Clean Sky 2
Information Day dedicated to the 2\textsuperscript{nd} Call for Proposal Partners (CfP02)

LPA – IADP
Presented by
Jens Koenig ; AIRBUS

Brussels, 3 September 2015
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

**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

*TRL 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
“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**
LPA-IADP Work Breakdown Structure

**WP 0**
LPA – IADP

**Platform 1 – WP 0**
Advanced Engine & Aircraft Configuration

- **WP 1.1**
  CROR Demo engine FTD

- **WP 1.2**
  Advanced engine integration driven fuselage

- **WP 1.3**
  Validation of scaled flight testing

- **WP 1.4**
  Hybrid Laminar Flow Control large scale demonstration

- **WP 1.5**
  Applied technologies for enhanced aircraft performance

- **WP 1.6**
  Demonstration of radical aircraft configurations

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

- **WP 2.1**
  Integrated product architecture

- **WP 2.2**
  Non-specific design technologies

- **WP 2.3**
  Technology validation

**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**
  Maintenance

**WP 0.1**
Technology assessment

**WP 0.2**
EcoDesign

**WP 0.3**
ITD - Interfaces

CS2 Info Day CfP02, Brussels 3.Sept.2015
## Overview of the LPA-CfP02 topics

<table>
<thead>
<tr>
<th>Identification Code</th>
<th>Title</th>
<th>Type of Action</th>
<th>Value (Funding in €)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JTI-CS2-2015-CFP02-LPA-01-04</td>
<td>Active technologies for acoustic and vibration comfort</td>
<td>IA</td>
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<tr>
<td>JTI-CS2-2015-CFP02-LPA-01-05</td>
<td>Validation of aero-vibro-acoustic model on new aerodynamic configurations.</td>
<td>RIA</td>
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<td>Laminar Horizontal Tail Plane full scale ground demonstrator</td>
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<td>JTI-CS2-2015-CFP02-LPA-01-10</td>
<td>Hybrid Prop. Demonstrator Components – Electric Power Drives (&quot;DRIVE&quot;)</td>
<td>IA</td>
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<tr>
<td>JTI-CS2-2015-CFP02-LPA-01-11</td>
<td>Hybrid Propulsion Component Studies – Electrics</td>
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<tr>
<td>JTI-CS2-2015-CFP02-LPA-02-07</td>
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<td>JTI-CS2-2015-CFP02-LPA-02-10</td>
<td>Development of pultrusion manufacturing applications</td>
<td>IA</td>
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</table>
LPA-IADP WBS – “Platform 1”

Large Passenger Aircraft Platform – integration topics

„Platform 1 - OAD“
„Platform 2 - OPD“
„Platform 3 - OSD“

Advanced Engine and Aircraft Configurations
Innovative Physical Integration Cabin-System-Structure

Airbus with SAAB, Dassault, SNECMA and Partners

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€

CS2 Info Day CfP02, Brussels 3.Sept.2015
Large Passenger Aircraft Platform – integration topics

Platform 1 - OAD
Platform 2 - OPD
Platform 3 - OSD

Advanced Engine and Aircraft Configurations
Innovative Physical Integration Cabin-System-Structure

Large Passenger Aircraft Platform – “Platform 2”

Platform 2  Innovative Physical Integration Cabin-System-Structure

WP 2.1 Integrated product architecture
WP 2.2 Non specific design technologies
WP 2.3 Technology validation
WP 2.3.1 Multi purpose demonstrators
  • Next generation fuselage, cabin & cargo functional demonstrator
  • Next generation cabin & cargo functional demonstrator
  • Next generation lower centre fuselage structural demonstrator
WP 2.3.2 Testing
WP 2.3.3 Pre-Production Line Technologies

Airbus with, Liebherr, Fraunhofer and Partners

Estimated Volume of Activities ~290M€

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Setup and Implementation LPA Platform 3

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

Estimated Volume of Activities ~222M€

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**Platforms**

- **Platform 1**
  - 8 Topics
  - Total funding 8,85 M€

- **Platform 2**
  - Dassault
  - Airbus
  - FHG

- **Platform 3**
  - Dassault
  - Airbus
  - Airbus

CS2 Info Day CfP02, Brussels 3.Sept.2015
• **JTI-CS2-2015-CFP02-LPA-01-04, Type: IA**

• **Title:** Active technologies for acoustic and vibration comfort

• **Objective:** Development and Evaluation of 3 active technologies for acoustic and vibration comfort:
  - Reducing engine vibrations transmission,
  - Reducing cabin noise from engine vibration,
  - Reducing global fuselage vibration from aerodynamic excitations.

This covers the design, build and test of specified components and their integration into a demonstrator test bench in the applicant’s premises.

This also covers the evaluation of the systems in flight (on a Dassault test aircraft).

In addition, suitable modelling and simulation modules for these components are to be provided.

• **Volume:** 750 k€ funding
• **3 Work packages with 6 tasks each:**
  – WP1: Active anti-Vibration Control System (AVCS) at engine mounts to deal with engine vibration
  – WP2: Active anti-Noise Control System (ANCS) for aircraft passenger seat to deal with engine noise
  – WP3: Active anti-Vibration Control System (AVCS) on the fuselage structure to deal with aerodynamic vibration

<table>
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<td>TX.2</td>
<td>Design (actuator, sensors, amplifier, controller)</td>
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<td>TX.3</td>
<td>Manufacturing and assembling</td>
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<td>TX.4</td>
<td>Aircraft integration</td>
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<td>TX.5</td>
<td>Demonstration Tests (ground, in-flight)</td>
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<td>TX.6</td>
<td>Results assessment</td>
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| TX.1              | Conceptual design, specifications and installation constraints | T0+6 |
| TX.2              | Design (actuator, sensors, amplifier, controller) | T0+12 |
| TX.3              | Manufacturing and assembling | T0+18 |
| TX.4              | Aircraft integration | T0+24 |
| TX.5              | Demonstration Tests (ground, in-flight) | T0+30 |
| TX.6              | Results assessment | T0+36 |

• **Targeted applicant:** industrial partner with capabilities in the design, implementation and testing of NVH active technologies

• **Required skills by the applicant:**
  – design and integrate these components for application in aircraft with in-flight qualification tests and/or “Flight Clearance”
  – experience in technological research and development in active control,
CFP02-LPA-01-05 ‘VAMNAC’

- **JTI-CS2-2015-CFP02-LPA-01-05, Type: RIA**

- **Title:** Validation of Aero-vibro-acoustic Model on New Aerodynamic Configurations.

- **Objective:**
  Improving knowledge on turbulent boundary layer noise and its propagation into the fuselage structure thanks to:
  - Development of innovative measurement tools (No impact on flow propagation, easily movable, measurements up to 6KHz)
  - Wind tunnel test on a modular mock up (scale 1) in a very low background noise will provide data about aero-acoustics and structural dynamics under non homogeneous loading
  - The mock up and wind tunnel facility should provide very good modularity during the testing.
  - Numerical simulations of the boundary layer excitation, vibro-acoustic response and acoustic propagation on the cavity inside of the model.

- **Volume:** 900 k€ funding
• **Workplanning:**

State of art of turbulent boundary layer noise model existent
State of art and innovation on measurement tools
Design, manufacturing and Instrumentation of the model
Wind tunnel testing in an anechoic wind tunnel test section
aero-vibro-acoustic simulation of the model
Test results analysis and comparison to aero-vibro-acoustic simulation
Synthesis

• **Targeted applicant:** research/industrial partner with capabilities in

  – the design, manufacturing and acoustic wind testing of scale 1 mock-up
    (The applicant should have a wind tunnel test section compatible with the size of the model with very low background noise levels)
  
  – aero-vibro-acoustic modelling and simulation

• **Required skills by the applicant:**

  – experience on development of innovative acoustic measurement tools and capability to improve the TRL of the concepts up to 4-5.
  – experience on design and manufacturing of the mock up.
  – experience on turbulent boundary layer noise and structure response modelling.
  – experience on aero-vibro-acoustic measurements and analysis up to 5 kHz

CS2 Info Day CfP02, Brussels 3.Sept.2015
• JTI-CS2-2015-CFP02-LPA-01-06, Type: IA

• Title: Laminar Horizontal Tail Plane full scale ground demonstrator

• Objective:
The aim of this project is the demonstration of the feasibility and the aerodynamics of a natural laminar horizontal tail plane. The partner will have to participate to its design and manufacture. The overall model will be representative to the outer 2,5m span full scale HTP of a bizjet instrumented and compatible with wind-tunnel test.

• Required skills by the applicant:
  – The applicant shall have a large experience in designing, sizing airframe parts for the aeronautical industry, in particular large composite parts. (carbon fiber and epoxy resin)
  – The applicant shall comply with the TM procedures concerning airframe design and manufacturing. These procedures will be provided in the requirement document to be issued during the negotiation phase.
  – The applicant shall be proficient in using CATIA V5 R20 software (Design modules in particular).

  The following manufacturing skills and equipment are required:
  – Strong knowledge on thermoset composite material with reinforced fibres,
  – Strong knowledge on aeronautical assembly technologies (metallic and composite materials),
  – Proven experience and capabilities in the realization of manufacturing studies.

• Volume: 1500 k€ funding
• **JTI-CS2-2015-CFP02-LPA-01-07, Type: RIA**

• **Title:** Design, test and manufacturing of robust fluidic actuators

• **Objective:**
  Design, test and manufacturing of robust, energy-efficient, aerodynamically effective actuators without moving parts for wind tunnel testing and aircraft-scale ground testing.

• **Required skills by the applicant:**
  - Profound knowledge in flow control actuator design for aircraft applications:
    - necessary design capabilities (actuator design, numerics and experiments)
    - numerical tools and computational resources
  - Actuator design must be based on pulsed air blowing with net mass flux. For robustness reasons actuators should have a low part count and mandatory no moving parts such as fast switching valves or similar.
  - Before answering to this call the actuators must have been validated with respect to:
    a) their aerodynamic effectiveness in 3D flow conditions of aircraft applications under industrial relevant Reynolds numbers (Re> 1mio wrt mean aerodynamic chord) and free stream Ma numbers (Ma>0.18)
    b) their robust functionality under harsh environment conditions (rain, ice, vibration etc.)

• **Volume:** 350 k€ funding
The work is organized in the following way:

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Title – Description</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Development, design, manufacturing and validation of actuators for wind tunnel testing</td>
<td>M6</td>
</tr>
<tr>
<td>T2</td>
<td>Support wind tunnel testing and analysis</td>
<td>M11</td>
</tr>
<tr>
<td>T3</td>
<td>Support development of integrated actuator solution from acoustics, structure, systems and aerodynamics point of view</td>
<td>M20</td>
</tr>
<tr>
<td>T4</td>
<td>Development, design, manufacturing and validation of full-aircraft scale actuators</td>
<td>M30</td>
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</tbody>
</table>

WP 1.5
Applied technologies for enhanced aircraft performance

WP 1.5.3
Flow Control for UHBR Turbofan Integration
• JTI-CS2-2015-CFP02-LPA-01-08, Type: RIA
• **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)

• **Volume:** 350 k€ funding

*AFC = Active Flow Control*
• **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 concept)
    – 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.
CfP02-LPA-01-09 ‘PREP’

- **JTI-CS2-2015-CFP02-LPA-01-09**
- **Title:** Test Aircraft Preparation and Qualification for Scaled Flight Testing (‘PREP’)
- **Objective:** This task will cover development activities for a scaled flight testing platform, incorporating know-how and results available in the frame of other R&D studies carried out by the partner. This will include the definition of the vehicle and of its modifications compared to an already existing baseline, and the qualification of the modifications and the complete vehicle.
- **Volume:** 2000 k€ funding
Schedule

Targeted applicant: partner with research background with experience in design, building and testing of scaled flight test vehicles (weight class 150kg). Special focus on Dynamically Scaled flight testing for Large Passenger Aircraft.

Required skills:
- 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-01-10 ‘DRIVE’

- **JTI-CS2-2015-CFP02-LPA-01-10**
- **Title:** Hybrid Propulsion Demonstrator Components – Electric Power Drives
- **Objective:** Development of Electric Drives components for a Hybrid Electric Propulsion system. This covers the design, build and test of specified components and their integration into a demonstrator test bench. In addition, suitable modelling and simulation modules for these components are to be provided.
- **Volume:** 2000 k€ funding
• **Targeted applicant**: industrial partner with capabilities in the design, implementation and testing of electric drives (4MW)

• **Required skills by the applicant:**
  – design and integrate these components for application in aircraft propulsion systems
  – provide the required interfaces to other components as well as to ancillaries such as the cooling system
CfP02-LPA-01-11 ‘SPARK’

- **JTI-CS2-2015-CFP02-LPA-01-11**
- **Title:** Hybrid Propulsion Component Studies – Electrics (‘SPARK’)
- **Objective:** This task supports the Hybrid Electric Propulsion demonstration with component and architecture simulations, modelization of basic principles and break-through innovation. The focus is on electric generation, conversion and drive components.
- **Volume:** 1500 k€ funding

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**CfP02 Info Day CfP02, Brussels 3.Sept.2015**

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[Diagram of hybrid propulsion system]
• **Schedule**

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<tr>
<td>T 1</td>
<td>Development of a target setting tool for electrical machines</td>
<td>T0+48</td>
</tr>
<tr>
<td>T 2</td>
<td>Development of a tool for the estimation of Power Electronics performance</td>
<td>T0+48</td>
</tr>
<tr>
<td>T 3</td>
<td>Electric machines cooling system technology forecast</td>
<td>T0+48</td>
</tr>
<tr>
<td>T 4</td>
<td>Preliminary Design of Heat Exchanger System</td>
<td>T0+48</td>
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<tr>
<td>T 5</td>
<td>Impact of Partial Discharge on Design</td>
<td>T0+48</td>
</tr>
<tr>
<td>T 6</td>
<td>Optimization of Overall Electrical System</td>
<td>T0+60</td>
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**Deliverables**

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<td>D-1</td>
<td>First version of target-setting tool for electric machines</td>
<td>Doc/SW</td>
<td>T0+24</td>
</tr>
<tr>
<td>D-2</td>
<td>Final version of target-setting tool for electric machines</td>
<td>Doc/SW</td>
<td>T0+48</td>
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<tr>
<td>D-3</td>
<td>Tool for the estimation of Power Electronic components, first version</td>
<td>Doc/SW</td>
<td>T0+24</td>
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<tr>
<td>D-4</td>
<td>Tool for the estimation of Power Electronics, final version</td>
<td>Doc/SW</td>
<td>T0+54</td>
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<td>D-5</td>
<td>Electric components cooling system technology forecast, component designs and simulation software, preliminary version</td>
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<tr>
<td>D-7</td>
<td>Heat Exchanger (for Hybrid Electric Propulsion), preliminary design</td>
<td>Doc</td>
<td>T0+24</td>
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<tr>
<td>D-8</td>
<td>Heat Exchanger (for Hybrid Electric Propulsion) final design</td>
<td>Doc</td>
<td>T0+48</td>
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<td>D-9</td>
<td>Partial Discharge, first laboratory assessment and simulation tool</td>
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<td>D-10</td>
<td>Partial Discharge, final laboratory assessment and simulation tool</td>
<td>Doc/HW</td>
<td>T0+48</td>
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<tr>
<td>D-11</td>
<td>Preliminary overall electric design and integrated simulation</td>
<td>Doc</td>
<td>T0+36</td>
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<tr>
<td>D-12</td>
<td>Optimized overall electric design and integrated simulation based on hardware demonstration</td>
<td>Doc</td>
<td>T0+60</td>
</tr>
</tbody>
</table>

• **Targeted applicant:** partner with a background in research with a proven track record of participation in research programmes with industrial participation

• **Required skills by the applicant:**
  – Preliminary design (technology forecast, modellisation, experimental assessment and design studies) for electric components and architectures for aerospace applications
  – Aerospace specific design requirements, such as component safety and reliability and the operation at higher altitudes
  – Higher voltage electric applications
  – Access to subscale rigs and demonstrators to support the programme.
Overview of the LPA-CfP02 topics

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Assignment of the LPA-CfP02 topics

WP 0
LPA – IADP

Platform 1 – WP 0
Advanced Engine & Aircraft Configuration
- WP 1.1 CROR Demo engine FTD
- WP 1.2 Advanced engine integration driven fuselage
- WP 1.3 Validation of scaled flight testing
- WP 1.4 Hybrid Laminar Flow Control large scale demonstration
- WP 1.5 Applied technologies for enhanced aircraft performance
- WP 1.6 Demonstration of radical aircraft configurations

Platform 2 – WP 0
Innovative Physical Integration Cabin-System-Structure
- WP 2.1 Integrated product architecture
- WP 2.2 Non-specific design technologies
- WP 2.3 Technology validation

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 Maintenance

WP 0.1 Technology assessment
WP 0.2 EcoDesign
WP 0.3 ITD - Interfaces
WP 2.3

Scope of WP2.3:

Set up **innovative architecture** compliant with **Body Landing Gear**, including:
- High loaded structure integration
- System integration
- Industrial process validation

Objectives:

1. **Secure the BLG benefits** with a managed risk level thanks to appropriate demonstration strategy
2. **Develop disruptive LCF architectures** offering additional benefits (Best Eco-Mix)
3. Guaranty the manufacturing ambitious **high production rate** (simple assembly, reduction and/or low cost shimming)
4. **Ensure the manufacturing feasibility** of the concept with the associated impact through elementary part, components, FAL assessments and Buy-in from plants
5. Propose a **new system lay out** compliant with BLG topic including all ATAs (Air conditioning, Bleed, Landing gear...) ...
WP 2.3.2

Scope of WP 2.3.2:

- Architecture Structure Mechanical analysis
- Architecture definition
- Structure & System Integration
- Components trade off (Best Eco-mix, innovative Material & Process, Adaptation to manufacturing constrains)
- Tolerance analysis linked to manufacturing feasibilities
- Mature components innovative technologies
• Landing gear large die-forged fitting with improved mechanical performance

Lower Centre Fuselage area

Landing Gear Fitting
Scope of the work

Development of new Landing Gear integration
  => Concept Phase
  => study as an enabler

Work break down structure

Objectives of the project

- Development of a high performance die-forged fitting in order to:
  - sustain high static & fatigue loadings

- Development of a die-forged fitting with geometry close to the final shape in order to:
  - reduce machining operations (time, chips formation)
  - reduce distortion

- The envelop of the fitting is around 1m50 * 1m50 * 1m thick, around 150 kg each
Deliverables

- Proposal of disruptive manufacturing route to be close to final shape
- Confirmation of distortion reduction thanks to manufacturing trials (no full scale die-forged part required)
- Confirmation of high mechanical behaviour thanks to testing campaign on coupons
- Numerical analysis to make the link between the sub-scale trials to full scale part

Expectations from applicants

- High skills in producing aeronautical die-forged parts
- Skills in modelling the thermomechanical behaviour

<table>
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</thead>
<tbody>
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</table>
• High production rate composite Keel Beam feasibility

Lower Centre Fuselage area

Landing Gear Fitting
**Scope of the work**

Development of new Landing Gear integration

=> Concept Phase

=> study as an enabler

**Objectives of the project**

- Development of a high performance keel beam in order to:
  - sustain high static compression loading

- Development of low weight composite part

- Development of an improved composite manufacturing process in order to:
  - sustain high production rate (50 a/c per month)
Deliverables
- Conduction of a stress study to size the keel beam to be able to sustain high compression loading
- Development of detailed design through CATParts
- Development of disruptive manufacturing route to be able to sustain high production rate

Expectations from applicants
- High skills in designing aeronautical parts
- High skills in static stress

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</table>
• Integrated main landing gear bay
Scope of the work

Development of new Landing Gear integration
=> Concept Phase
=> study as an enabler

Objectives of the project

- Development of an innovative Main Landing Gear Bay dealing with:
  - high load transfer
  - high area of integration
  - high production rate
  - low production cost (reduction of Recurring Cost)

- The global size: length = ~2500 mm / width = ~4000m/ height = ~1200mm

- The Main Landing Gear Bay will have to sustain high loads, around 100 tons.
Deliverables

- Conduction of a stress study to size the Landing Gear Bay to be able to sustain high loading
- Trade off studies between several proposals – selection of best design
- Development of specific design through CATParts
- Development of manufacturing route to be able to sustain high production rate

Expectations from applicants

- High skills in design & stress of both composite & metallic parts
- High skills in Manufacturing Engineering for elementary parts and assembly
- High skills in aircraft architecture

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CS2 Info Day CfP02, Brussels 3.Sept.2015
<table>
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<tr>
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<tr>
<td>• Development of pultrusion manufacturing applications</td>
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</table>
Scope of the work

- Low energy consumption manufacturing process
- Manufacturing cost reduction

Objectives of the project

- Pultrusion process enables to produce extruded composite parts without the need of autoclave for polymerisation
  ⇒ Development of new potential applications for pultrusion manufacturing
  ⇒ Development of robust manufacturing routes to enable 50 a/c per month
- The indicative thickness range is from 1mm to 6mm
- The maximum envelop of the cross-section of the parts is 200mm*200mm
Deliverables
- Development of new potential applications for pultrusion manufacturing
- Demonstration of good extrudability (low distortion, final shape corresponding to the design) together with relevant mechanical properties (polymerisation with no defect, static requirements, Fire Smoke & Toxicity requirement)
- The targeted applications are today made of Pre-impregnanted materials, with Epoxy resin, associated to multi-axial stacking sequence (typically using 0° / 45° / -45° / 90°). The applicant must demonstrate the use of aeronautic fibers: “Intermediate Modulus” or “High Resistance”.
- Extrusion + Experimental campaign to validate the mechanical properties, and check by NDT

Expectations from applicants
- Recognized skills in pultrusion and recognized experience in carbon fibers
- Engineering skills (composite material, mechanical behaviour)
- Pultrusion dies
- Non-Destructive Testing capacity
- Hability to perform standard coupons CFRP test
- Capacity to produce around 300 Tons of Carbon parts per year

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Assignment of the LPA-CfP02 topics

**WP 0**
LPA – IADP

**Platform 1 – WP 0**
Advanced Engine & Aircraft Configuration

- WP 1.1 CROR Demo engine FTD
- WP 1.2 Advanced engine integration driven fuselage
- WP 1.3 Validation of scaled flight testing
- WP 1.4 Hybrid Laminar Flow Control large scale demonstration
- WP 1.5 Applied technologies for enhanced aircraft performance
- WP 1.6 Demonstration of radical aircraft configurations

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

- WP 2.1 Integrated product architecture
- WP 2.2 Non-specific design technologies
- WP 2.3 Technology validation

**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 Maintenance

**Clean Sky**
Touchscreen control panel for critical system management functions

- Indicative funding value: 2 000 k€
- Duration: 93 months
- The purpose of this Call for proposal is to develop a touchscreen control panel that could replace standard overhead control panels as an incremental step on existing aircrafts and more globally on future cockpits. In order to address all overhead functions, the technology should be compliant with failure conditions up to CAT. Therefore, the whole control chain shall be secured from the touch sensor to the controlled system.
- The project should last 3 years at most and target TRL5 maturity by the end of the project thanks to a representative prototype that would be integrated on a large aircraft cockpit simulator.
- An extension may be decided to feed Airbus Disruptive Cockpit Demonstrator, bringing the project duration up to 7.5 years
This call contributes to the LPA Platform 3 Workpackages 3.1, 3.3, 3.4 and 3.5

- Development of functions for “Functions and solutions for man-machine efficiency”
  - Tactile HMI
- Flight tests on large passenger airframer airplane
- Integration on passenger aircraft “Enhanced cockpit” ground demonstrator
- Integration on passenger aircraft “Disruptive cockpit “ground demonstrator

CS2 Info Day CfP02, Brussels 3.Sept.2015
Functions and solutions for man-machine efficiency

• The objective of this Call for Partner is to define relevant requirements and to develop a touchscreen control panel system that can provide the capacity to host critical commands towards A/C systems (engine, FUEL, ...).
• The activities of this Call will cover the design, development and tests of the equipment itself, the associated system architecture as well as the operational concept, in order to reach TRL5 maturity by the end of the project.
• The integration and tests activities will consist in a first phase, leading to prototype testing on large passenger aircraft cockpit simulator, and a second conditional phase for integration and testing on the Disruptive Cockpit demonstrator.
The expected contribution from the applicant consists in:

- Supporting the requirements definition at equipment and system level based upon requirements provided by the aircraft manufacturer.
- Defining touchscreen control panel units based upon system architecture concept provided by the A/C manufacturer.
- Building & testing prototypes (hardware and software) for concept validation, operational and performance verification on applicant facilities, interfacing with A/C systems models to be provided by the A/C manufacturer.
- Support the aircraft manufacturer during the integration, tests and validation of the prototypes on airframer simulators and/or flight tests platform.
## High level roadmap

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<tr>
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<td><strong>Definition of requirements</strong></td>
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<td><strong>System definition</strong></td>
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<tr>
<td><strong>System validation &amp; Verification</strong></td>
<td>![TRL 4 Building blocks]</td>
<td>![TRL 5 Integrated solution]</td>
<td>![TRL 5 Enhanced cockpit]</td>
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New flight crew oxygen mask concept for prolonged use in civil aircraft

- Indicative funding value: 550 k€
- Duration: 93 months
- Current flight crew oxygen masks are not adapted to prolonged use as required for some aircraft operations. In addition, the future cockpit will feature new Man Machine interaction means, potentially incompatible with state of the art oxygen masks. The objective of the project is to develop and validate mask solutions which would drastically increase the mask comfort for long duration and the compatibility with innovative man machine interface.
- The project should last 2,5 years at most and target TRL5 maturity by the end of the project thanks to a representative prototype that would be integrated on a large aircraft cockpit simulator.
- An extension may be decided to feed Airbus Disruptive Cockpit Demonstrator, bringing the project duration up to 7,5 years.
This call contributes to the LPA Platform 3 Workpackages 3.1, 3.3, 3.4 and 3.5

- Development of functions for “Functions and solutions for man-machine efficiency”
- Flight tests on large passenger airframer airplane
- Integration on passenger aircraft “Enhanced cockpit” ground demonstrator
- Integration on passenger aircraft “Disruptive cockpit “ground demonstrator”
Functions and solutions for man-machine efficiency

• The objective of the project is to define relevant requirements and to develop mask solutions which would drastically increase the mask comfort for long duration use and compatibility with innovative man machine interface.

• The activities of this Call will cover the design, development and tests of the equipment itself, its compatibility with other worn devices, the associated system architecture as well as the operational concept, in order to reach TRL5 maturity by the end of the project.

• The integration and tests activities will consist in a first phase, leading to prototype testing on large passenger aircraft cockpit simulator, and a second conditional phase for integration and testing on the Disruptive Cockpit demonstrator.
The expected contribution from the oxygen mask manufacturer applicant consists in:

- Supporting the requirements definition at equipment and system level based upon requirements provided by the aircraft manufacturer
- Defining mask concept upon system architecture concept provided by the A/C manufacturer
- Building & testing prototypes for concept validation, operational and performance verification on applicant facilities
- Support the aircraft manufacturer during the integration, tests and validation of the prototypes on airframer cockpit mock-up and/or flight tests platform
The expected contribution from the research institute applicant consists in:

- Supporting the requirements definition at equipment and system level based upon requirements provided by the aircraft manufacturer
- Evaluate human factors aspects of new mask concepts / prototypes
- Test and evaluate physiological performance of new mask concepts / prototypes
### High level roadmap

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<td>![TRL 5 Enhanced cockpit]</td>
<td>![Flight tests (Conditional)]</td>
<td>![Decision gate]</td>
<td>![TRL5 Disruptive cockpit]</td>
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</table>
Head-up system integration in next generation cockpits

This topic contributes to the LPA Platform 3 Work Packages 3.1, 3.3, 3.4

- Indicative funding value: 1MEuros
- Duration: 36 Months
- Objectives: Head Up Display is more and more a standard equipment in aircraft, both for economical reasons (the cost has been reduced drastically) and the demonstration of its benefits is now widely shared. The objectives of the project is to study how to efficiently integrate and use HUD in next cockpit generation.

- The applicant is expected to support Dassault Aviation in that objective by:
  - providing two physical HUD on the FALCON bench
  - providing rapid prototyping environment allowing to modify & define HUD MMI & associated logics
  - supporting architecture studies linked to the integration of dual HUD including new functionalities in next cockpit generation

- Thus, the applicant is expected to have extensive experience in HUD system as well as civil certification (CS25). Experience in state of the art HUD functionalities for HUD such as combined vision system would be greatly appreciated.
- **Schedule**

<table>
<thead>
<tr>
<th>1</th>
<th>HUD Integration in the Airframer’s bench</th>
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<tbody>
<tr>
<td>1.1</td>
<td>Identify from requirements (see §3) and apply HUD system design change for simulator integration</td>
</tr>
<tr>
<td>1.2</td>
<td>HUD Integration on Airframe manufacturer simulator</td>
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<tr>
<td>1.3</td>
<td>Results Assessment</td>
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<table>
<thead>
<tr>
<th>2</th>
<th>Validation of functionalities and MMIs</th>
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</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Prototype the new functionalities and MMI changes as specified by Dassault-Aviation (see §3)</td>
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<tr>
<td>2.1.1</td>
<td>Rapid prototyping - Initial version (V0)</td>
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<tr>
<td>2.1.2</td>
<td>Updated version (V1)</td>
</tr>
<tr>
<td>2.1.3</td>
<td>Updated version (V2)</td>
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<tr>
<td>2.1.4</td>
<td>Final Version</td>
</tr>
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<td>2.2</td>
<td>Support the evaluations at the Airframer’s premises</td>
</tr>
<tr>
<td>2.2.1</td>
<td>V0</td>
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<tr>
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<tr>
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<td>V2</td>
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<tr>
<td>2.2.4</td>
<td>Final Version</td>
</tr>
<tr>
<td>2.3</td>
<td>Results Assessment</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Architecture of Head Up System</th>
</tr>
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<tbody>
<tr>
<td>3.1</td>
<td>Contribute to identify the boundaries between HUD system, sensors, avionics and Flight Guidance system</td>
</tr>
<tr>
<td>3.2</td>
<td>Identify next generation HUD Integration architecture design change (including I/O)</td>
</tr>
<tr>
<td>3.3</td>
<td>Results Assessment</td>
</tr>
</tbody>
</table>

| 4 | Project final assessment |

**Contact:** Cyril.Saint-Requier@dassault-aviation.com
Any questions on the 2\textsuperscript{nd} Call for Proposals can be addressed to the following mailbox: \texttt{Info-Call-CFP-2015-01@cleansky.eu}

Last deadline to submit your questions: 15\textsuperscript{th} October 2015

Thank you!
Thank You

Disclaimer

- The selection of Partners will be based on Horizon 2020 Rules for Participation, the rules for submission of proposals, evaluation and selection of Partners as adopted by the Governing Board of Clean Sky 2 JU and will apply to the calls for Proposals.
- The content of this presentation is not legally binding. This presentation wishes to provide a preliminary overview of these rules.
- 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 Programme.