LPA-1-18 ‘New Acoustic Signal Processing Methods’

- **Schedule:** 36 months duration

	2017		2018				2019				2020	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
WP1.1						▲				▲		
WP1.2						▲						▲
WP2.1					▲							
WP2.2								▲				
WP3.1								▲				
WP3.2												▲

- **Targeted applicant**: partner with high skills in signal processing (cyclo-stationarity, acoustic sources separation, stochastic modelling, sparse and Bayesian approaches) and mathematics. Strong academic and research background with experience shall be demonstrated (e.g. publications….).
- **Required skills**:
  - Signal processing
  - Cyclo-stationarity
  - Acoustic sources separation by the use of spatial filtering effect and source localization
  - Stochastic modelling, Gaussian process, sparse and Bayesian approaches.
- **Capabilities**: Anechoic room and microphones.
- **Topic manager**: Airbus

JTI-CS2-2016-CFP04-LPA-01-19

High fidelity Large Eddy Simulation using reduced model for engine broadband noise prediction

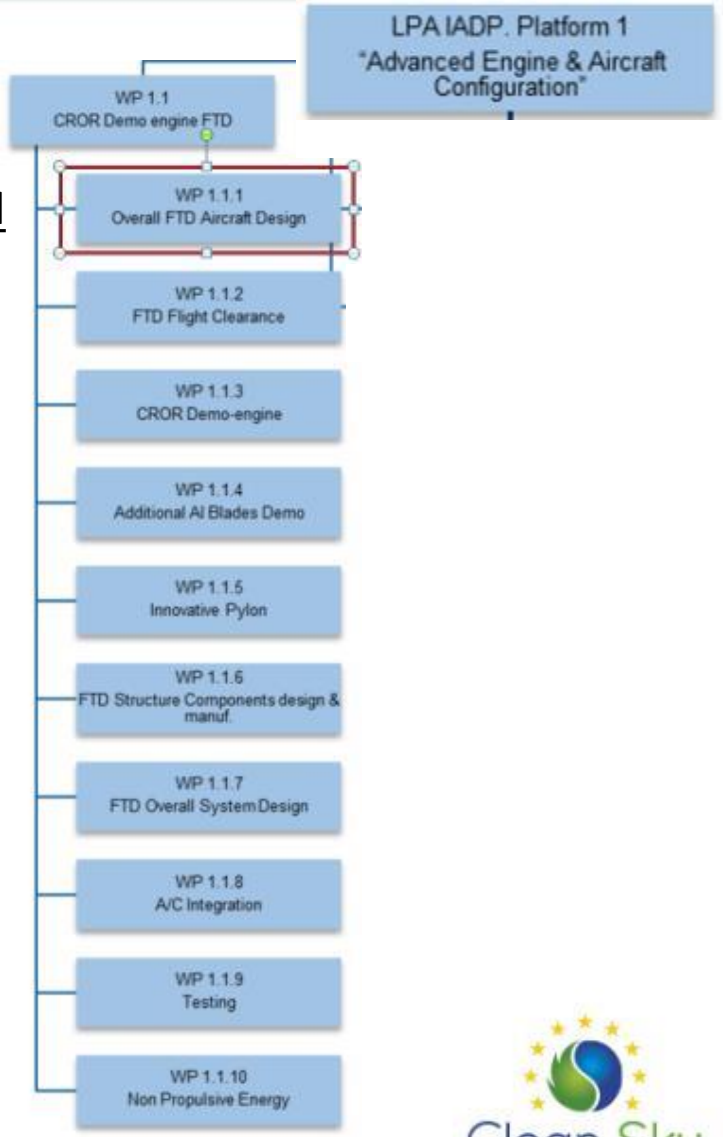
Innovation Takes Off

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

Clean Sky 2

CFP04-LPA-01-19 ´High fidelity LES using reduced model for engine broadband noise predicition´

- **JTI-CS2-2016-CFP04-LPA-01-19**
- **Type of action:** RIA
- **Title:** High fidelity Large Eddy Simulation using reduced model for engine broadband noise prediction
- **Objective:** Improvement of Open Rotor and UHBR Fan broadband noise prediction by using high fidelity reduced model Large Eddy Simulation methods with focus on turbulence in boundary layers and wakes, by direct noise computation or by providing enhanced inputs to broadband noise semi-empirical models
- **Volume:** 600 k€ funding
- **Duration**: 36 months
- **Start:** Q2 2017

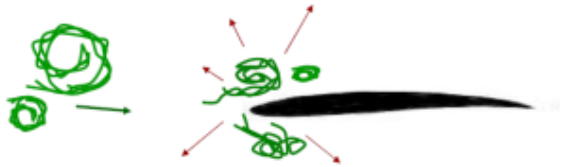


JTI-CS2-2016-CFP04-LPA-01-19

- **Schedule**:

		Year 1				Year 2				Year 3			
	Task	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
WP1	**Trailing Edge noise**												
WP1.1	Static airfoil simulations												
WP1.2	3D rotating blade simulations												
WP1.3	Improved models for wall turbulence statistics												
WP2	**Wake Interaction noise**												
WP2.1	Method dev. & valid. on a simplified conf.												
WP2.2	Application on a realistic case for noise prediction												
WP3	**Total noise prediction**												
WP3.1	Complete CROR noise simulation												
WP3.2	Complete fan stage noise simulation												

Trailing edge noise



Wake interaction noise

JTI-CS2-2016-CFP04-LPA-01-19

- **Targeted applicant**: Due to the nature of the topic and respectively to the expected contribution, partners are expected to have a strong research background
- **Requested skills:**
  - Advanced high fidelity computational unsteady aerodynamic modelling (Large Eddy Simulation, LES)
  - Capability to produce 2.5D profile non-rotating LES computations with a reasonable turnaround time by using highly scalable code
  - Capability to produce 3D rotating computations using reduced order model LES techniques (e.g. phase lagged approach), while not significantly compromising result accuracy, capability to compute far field noise from a LES computation of rotating bodies
  - Flow turbulence and aeroacoustics physical analysis, a background on broadband noise analytical modelling is a plus.

- The CFD code used for 3D rotating reduced model LES shall be made available to the topic manager during the whole duration of CS2 (LPA) project since it shall be used to predict broadband noise of CROR / UHBR demonstrators

- Successful applicant is expected to sign an implementation agreement

JTI-CS2-2016-CFP04-LPA-01-20

Hybrid machining for high removal rates and surface integrity applicable for safety critical super alloy parts

Innovation Takes Off

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

Clean Sky 2

CFP04-LPA-1-20 ´Hybrid machining for high removal rates…´

III. Hybrid Machining for High Removal Rates and Surface Integrity Applicable for Safety Critical Super Alloy Parts

Type of action (RIA or IA)	IA		
Programme Area	LPA, Platform 1, WP 1.1.3		
Joint Technical Programme (JTP) Ref.	JTP V5		
Indicative Funding Topic Value (in k€)	700 k€	**Type of agreement**	Implementation Agreement
Duration of the action (in Months)	36 months	**Indicative Start Date**[4]	Q2 2017

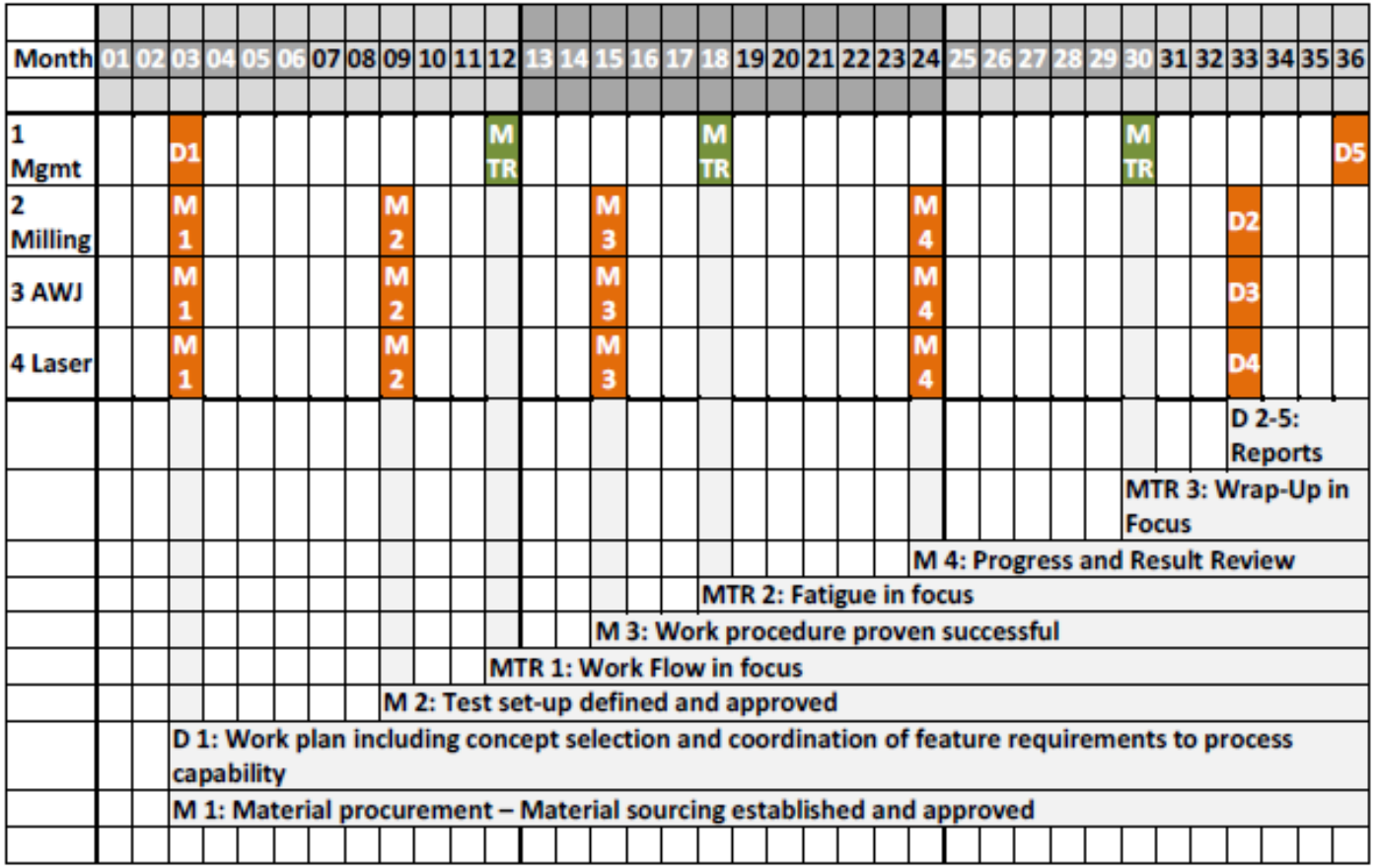
Identification	**Title**
JTI-CS2-2016-CFP04-LPA-01-20	Hybrid machining for high removal rates and surface integrity applicable for safety critical super alloy parts
Short description (3 lines)	
Development of hybrid machining processes (machining combined with other processes such as laser and abrasive water jet) applicable to super alloys. The objective is increased removal rates compared to conventional machining with focus on surface integrity for safety critical parts.	

CFP04-LPA-1-20 ´Hybrid machining for high removal rates…´

- **Development of hybrid machining processes**
- **Conventional machining combined with other processes such as:**
  - Laser
  - Abrasive water jet
- **Applicable to Ni-base super alloys**
- **The objective is increased removal rates compared to conventional machining with focus on surface integrity for safety critical parts.**
- **Applicable to complex load bearing parts such as rotating frames and turbine rear frames**
  - Ring – vane/strut – ring
  - Internal and external machining

CFP04-LPA-1-20 ´Hybrid machining for high removal rates…´

Schedule



CFP04-LPA-1-20 ´Hybrid machining for high removal rates…´

Special skills, capabilities, certifications etc. expected avaiable to the applicant(s)

- **Machine Equipment**
  The consortium should have work-shop facilities in line with the proposed deliverables (preferably) or, if such equipment is not available, existing relations with institutions or companies that accommodate such equipment and the possible need for equipment intended for advanced coolant applications.
  - Ultra-Sonic (milling capability for ceramic milling)
  - Laser (fiber laser capability and controllable for parameter optimization)
  - Abrasive Water Jet (multi axis tilt head)
  - Heat treatment (including induction heating for milling experiments)
  - Process monitoring equipment will be considered advantageous.

- **Research Tools**
  Sensor and data acquisition equipment must be available in line with the proposed deliverables and in particular for the physical units “Force [N]”, “Power [W]” and “Temperature [°C]”.
  Software for DoE (Design of Experiments) and MVA (Multi Variant Analysis).
  Experience from relevant metallurgical simulation and manufacturing process simulation is required.

- **Materials Laboratory**
  Facilities to perform material analysis and be able to prepare and mount metallographic samples in order to perform investigations of machined surfaces (cross section and top surface).
  Such investigations are expected to comprise,
  - Optical microscopy & scanning electron microscopy: FE-SEM; EBSD; EDS
  - Surface analysis capability: Hardness; Surface roughness.
  - Residual stress measurements: XRD; Drilling.
  - Fatigue test capability
  - Chemical analysis tools: GD-OES; EDS; XRF; Microsond

  The partner/consortium should preferably hold an “ISO/IEC 17025” certificate.
  An Implementation agreement will be proposed to manage the IPR and the relation between the Topic manager and the Applicant(s).

Clean Sky
JOINT UNDERTAKING

JTI-CS2-2016-CFP04-LPA-01-21

Design for high AN^2 (disc and blade attached)

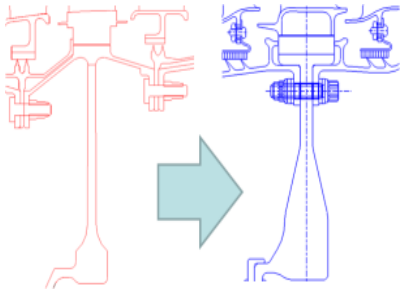
Innovation Takes Off

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

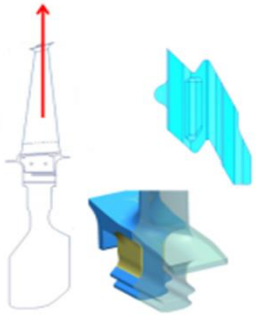
Clean Sky 2

CFP04-LPA-1-21 ´Design for high AN²´

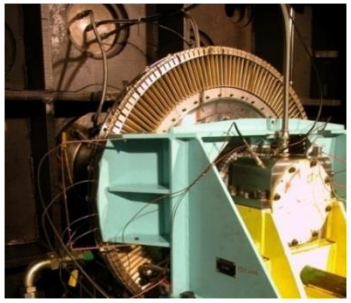
- **JTI-CS2-2015-CFP04-LPA-1-10**
- **Title:** *Design for High AN2* (Disk & Blade attachment)*
- **Company managing the topic:** Avio Aero
- **Objective:** develop ad-hoc and innovative methods and criteria in order to face the challenge to correctly design and predict stress level in innovative High Speed Power Turbine for next generation geared engine application. Those methods will be validated through an extensive test campaign (both component test & spin rig test).
- **Volume:** 500 k€ funding



Disk profile evolution for High AN2



Blade attachment optimization



Spin rig tests

Platform 1 – WP0
Advanced Engine and Aircraft Configuration

WP1.1
CROR engine demonstrator FTD

WP1.1.3
CROR demo engine

WP1.1.3.4
Component maturation plan

WP1.1.3.4.1
Power Turbine

WP1.1.3.4.1.1
Product Turbine TDP

WP1.1.3.4.1.2
Product Turbine Technology Development

*AN2: turbine blade stress is proportional to AN2. AN2 is the product of the annulus mid-area along the rotor blade (A) and the blade rotational speed squared (N2).

CFP04-LPA-1-21 ´Design for high AN²´

- **Schedule**

Duration	27 months
Start	Q2/2017

	T0+1	T0+2	T0+3	T0+4	T0+5	T0+6	T0+7	T0+8	T0+9	T0+10	T0+11	T0+12	T0+13	T0+14	T0+15	T0+16	T0+17	T0+18	T0+19	T0+20	T0+21	T0+22	T0+23	T0+24	T0+25	T0+26	T0+27
WP1: Method Development Optimization					D1.1 M1.1																						
WP2: TA design & Delivery										D1.2				M1.2	D1.4												
WP3: Rig design / Adaptation														M1.3	D1.3 D1.5												
WP4: Test & Data Appraisal & Method validation														M1.5							M1.4						M1.6 M1.7 D1.6 D1.7
WP5: CFP management																											D1.8

- **Targeted applicant**: partner with extensive research background and experience in developing methods and tools for robust structural optimization. Strong legacy in design and validation test campaigns execution is also an asset requested
- **Required skills**:
  - Strong background in methods and tools development for industrial applications
  - Extensive and proven experience in design and test validation of aerospace products (in particular Pressure Turbine sub-modules)
  - Access to the test facilities
  - Experience in aerospace R&T and R&D programs
  - Management of building phase

JTI-CS2-2016-CFP04-LPA-01-22

RIGHT
(Rig instrumentation, test support & data analysis for high speed power turbine)

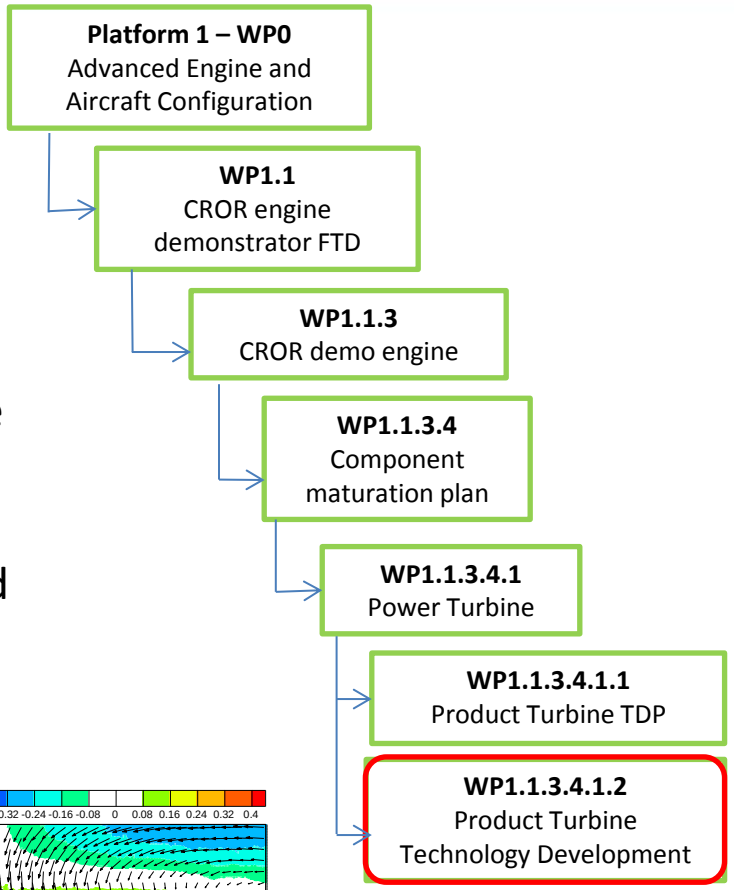
Innovation Takes Off

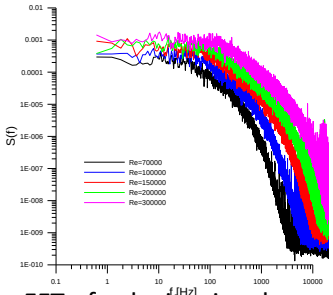
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

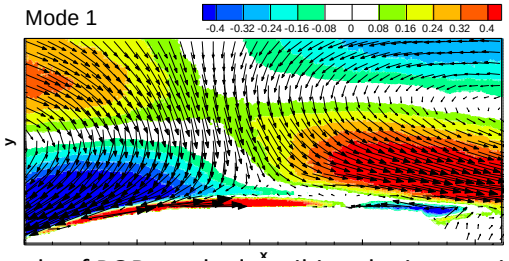
CFP04-LPA-1-22 'RIGHT'

- **JTI-CS2-2016-CFP04-LPA-1-22**
- **Title:** RIGHT (*Rig instrumentation, test support & data analysis of High Speed Power Turbine)*
- **Company managing the topic:** Avio Aero
- **Objective:** developing experimental features able to properly characterize the flow field and the aerodynamic efficiency of a high speed turbine module to validate specific technologies. The acquired data should be able to characterize the unsteady 3-dimensional flow field and the application of advanced post-processing routines (i.e. POD, FFT) will have to be applied in order to simplify the problem, thus further explaining the loss production mechanisms.
- **Volume:** 350 k€ funding





FFT of velocity signals



Example of POD mode describing the interaction between rotor wakes with stator blade boundary layer

CFP04-LPA-1-22 'RIGHT'

- **Schedule**

Duration	24 months
Start	Q2/2017

	T0 +1	T0 +2	T0 +3	T0 +4	T0 +5	T0 +6	T0 +7	T0 +8	T0 +9	T0 +10	T0 +11	T0 +12	T0 +13	T0 +14	T0 +15	T0 +16	T0 +17	T0 +18	T0 +19	T0 +20	T0 +21	T0 +22	T0 +23	T0 +24
Start of the project - KOM																								
Instrumentation definition				M1	D1																			
Instrumentation design									M2	D2														
Instrumentation readyness														M3	D3									
Test support																			M4					
Data reduction																						M5	D4	

- **Targeted applicant**: partner with research background and experience in developing methods and tools for data acquisition and post processing.
- **Required skills**:
  - Expertize in acquisition, post-processing and data analysis in rotating machinery for analysis of the three-dimensional time-varying flow field of multi stage machines;
  - Expertize in CFD calculations on rotating rig and CFD support to experimental testing;
  - Experience in unsteady analysis of stator-rotor interactions, turbulence and transition modeling in steady and unsteady turbomachinery flows with focus on low Reynolds and high Mach number flows (shock wave – boundary layer interaction);
  - It is also requested that Applicant(s) gives a continuous on-site support to test rig activities as well as the concurrence with topic manager for rig instrumentations.

JTI-CS2-2016-CFP04-LPA-01-23

Low cost, smart tooling for composites

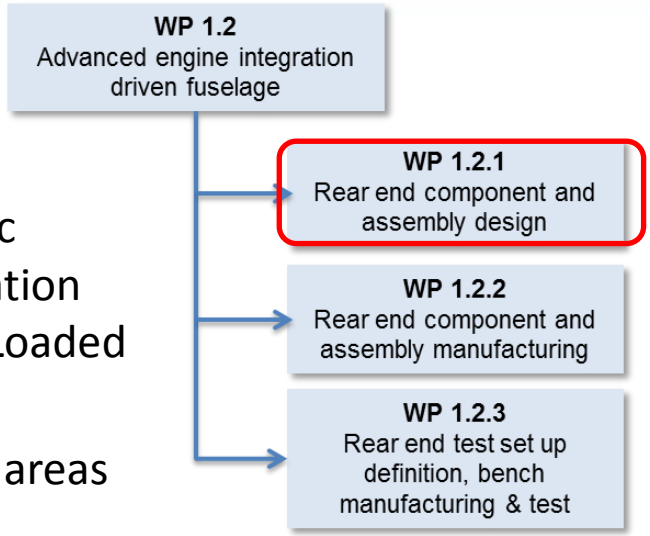
Innovation Takes Off

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

Clean Sky 2

CFP04-LPA-1-23 ´Low cost, smart tooling for composites´

- **JTI-CS2-2015-CFP04-LPA-1-23**
- **Title:** *Low cost, smart tooling for composites.*
- **Objective:** The objective of this topic is the design and manufacturing a smart tooling for an advanced automatic composites manufacturing process for the engine integration on fuselage structure of Large Passenger Aircraft. (High Loaded Frames)
- Focus to achieve improvements in particular in following areas
  - Low cost / natural materials
  - Eco-Design
  - Energy Savings
  - Production Time saving, simplified manufacturing process
- **Volume:** 0.5 M€ funding



CFP04-LPA-1-23 ´Low cost, smart tooling for composites´

Schedule

- **Start Q2/2017**
- **Duration : 18 months**

Tasks		
Ref. No.	***Title – Description***	***Due Date***
T0	Concurrence engineering and design composites development for tooling definition	***T0+6***
T1	Manufacture the Press-forming tooling.	***T0+10***
T2	Manufacture the Curing tooling for new configurations and composite materials.	***T0+16***
T3	Validation of the tooling as agreed with the TM (dimensional, air tightness…)	***T0+18***
T4	Delivery of the manufacturing tooling to the TM facilities and support set up	***T0+18***

Deliverables			
Ref. No.	***Title - Description***	***Type***	***Due Date***
D01	Device and tooling specification	R	T0+5
D02	Technical specification press-forming tooling.	R	T0+13
D03	Curing tooling manufactured	H	T0+18
D04	Final report: Conclusions and lesson learned	R	T0+18

Milestones (when appropriate)			
Ref. No.	***Title - Description***	***Type***	***Due Date***
M01	Device and tooling specification	R	T0+5
M02	Device and press-forming tooling manufactured	R	T0+13
M03	Curing tooling manufactured	R	T0+18
M04	Tooling reception	R	T0+18

JTI-CS2-2016-CFP04-LPA-01-24

High trough-put micro drilling (HTMD) system

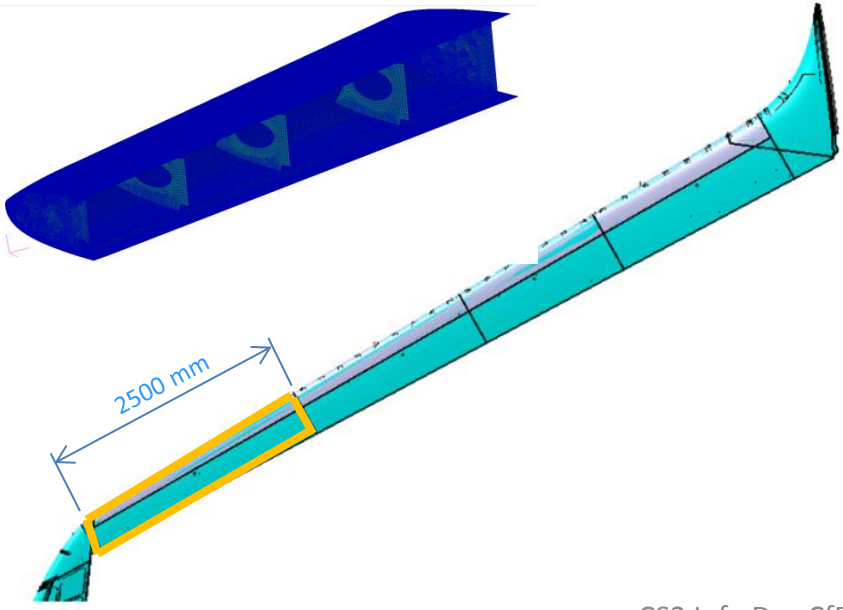
Innovation Takes Off

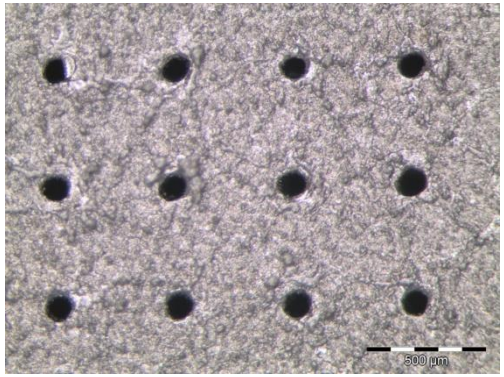
http://www.cleansky.eu/content/homepage/about-clean-sky-2

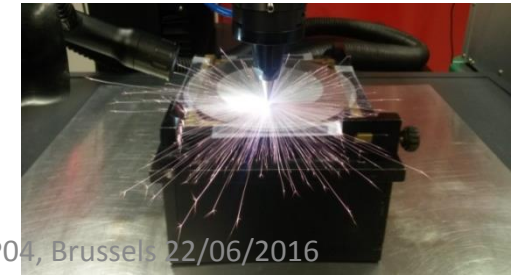
Clean Sky 2

CfP04-LPA-01-24 ‘HTMD’

- **JTI-CS2-2016-CFP04-LPA-01-24**
- **Title:** *High throughput micro drilling (HTMD) system*
- **Objective:** Design and manufacturing of a prototype machine to micro-perforate holes between 50 and 100 micrometer in diameter in large Titanium sheets with high throughput and rate (up to 300 hole/second) to be tested on an industrial environment (up to TRL-6).
- **Volume:** 2000 k€ funding







WP 1.4
Hybrid Laminar Flow Control (HLFC) large scale demonstration

- **WP 1.4.1** Advanced HLFC design
- **WP 1.4.2** Certification rules for operational HLFC systems
- **WP 1.4.3** HLFC Fin long term operation
- **WP 1.4.4** HLFC wing components demonstrators
- **WP 1.4.5** HLFC large scale wing pre-flight demonstrator
- **WP 1.4.6** Demonstration of NLF applied on airframe

CfP04-LPA-01-24 ‘HTMD’

Schedule (Start: 02/2017)

		2017									2018												2019												2020		
		Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1		
Tasks		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Task 1	Process selection and optimization.																																				
Task 2	HTMD system design																																				
Task 3	HTMD system manufacturing, assembly and testing, including the commissioning and acceptance tests.																																				
Task 4	HTMD system optimization (operational testing).																																				

Deliverables		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
D1	Specification of the manufacturing process parameters																																				
D2	Samples produced with the selected manufacturing processes																																				
D3	Preliminary design of the production system																																				
D4	Matrix of fulfilment of the specifications (v1)																																				
D5	Preliminary design of the production system																																				
D6	Matrix of fulfilment of the specifications (v2)																																				
D7	Manufacturing system ready for panel production																																				
D8	Micro-drilled panels ready for inspection and testing (validation of the prototype machine)																																				
D9	Performance problems and opportunities for design future microdrilling machines.																																				

Milestones		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
M1	Process validation																																				
M2	Preliminary design review (PDR)																																				
M3	Detailed design review (DDR)																																				
M4	Manufacturing system acceptance																																				
M5	Micro-drilled panels for demonstrator available																																				

CfP04-LPA-01-24 'HTMD'

Targeted applicant:,

- It is expected that the applicant has previous experience and background in:
  - Laser micro-drilling and other alternative techniques (micro EDM, pulsed micro ECM, e-beam micro drilling…..).
  - Design, manufacturing, assembly and commissioning of innovative production systems.
  - Monitoring and control of manufacturing processes.

Required skills:

- A thorough understanding and demonstrated competence in the area of high energy density manufacturing processes.
- Previous experience in high throughput micro-drilling of titanium panels.
- A demonstrated ability to protect new intellectual property and avoid conflict with existing IPR.
- A demonstrated ability to industrialize developed technology related with surface manufacturing processes.
- A demonstrated experience from collaborative R&D of manufacturing technologies within European projects.

JTI-CS2-2016-CFP04-LPA-01-25

Smart amplifier and a control box for fluidic actuators

Innovation Takes Off

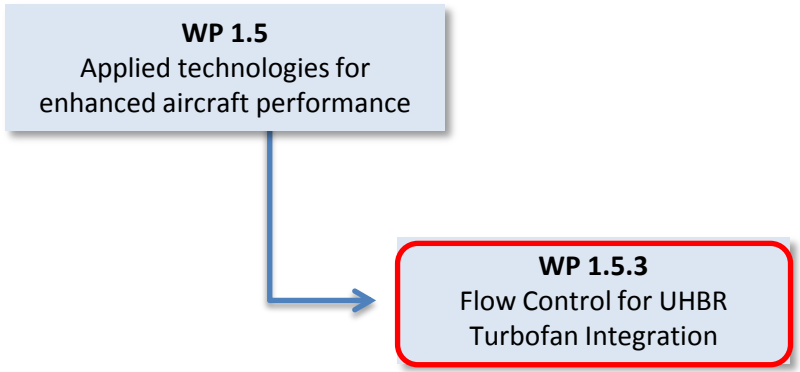
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

CFP04-LPA-01-25 (updated 01-08)

- **JTI-CS2-2015-CFP02-LPA-01-25**
- **Title:** Drive and control system for piezoelectric AFC* actuators
- **Objective:**
  - Development and design of a drive and control system concept for piezoelectric-driven AFC actuators
  - Development of a detailed design adapted to the space allocation for the installation close to a synthetic jet actuator system or a pulsed jet actuator system in the pylon wing junction region
  - Development of a demonstrator (hardware) and manufacturing for a Ground Based Demonstrator (GBD)

- **Start:** Q2/2017
- **Duration:** 24 months
- **Type of action:** RIA
- **Volume:** 500 k€ funding



*AFC =Active Flow Control

CFP04-LPA-01-25 (updated 01-08)

Required skills by the applicant:

- Profound knowledge in the development and realization of drive and control systems
- The drive and control system shall be capable to drive resonant piezoelectric AFC actuator in a performance range that is relevant for Ground Test and Flight Test application
  - Capacitance of the piezoelectric transducer up to 200nF per single element
  - Driving Voltage up to 200Vpp; preferably unipolar driven, optionally bipolar driven
  - Driving Frequency up to 4kHz (depending on the application and the actuation conept)
  - Minimal space allocation – an integrated solution should be preferred
  - Minimal energy consumption or a concept to minimize the energy consumption of the system
- The actuators shall also be driven in a dusty or humid environment, the drive and control box shall be secured against these environmental impacts.

JTI-CS2-2016-CFP04-LPA-01-26

Design build and test innovative actuation concepts for separation flow control

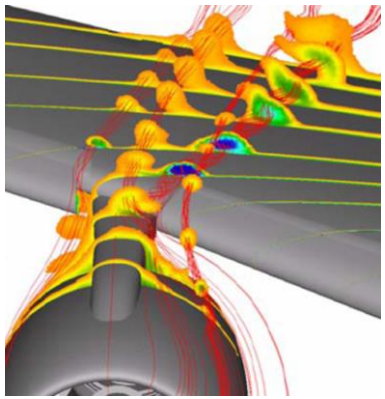
Innovation Takes Off

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

Clean Sky 2

CFP04-LPA-01-26 Design, Build and Test Innovative Actuation Concepts for Separation Flow Control

- **JTI-CS2-2016-CFP04-LPA-01-26**
- **Title:** Design, Build and Test Innovative Actuation Concepts for Separation Flow Control
- **Objective:** To use preferably existing flow control concepts in combination with each other and/or in innovative arrangements to achieve better aerodynamic effectiveness or system efficiency.
- **Approach:** concept design with numerical and experimental studies on a generic configuration. Concept validation of most promising concept with large WT model representative for the engine/pylon configuration at realistic Reynolds number
- **Type of action:** RIA
- **Volume:** 700 k€ funding

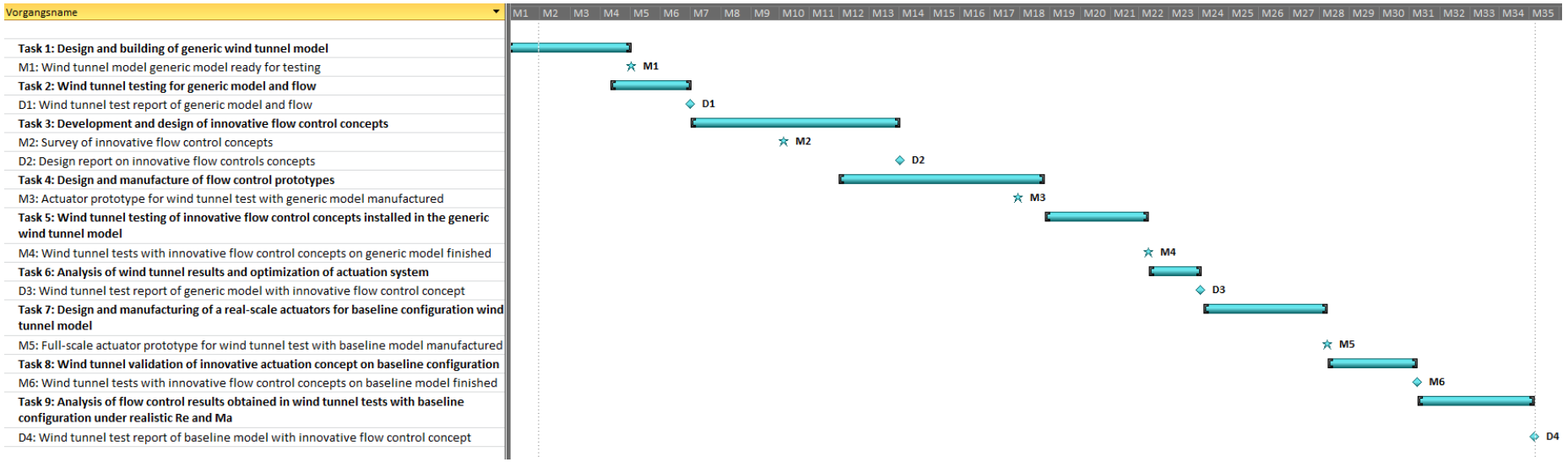


WP 1.5
Applied technologies for enhanced aircraft performance

- **WP 1.5.1** Knowledge Base UHBR Turbofan/Wing Integration on LPA
- **WP 1.5.2** Powerplant 2025 Integration Technologies
- **WP 1.5.3** Flow Control for UHBR Turbofan Integration
- **WP 1.5.4** Technologies for Loads and Noise Control

CFP04-LPA-01-26 Design, Build and Test Innovative Actuation Concepts for Separation Flow Control

- **Schedule**



- **Targeted applicant**: partner/consortium with suitable wind tunnel facility and wind tunnel models representative for the use case as well as with access to high performance computing resources required for design work
- **Required skills**:
  - Flow control actuator design
  - In wind tunnel model design, manufacturing and modification
  - In wind tunnel testing, flow visualisation, data measurements and post-processing/analysis
  - In preparing, conducting and post- processing high-fidelity numerical flow simulations (e.g. URANS)

JTI-CS2-2016-CFP04-LPA-01-27

Development of scaled models for synthetic jet actuators based on aerodynamic characterization in CFD, ground and wind tunnel testing

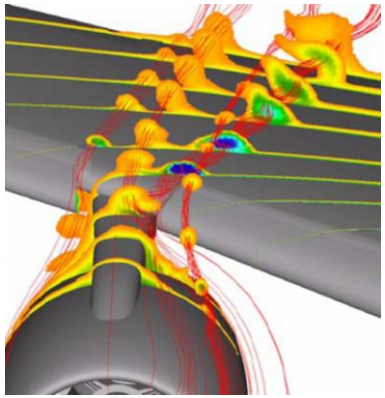
Innovation Takes Off

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

Clean Sky 2

CFP04-LPA-01-27 Development of scaled models for Synthetic Jet Actuators Testing

- **JTI-CS2-2016-CFP04-LPA-01-27** **Title:** Development of scaled models for Synthetic Jet Actuators based on Aerodynamic Characterization in CFD, Ground and Wind Tunnel Testing
- **Objective:** High fidelity numerical simulations will be used to characterize the synthetic jet actuators. The CFD data will be validated by ground tests (w/o cross flow) and wind tunnel tests (with cross flow). The results of the numerical simulations will be used to develop scaled models for performance estimation and calculation of geometrical design parameters of the actuators.
- **Type of action:** RIA
- **Volume:** 600 k€ funding



WP 1.5
Applied technologies for enhanced aircraft performance

- **WP 1.5.1** Knowledge Base UHBR Turbofan/Wing Integration on LPA
- **WP 1.5.2** Powerplant 2025 Integration Technologies
- **WP 1.5.3** Flow Control for UHBR Turbofan Integration
- **WP 1.5.4** Technologies for Loads and Noise Control

CFP04-LPA-01-27 Development of scaled models for Synthetic Jet Actuators Testing

- **Schedule**

Tasks		
Ref. No.	***Title – Description***	***Due Date***
T1	High fidelity numerical simulations of existing SJA prototype designs in quiescent air condition	M10
T2	Experimental testing of actuator prototypes in quiescent air condition.	M12
T3	Comparison of numerical and experimental results and modelling of the system.	M15
T4	High fidelity numerical simulations of existing SJA prototype designs in cross flow condition.	M18
T5	Experimental testing of actuator prototypes in cross flow conditions	M20
T6	Comparison of numerical and experimental results and modelling of the system.	M24
T7	Development of scale model for the synthetic jet actuators based on the validated CFD and test results for quiescent air (T3) and cross-flow condition (T6).	M30
T8	Verification of scale model in the design of a new SJA	M36

- **Targeted applicant**: partner/consortium with suitable wind tunnel facility and wind tunnel models representative for the use case as well as with access to high performance computing resources required for design work
- **Required skills**:
  - Profound knowledge in flow control actuator design for aircraft applications. The actuator design must be based on pulsed air blowing without net mass flux.
  - Expertise in the area of CFD, flow measurements and characterization of fluidic devices

JTI-CS2-2016-CFP04-LPA-01-28

Divergent aircraft configurations

Innovation Takes Off

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

Clean Sky 2

CfP04-LPA-01-28 'Divergent Aircraft Configurations'

- **Key info:**

Type of action (RIA or IA)	RIA		
Programme Area	LPA, Platform 1, WP1.6.1.4		
Joint Technical Programme (JTP) Ref.	JTP V5		
Indicative Funding Topic Value (in k€)	1 500 k€	**Type of agreement**	Implementation Agreement
Duration of the action (in Months)	30 months	**Indicative Start Date**[12]	Q2 2017

Identification	**Title**
JTI-CS2-2016-CFP04-LPA-01-28	**Divergent Aircraft Configurations**
Short description (3 lines)	
Requested is the delivery of analysis models, of a design platform and of design support for an aircraft design exercise in the field of novel (hybrid) propulsion architectures. The requested know-how comprises system, airframe and operation modelling as well as optimization expertise.	

- **Company hosting**: DLR
- **Close cooperation with**: Airbus, DLR, ONERA, RR

CfP04-LPA-01-28 'Divergent Aircraft Configurations'

- **Scope of work:**

Tasks		
Ref. No.	***Title - Description***	***Due Date***
T 1	Advanced structural models and analysis for aircraft concept explorations	M0+30
T 2	Refined on-board system models and analysis for overall aircraft assessments	M0+30
T 3	Operational and mission model and analysis of hybrid electric aircraft	M0+30
T 4	Design platform for analysis and optimization of subsystems and configurations	M0+30

- **Schedule deliverables:**

Deliverables			
Ref. No.	***Title - Description***	***Type***	***Due Date***
D 3.1	Operational model of hybrid electric aircraft	Report	T0+6
D 4.1	Design platform for analysis and optimization of subsystems and configurations	Software	T0+6
D 1.1	Advanced structural models and analysis for aircraft concept for first selected reference	Analysis models	T0+9
D 2.1	Models of aircraft systems for overall aircraft assessment for one reference configuration	Analysis models	T0+9
D 1.2	Advanced structural models and analysis for aircraft concept for second selected reference	Analysis models	T0+18
D 2.2	Models of aircraft systems for overall aircraft assessment for second reference configuration	Analysis models	T0+18
D 3.2	Assessment of DLR and ONERA reference configurations	Analysis models	T0+18
D 4.2	Analysis of hybrid propulsion wrt systems on global aircraft level performed for one selected reference	Analysis models	T0+18
D 1.3	Advanced structural models for propulsion integration analyzed for overall design space	Report	T0+30
D 2.3	Aircraft systems for hybrid propuls optimized in overall aircraft assessment	Report	T0+30
D 3.3	Assessment of the down-selected DLR and ONERA most promising configuration	Report	T0+30
D 4.3	Analysis and Optimization wrt systems on global aircraft level performed and evaluated	Report	T0+30

Clean Sky
JOINT UNDERTAKING

CfP04-LPA-01-28 ‘Divergent Aircraft Configurations’

- **Targeted applicant background and skills:**
  - Strong background in conceptual aircraft design and optimization,
  - Experience in development of structural models, from conceptual design to preliminary design
  - Modelling and assessment of hybrid propulsion and hybrid propulsion systems,
  - Modelling and assessment of flight mechanics, handling qualities and operational modelling,
  - Background in design software development and application,
  - A track record of cooperation with external design groups in the field of aircraft simulation and design.

Overview of the LPA-CfP04 topics

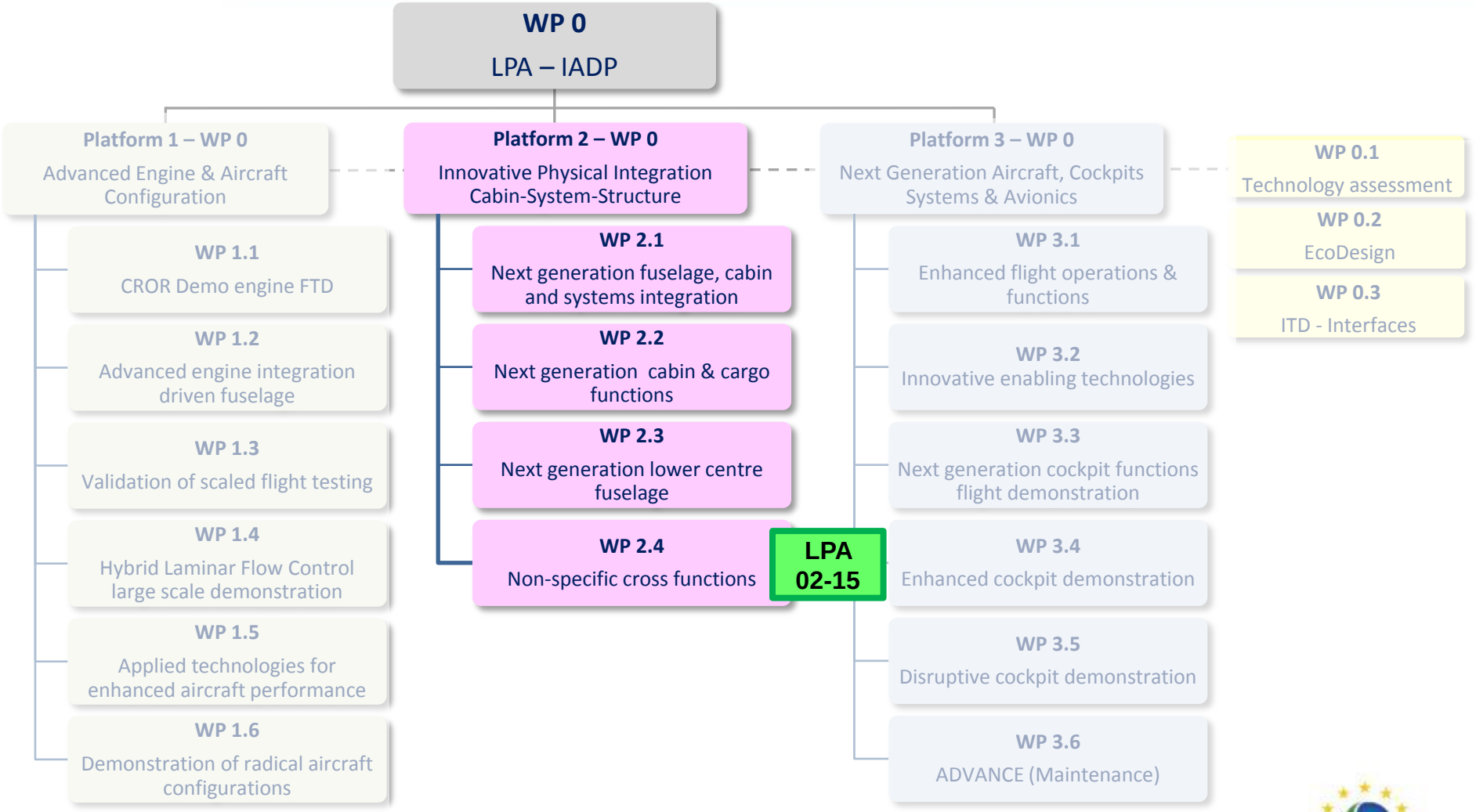
Platform 2

1 Topic

Total funding 0,8 M€

Identification Code	Title	Type of Action	Value (Funding in M€)	Topic Leader
JTI-CS2-2016-CFP04-LPA-02-15	Development of a Multi-scale method to predict large aircraft component failure taking into consideration Manufacturing Uncertainties for Predictive Virtual Simulations	RIA	0,800	Airbus

Assignment of CfP04-topics to the LPA-IADP WBS



JTI-CS2-2016-CFP04-LPA-02-15

Development of a multi-scale method to predict large aircraft component failure taking into consideration uncertainties for predictive virtual simulation

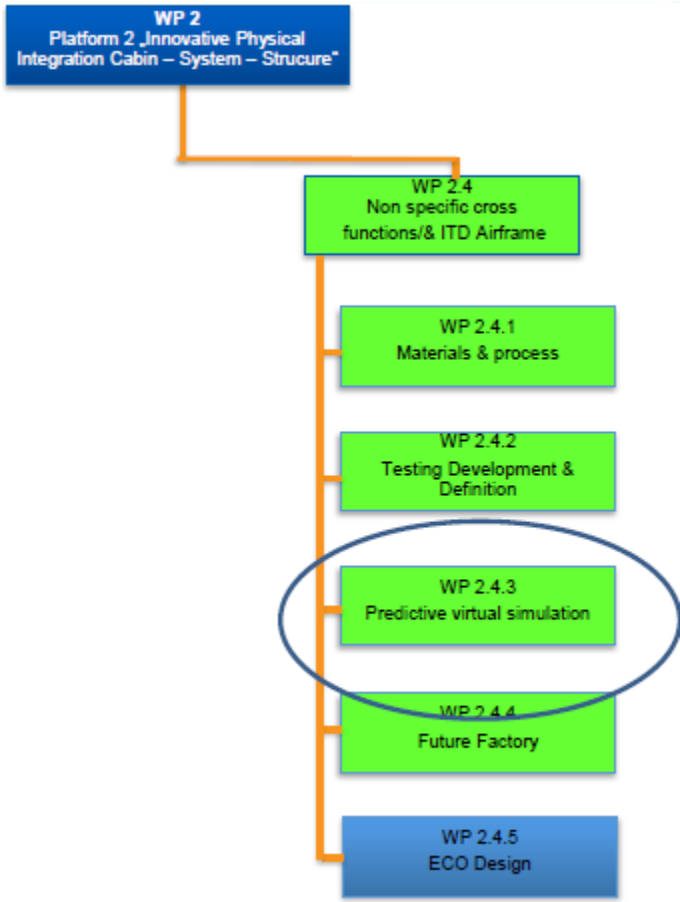
Innovation Takes Off

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

Clean Sky 2

CfP02-LPA-02-15 ‘Virtual Multiscale Failure Prediction’

- **JTI-CS2-2015-CFP02-LPA-02-15**
- **Title:** Development of a Multi-scale method to predict large aircraft component failure taking into consideration Manufacturing Uncertainties for Predictive Virtual Simulations
- **Objective:** In the frame of WP 2.4.3, this research activity will produce an innovative Multi-scale framework enabling the prediction of large aircraft component failure with very high level of accuracy and taking into consideration effects of modelling uncertainties. The new toolbox will be applied to support the development of the LPA Platform 2 demonstrators and be compatible with existing simulation tools.
- **Type of action:** RIA
- **Volume:** 800 k€ funding

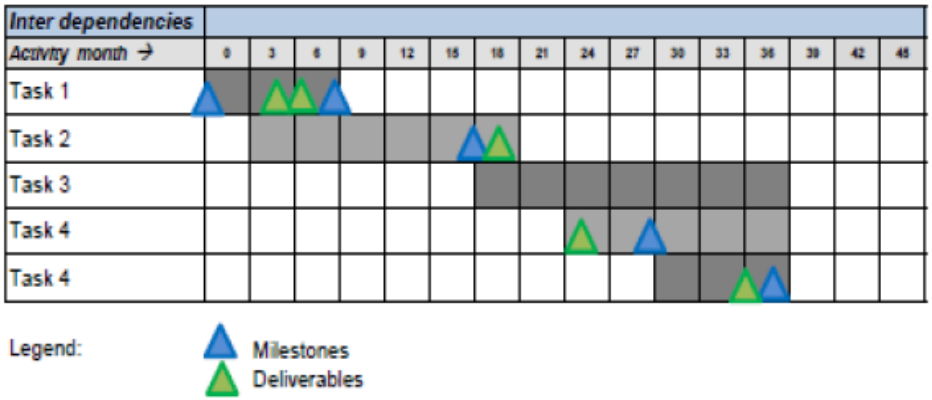


CfP02-LPA-02-15 'Virtual Multiscale Failure Prediction'

- **Schedule**

  The global interdependency between tasks/deliverables/milestones is shown in the here under table:

  Start of activity is 02/2017, duration is 36 months



- **Targeted applicant**: partner with research background and experience in :
  - Design of vehicles for Dynamically Scaled Flight Testing (Large Passenger Aircraft)
  - Management of building phase
  - Contribution to the building, for certain components
  - Vehicle and on-board systems qualification
  - Flight physics understanding of Dynamically Scaled testing

CfP02-LPA-02-15 'Virtual Multiscale Failure Prediction'

- **Schedule / Main Deliverables**

M0: official project start

Deliverables			
Ref. No.	Title – Description	Type	Due Date
1	Document describing sources of modelling uncertainties in predictive virtual simulation of aerospace structures and their potential impact on the accuracy results	Report	M0 + 3M
2	Selection of most pertinent multi-scale method in Use in Industry & University and their Applications	Report	M0 + 4M
3	Uncertainty quantification & Management tool	Report + Models + Tools+ User manual	M0 + 18M
4	Delivery of micro/meso and macro-scale strategies & New multi-scale framework	Report + Models + Tools+ User manual	M0 + 24M
5	Results on the application of PVS multi-scale strategy to two CleanSky 2 demonstrators	Report + Models	M0 + 34M

Overview of the LPA-CfP04 topics

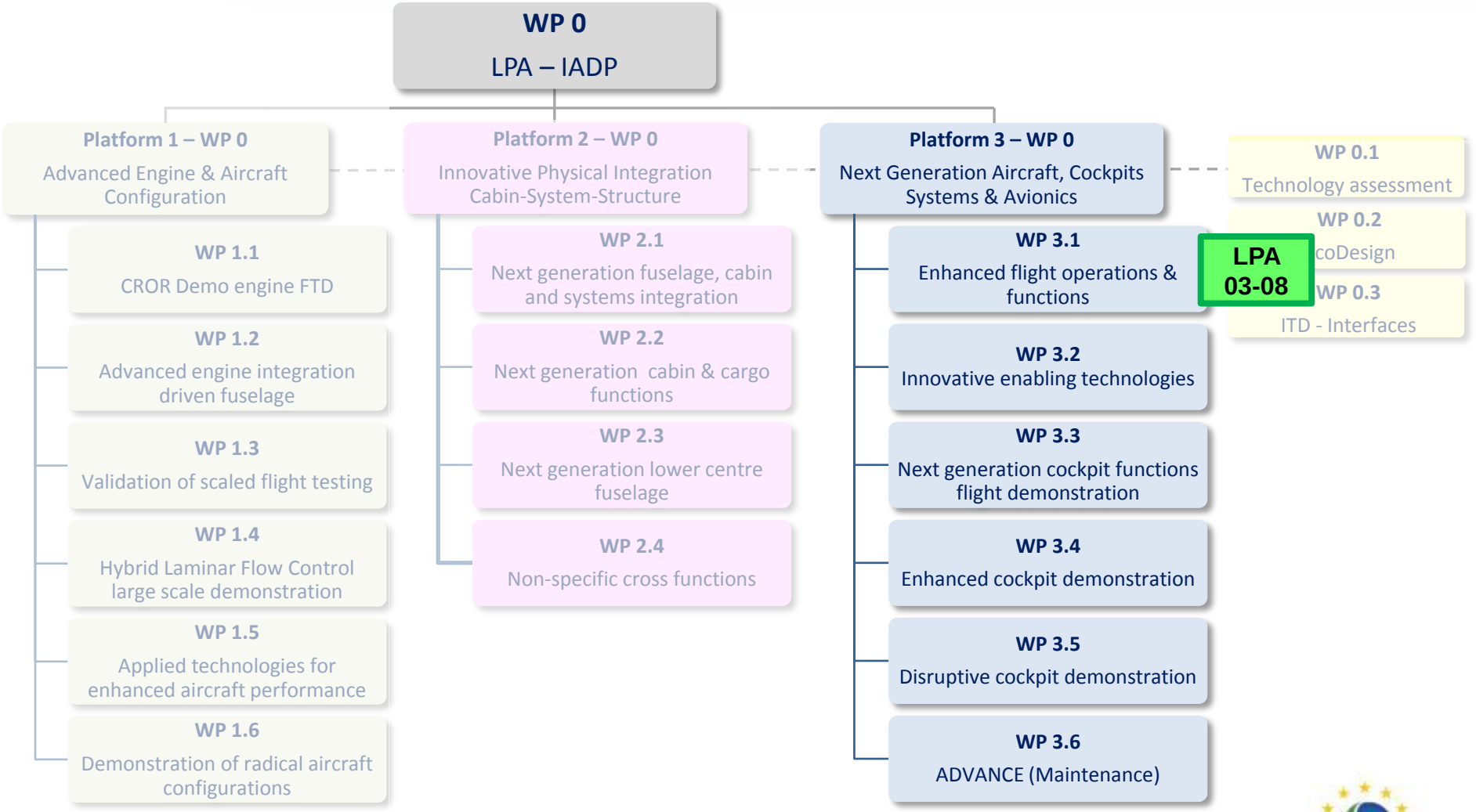
Platform 3

1 Topic

Total funding 1,5 M€

Identification Code	Title	Type of Action	Value (Funding in M€)	Topic Leader
JTI-CS2-2016-CFP04-LPA-03-08	Active Cockpit Simulator/Ground Station Facility and Test Environment enhancement	IA	1,500	Airbus

Assignment of CfP04-topics to the LPA-IADP WBS



JTI-CS2-2016-CFP04-LPA-03-08

Active cockpit simulator / ground station facility and test environment enhancement

Innovation Takes Off

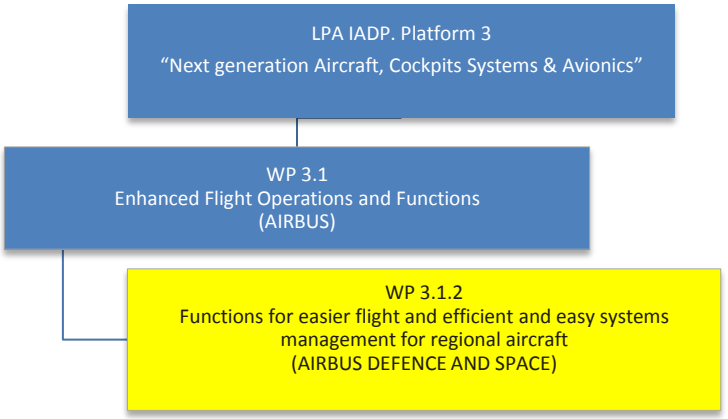
http://www.cleansky.eu/content/homepage/about-clean-sky-2

Clean Sky 2

CFP04-LPA-03-08 'Test Environment Enhancement'

JTI-CS2-2016-CFP04-LPA-03-08 **Topic hosting industry:** Airbus Defence and Space SAU

- **Title:** "Active Cockpit Simulator/ Ground Station Facility and Test Environment Enhancement"
- **Type of action:** IA
- **Volume:** 1500 k€ indicative funding
- **Start Date** : 1st June 2017, duration 20 months
- **Objective:** The objective is to develop HW & SW to enhance the current Active Cockpit Simulator integrating an advanced Ground Station Console configuration for a new Regional Aircraft Concept of Operation. It will allow performing the Human Factor Validation of CS2 LPA PT3 Reduced Cockpit Workload Technologies in a new generation Test Environment.



- The successful applicant is expected to sign an Implementation Agreement

CFP04-LPA-03-08 ‘Test Environment Enhancement’’

- **Schedule / Main Milestones**

Milestones		
Ref. No.	***Title - Description***	***Due Date***
M0	KOM: Kick of meeting	T0
M1	PDR: Partner provides a preliminary design agreed with Call requester	T0+3
M2	CDR: Partner provides a detailed design agreed with Call requester and freezed	T0+6
M3	Preliminary Acceptance of the solutions provided prior to deliver to Active Cockpit	T0+10
M4	Integration of the solutions in the Active cockpit	T0+16
M5	Test dry run and fine tuning of the solutions to reach a satisfactory solution performance	T0+18
M6	Solutions integrated ready for new technologies evaluations with pilot in the loop	T0+20

CFP04-LPA-03-08 'Test Environment Enhancement'

- **Schedule / Tasks**

Tasks		
Ref. No.	***Title – Description***	***Due Date***
WP1	Development of Out of the Window day / night test environment (150x40 degrees visual system, lighting system representing sun light, frame enclosure for night low light evaluation scenes.)	T0+20
WP2	Development of Enhanced instrument panels and flight controls representation	T0+20
WP3	Development of a beyond state of the art pilot and copilot monitor sensors system	T0+20
WP4	Development of an innovative 3D sound Environment	T0+20
WP5	Develop, design and manufacture of Ground Station Console Simulator Facility including Data Link simulation models	T0+20

- **Targeted applicant**: partner with a background in research and proven track record in aeronautical simulators systems, both HW and SW and test rig environments.
- **Required skills by the applicant:**
  - Understanding Aeronautical interfaces (ARINC429, ARINC629, MIL-STD-1553, AFDX) and ARINC 653 / Integrated Modular Avionics
  - System functional testing of simulators
  - Integration of biometric sensors applications, wireless interfaces & stress generation systems
  - 3D Audio recording & processing

Any questions?

Info-Call-CFP-2016-02@cleansky.eu

Last deadline to submit your questions:
16th August 2016, 17:00 (Brussels Time)

Thank You

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