Innovation Takes Off

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Clean Sky 2
Information Day dedicated to the 1st Call for Proposals (CFP01)

LPA - IADP
Jens Koenig : AIRBUS
François Mirville : SAFRAN/Sncema

Paris, 3 February 2015

Innovation Takes Off

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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

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

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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

CS2 Info Day CfP#1, Paris 3rd Feb. 2015
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

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Large Passenger Aircraft Platform – integration topics

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€
LPA-IADP WBS – “Platform 2”

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 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
Innovative Flight Operations

WP 1.6
Demonstration of radical aircraft configurations

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

WP 3.1
Enhanced flight operations & functions

WP 3.2
Avionic backbone technologies development, integration & demonstration

WP 3.3
Next generation cockpit functions flight demonstration

WP 3.4
Next generation cockpit ground demonstrator

WP 3.5
Pilot Case Demonstrator

WP 3.6
Maintenance

Platform 0
LPA – IADP

WP 0.1
Technology assessment

WP 0.2
EcoDesign

WP 0.3
ITD - Interfaces
**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

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**Estimated Volume of Activities ~290M€**
Large Passenger Aircraft Platform – integration topics

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€

CS2 Info Day CfP#1, Paris 3rd Feb. 2015
## Overview of the LPA-CFP01 topics

<table>
<thead>
<tr>
<th>Identification</th>
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<th>Type of Action</th>
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<td>JTI-CS2-2014-CFP01-LPA-01-01</td>
<td>OPEN ROTOR Engine Mounting System</td>
<td>IA</td>
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<td>JTI-CS2-2014-CFP01-LPA-01-02</td>
<td>Support to future CROR and UHBR propulsion system maturation</td>
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<td>JTI-CS2-2014-CFP01-LPA-01-03</td>
<td>Development of advanced laser-beam welding technology for the manufacturing of structures for titanium HLFC structures.</td>
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<td>Cost Reduction On Composite Structure Assembly – Blind fastener inspection technology for quality control</td>
<td>IA</td>
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<tr>
<td>JTI-CS2-2014-CFP01-LPA-02-02</td>
<td>Cost Reduction On Composite Structure Assembly – Definition And Development Of An Inspection Tool To Characterize Inner Surface Hole Quality</td>
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<td>JTI-CS2-2014-CFP01-LPA-02-03</td>
<td>Rapid Assembly Of Bracket For Structure-System Integration</td>
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<td>JTI-CS2-2014-CFP01-LPA-02-04</td>
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<td>JTI-CS2-2014-CFP01-LPA-02-05</td>
<td>Environmental Friendly Fire Suppression</td>
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<td>Development of Thermoelastic Stress Analysis for the detection of stress hotspots during structural testing</td>
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<td>JTI-CS2-2014-CFP01-LPA-03-01</td>
<td>Process and Methods for E2E Maintenance Architecture development and demonstrations and solutions for technology integration</td>
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<td>Aircraft System Prognostic solutions integrated into an airline E2E maintenance operational context</td>
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<td>JTI-CS2-2014-CFP01-LPA-03-03</td>
<td>Airline Maintenance Operations implementation of an E2E Maintenance Service Architecture and its enablers</td>
<td>RIA</td>
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Top objectives

• Validate the aerodynamic efficiency and noise level for a full size airworthy CROR pusher engine under operational conditions (TRL 6)

• Demonstrate and validate the viability of the chosen propulsion system concept and associated technologies like power gearbox, pitch control, lubrication system, propeller and blade design

• Demonstrate and validate a pylon concept and system integration, addressing loads, vibration, and noise attenuation technologies in real size

• Synthesize available data from Clean Sky with CROR demo-engine flight test data, re-calibrate tools

Gross budget: 185M€, including 120M€ for WP1.1.3

SNECMA is leading WP1.1.3. CROR Demo Engine

Timescale: Q3 2014 – 2 2023
• **SNECMA** is leading **WP 1.1.3. CROR Demo Engine**
• **Timescale:** Q3 2014 – Q2 2023
• **Call For Proposals (CfPs) are part of the FTD CROR Demo Engine Development**
• **CfPs in WP1.1.3. will generally aim at**
  – A research study
  – And/Or Design, manufacture, assembly and instrumentation of a module or sub-module for FTD CROR Demo Engine ;
• **CfP #1 topic : Open Rotor Engine Mounting System (EMS) JTI-CS2-2014-CFP01-LPA-01-01**
Open Rotor Engine Mounting System (EMS)  
JTI-CS2-2014-CFP01-LPA-01-01

- Design, manufacture, assembly and instrumentation of the Engine Mounting System for Flight Test Demo of the CROR Engine;
- EMS Set for characterization and validation through Partials tests: manufacture, assembly and instrumentation, mechanical tests.
- Structural Part linking the Engine to the pylon
- Partner is expected to provide
  - Contribution to the EMS specifications
  - Technology proposals in order to challenge the mass of the EMS
  - a qualified EMS for demonstrator testing

Type of action: IA  
Programme Area: LPA  
JTP Ref.: WP1.1.3.CROR Demo Engine  
Indicative Funding Topic Value: 2000 k€  
Duration: 72 month  
Start Date: 09-2015

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II. **Support to future CROR and UHBR propulsion system maturation**

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<td>Support to future CROR and UHBR propulsion system maturation</td>
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**Short description (3 lines)**

This topic consists of key activities dedicated to the maturation of future CROR and UHBR propulsion system integration from TRL3 to TRL6. The main areas of activities are aerodynamic and acoustic calculations, wind tunnel acoustic liners development and flight-test ground instrumentation & chase aircraft as well as blade/fuselage impacts calculations & tests.
III. Development of advanced laser-beam welding technology for the manufacturing of structures for titanium HLFC structures

<table>
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<tr>
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<td>WP Level 1.4 – HLFC Large Scale Demonstration</td>
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Identification | Title
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JTI-CS2-2014-CPW01-LPA-01-03 | Development of advanced laser-beam welding technology for the manufacturing of structures for titanium HLFC structures.

Short description (3 lines)
Development of process and system technology for reproducible laser welding and straightening of titanium structures for Hybrid Laminar Flow Technology (HLFC) structures with the assistance of an FE-based process for laser welding and straightening, including 3D deformation and residual stress prediction.
Assignment of the IADP LPA-CFP01 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

CS2 Info Day CFP#1, Paris 3rd Feb. 2015
LPA PF2 - Overview of the CFP01 topics

<table>
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<th>WP 2.2.2.1</th>
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<tr>
<td>Title</td>
<td>COST REDUCTION ON COMPOSITE STRUCTURE ASSEMBLY—Innovative blind fastener inspection technology for quality control</td>
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<tr>
<td>Indicative Funding Topic Value (in k€)</td>
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<tr>
<td>Duration of the action (in Months)</td>
<td>36 months</td>
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Short description
The expected outcomes are the definition, development and prototype realization of an innovative inspection monitoring process for specific and complex high strength blind fasteners that pose a challenge in terms of online process monitoring in typical aerospace assembly application.

Figure 1: Threaded stem fastener installation sequence (cross sections)
LOCOMACHS is an EU project nearly at the end, we know already that the developed solution is not applicable in our industrial context.
**Title**
RAPID ASSEMBLY OF BRACKET FOR STRUCTURE-SYSTEM INTEGRATION

<table>
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<td>Duration of the action (in Months)</td>
<td>36 months</td>
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</table>

**Short description**

The aim of this work package 2.2.2.2, is to deliver alternative technologies for rivet less brackets assembly. A first step will be to identify and perform pre-screening tests in order to assess the potential of the technologies.

A down selection will be performed and a more complete set of tests will be done in order to pre-qualify the most promising one or two technologies.
## Joint Technical Programme (JTP) Ref.

<table>
<thead>
<tr>
<th>Title</th>
<th>LPA 02-04</th>
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<td>LPA PF2 - Overview of the CFP01 topics</td>
<td>WP 2.2.3.1</td>
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### Overview

**Title**: Automation in Final Aircraft Assembly Lines and Enabling Technologies

<table>
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<tr>
<th>Topic Number</th>
<th>JTI-CS2-CFP01-LPA-02-04</th>
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<td>Start Date</td>
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**Short description**

Development of automation concepts and technologies to radically increase the use of automation systems in Aircraft Section Assembly (MCA) and Aircraft Final Assembly (FAL) including concepts for realization of industry 4.0 approach. Linked to JTP chapter 6.6 (WP 2.2.3).

Applicants shall have capacities and testing facilities to deliver adequate automation systems and shall have a proven knowledge with aircraft certification and qualification procedures.

### Major Components

- **Standard Equipping:** Flexible Handling Device
- **Assembly**
- **Customized Equipping:** Digital Printing of Customized Electrics

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CS2 Info Day CFP#1, Paris 3rd Feb. 2015
### Environmental Friendly Fire Suppression

<table>
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<tr>
<th>Joint Technical Programme (JTP) Ref.</th>
<th>WP 2.2.6.2 – Innovative Physical Integration Cabin-System-Structure</th>
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<td><strong>Topic Number</strong></td>
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<td><strong>Partners requested</strong></td>
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**Short description:**

Design, development, and testing of an environmental friendly fire suppression system for aircraft cargo holds. Proof of fire suppression performance against applicable performance standards. Demonstration of fire suppressant distribution and agent hold time.

Applicants shall have a proven strong expertise in performing fire tests as well as environmental test acc. to RTCA-DO 160F / EUROCAE ED-14.
LPA PF2 - Overview of the CFP01 topics

**Title**

Development of Thermoelastic Stress Analysis for the detection of stress hotspots during structural testing

**Indicative Funding Topic Value (in k€)**

350 k€

**Duration of the action (in Months)**

36 months

**Start**

09-2015

The objective is to prove the feasibility of applying Thermoelastic-Stress Analysis in a structural test environment for detecting stress hotspots. The detection and quantification of localised stress will help to reduce the product development time, risk and cost.

Figure 1: Overall plan for the development of TSA as a method for identifying Stress Hot-Spot during structural testing.
Assignment of the LPA-CFP01 topics
### X. Process and Methods for E2E Maintenance Architecture development and demonstrations and solutions for technology integration

<table>
<thead>
<tr>
<th>Type of action (RIA or IA)</th>
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<tr>
<td>LPA PL3 WP3.6 - 1</td>
<td>Process and Methods for E2E Maintenance Architecture development and demonstrations and solutions for technology integration</td>
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Short description (3 lines):

General WP3.6

LPA WP3.6 **Maintenance** is structure in multiple Sub-Work packages providing the major integration and demonstration deliverables for the End-To-End service architecture and its enablers, such as aircraft level solutions for structure and system health monitoring and management, collaborative environment to connecting all actors and providing the integration into the airline operational fleet and maintenance environment.

This research oriented call for proposal **Process and Methods for E2E Maintenance Architecture development and demonstrations and solutions for technology integration** is addressing the following aspects:

- the ability to define and develop service oriented architectures for the legacy fleet
- the capability to evaluate the efficiency and performance of an E2E Architecture
- the ability to integrate key fundamental technology bricks for e.g. structure health monitoring into and condition based maintenance concept
LPA PF3 - Overview of the CFP01 topics

WP 3.6 Maintenance

WP 3.6.1
E2E Maintenance operations definition and improvements

WP 3.6.1-1
Service & Operation Design

WP 3.6.1-2
E2E Architecture Specific Capacities

WP 3.6.1-3
E2E Architecture & IHMM Development

WP 3.6.1-4
E2E Architecture Evaluation

WP 3.6.2
Prognostics and Condition Based Maintenance

WP 3.6.2-1
Structural Health Monitoring

WP 3.6.2-2
System Prognostic

WP 3.6.2-3
Prognostic and SHM integration in Health Management systems

WP 3.6.3
Fleet data management

WP 3.6.3-1
Collaborative Environment

WP 3.6.3-2
Data Consolidation Environment and Data Analytics

WP 3.6.3-3
Maintenance Planning and Optimization

WP 3.6.3-4
Configuration Management

WP 3.6.4
Maintenance execution

WP 3.6.4-1 Mobile Tools for Maintenance execution enhancement

WP 3.6.4-2 Communication Infrastructure

WP 3.6.4-3 IVV

WP 3.6.4-4 Impact Assessment

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### Aircraft System Prognostic solutions integrated into an airline E2E maintenance operational context

<table>
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<tr>
<th>Type of action (RIA or IA)</th>
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<td>JTI-CS2-2014-CFP01-LPA-03-02</td>
<td>Aircraft System Prognostic solutions integrated into an airline E2E maintenance operational context</td>
<td>Demonstration of system health monitoring and prognostic architectures (on-board/on-ground solutions) for selected system use cases (e.g. APU, pneumatic and electrical power generation system) for large passenger aircrafts. Demonstration of specific prognostic solutions (e.g. data processing, failure mode identification, prognostic algorithm, degradation models, etc.) and its integration into the overall Integrated Health Monitoring Management System. Development and demonstration of the efficiency of augmented reality based maintenance tools making use of information as provided by the integrated health monitoring system is addressed.</td>
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</table>
This enabling aircraft technology oriented call for proposal Aircraft System Prognostic solutions integrated into an airline E2E maintenance operational context is addressing the following aspects:

- Capabilities to develop, adapt and integrate system health monitoring solutions with prognostics concepts for use case dedicated to APU, pneumatic and electrical power generation systems for typical short range type of aircraft applications
- Capabilities to develop and demonstrate aircraft/system level prognostics solutions as services offers to airlines for maintenance planning and maintenance execution purposes
- Ability to integrate these prognostics solutions into an aircraft/ground based IHMM platform
- Capability to integrate above prognostic solutions with airline maintenance operational environments (e.g. Maintenance Information Systems and multi-type of aircraft fleet context provided by short- and long range type of large passenger aircrafts)
- Capability to use health management information as provided above among other maintenance relevant information with other technologies supporting maintenance task execution such as augmented reality solutions
LPA PF3 - Overview of the CFP01 topics

Conference: CS2 Info Day CFP#1, Paris 3rd Feb. 2015
LPA PF3 - Overview of the CFP01 topics

XII. Airline Maintenance Operations implementation of an E2E Maintenance Service Architecture and its enablers

<table>
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<tr>
<td>JTI-CS2-2014-CFP01-LPA-03-03</td>
<td>Airline Maintenance Operations implementation of an E2E Maintenance Service Architecture and its enablers</td>
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Short description (3 lines)
Multidisciplinary Integration and real-life operational demonstration of E2E Maintenance Services Architecture, enabling effective cooperation between OEMs, suppliers, airlines and MROs featuring solutions with focus on mixed legacy fleet maintenance operations, technology enablers for Integrated Health Monitoring Management solution based on prognostics, maintenance planning and optimization, remote support and maintenance mobile tools/applications and its seamless integration in the existing maintenance operations landscape (incl. MIS)
This architecture operational integration and demonstration oriented call for proposal *Airline Maintenance Operations implementation of an E2E Maintenance Service Architecture and its enablers* is addressing the following aspects:

- Capability to develop value driven maintenance service scenarios, requirements and KPIs based on real life experience of the main maintenance actors (airlines, MROs, OEMs)
- Ability to integrate and implement above scenarios, requirements into E2E architectures and Integrated Health Monitoring and Management platforms (aircraft/ground)
- Capability to develop and demonstrate the technical infrastructure and data management, analytics solutions enabling the connection of all data sources (provided by airlines, MROs, OEMs, for aircraft data, schedule data, weather, resources, etc.) taking into account today’s maintenance information system standards (e.g. preferable as used by airlines/MROs participating to this call)
- Ability to provide integration and operational performance demonstration of prognostic solutions, configuration management, maintenance planning and optimization solutions in an airline operational context (mixed fleet of short and long range type of aircrafts)
- Capabilities to adapt integrate and demonstrate the performance of maintenance mobile tool technologies with a remote support functions in real airline maintenance environment.
LPA PF3 - Overview of the CFP01 topics
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.