CfP10 Info Day: Technical Session

7th May 2019

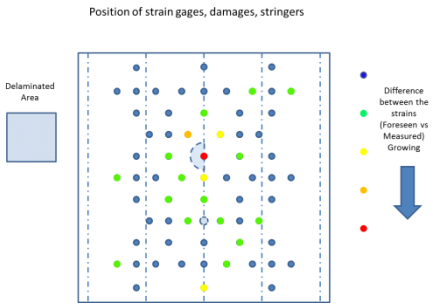
Location: CCI Occitanie (Blagnac, France)

JTI-CS2-2019-CFP10-REG-01-18

Title: Theoretical and experimental evaluations of strain field modification induced by flaw in loaded composite structures.

WP Location: REG IADP - WP 3.1; WP 3.2

Objectives:



To enhance the Technology Readiness Level of a SHM Method using an algorithm based on passive strain sensor utilization, through:

- Modelling of strain modification around flaws in composite structures.
- Validate the modelling through tests on specimens and on element with defects and/or damages.
- Morphology definition of diagnostic indications provided by the SHM software, through virtual testing on damaged representative subcomponents and structures, with different type, size and positions of the flaws.

JTI-CS2-2019-CFP10-REG-01-18

Tasks description:

- Task 1: **Modelling of the strain field modification induced by the presence of flaws, with different kind of morphology and size.**

Activities
Flaws definition for modelling, with different kind of morphology (i.e. delamination, debonding, and so on) and size.
Flaws modelling based on the known information and flaws morphology. In this case, it shall be defined how the partners intend to model flaws, like delamination or damaged area, etc.
Specimens and Elements definition to be tested in tasks 2 and 3, it shall be defined in terms of geometry, materials, lay-ups and testing procedures.
Engineering evaluation of the test results obtained from tasks 2 and 3 for the flaws model validation or tuning. In this case, we shall intend to compare the experimental with theoretical data (by FEM).

The information about the reference full scale structure to model (design, material properties and loads) will be made available for the activities covered by this proposal.

JTI-CS2-2019-CFP10-REG-01-18

Tasks description:

- Task 2: **Experimental determination of the strain field modification induced by the presence of flaws, with different kind of morphology and size, on composite specimens.**

Activities
Definition of a plan for the artificial defects fabrication and for impact damaging. In phrase, a suitable NDI procedures to check the outputs from the fabrication process shall be defined.
Specimens fabrication with materials that shall be representative of the reference test article. The panels for specimen fabrication will be made available, including defects if required. The partners will only perform impact damage as required by the test plan, as well as NDI checks and, if necessary, destructive investigations on the panels and specimens obtained.
Specimens instrumentation and testing. A sufficient number of strain gages and/or rosettes shall be put on the specimens in order to record the strains distribution in the flaw nearby.
Test report including also the test procedures and results shall be provided.

JTI-CS2-2019-CFP10-REG-01-18

Tasks description:

- Task 3: **Experimental determination of the strain field modification induced by the presence of flaws, with different kind of morphology and size, on composite elements.**

Activities
Definition of a plan for the artificial defects fabrication and for impact damaging. In phrase, a suitable NDI procedures to check the outputs from fabrication process shall be defined.
Elements fabrication with materials shall be representative of the reference test article. The elements will be made available, including defects if required. As elements, this proposal shall deal with mono or multi stringers panels. The partners will only perform impact damage as required by the test plan, as well as NDI checks and, if necessary, destructive investigations on the panels.
Elements instrumentation and testing. A sufficient number of strain gages and/or rosettes shall be put on the elements in order to record the strain distribution in the flaw nearby.
Test report including also the test procedure and results shall be provided.

JTI-CS2-2019-CFP10-REG-01-18

Tasks description:

- Task 4: **Virtual morphology definition of diagnostic indications provided by the SHM software on damaged representative subcomponents, with different size, type and positions of the flaws.**

Activities
FEM model of a representative subcomponent, in pristine condition shall be built. A CATIA model of a representative subcomponent will be provided for the activities.
Virtual testing on the FEM model in pristine condition and under different loads condition (they will be provided) shall be performed. Then the strains field in pristine conditions shall be provided to a specific SHM software, which be made available for the activities.
Development of FEM subcomponent models with flaws (the type of flaws have just defined into the task 1).
Virtual testing on the FEM models with flaws under different loads condition shall be performed. And the strains distribution shall be provided to a SHM software, this latter will issue a colored mapping with the indication of all detected defects on the reference subcomponent.
Correlation between flaw types and sizes and software SHM indication. This shall make possible to create a sort of a flaw-mapping database of subcomponent.

JTI-CS2-2019-CFP10-REG-01-18

Tasks description:

- Task 5: **Virtual morphology definition of diagnostic indications provided by the SHM software on damaged structures, with different size, type and positions of the flaws**

Activities
FEM model of a representative component, in pristine condition shall be built. A CATIA model of a representative subcomponent will be provided for the activities. As a representative component, for example we could focus on a fuselage barrel section.
Virtual testing on the FEM model in pristine condition and under different loads condition (they will be provided) shall be performed. Then the strains field in pristine conditions shall be provided to a specific SHM software, which be made available for the activities.
Development of FEM component models with flaws (the type of flaws have just defined into the task 1).
Virtual testing on the FEM models with flaws under different loads condition shall be performed. And the strains distribution shall be provided to a SHM software, this latter will issue a colored mapping with the indication of all detected defects on the reference component.
Correlation between flaw types and sizes and software SHM indication. This shall make possible to create a sort of a flaw –mapping database of component.

JTI-CS2-2019-CFP10-REG-01-18

Major Deliverables:

Deliverables			
Ref. No.	***Title - Description***	***Type****	***Due Date***
D1.2	Specimen and element Test Plan	R	T0+3
D1.3	FEM of pristine and damaged specimens and elements	R	T0+10
D1.4	Comparison between virtual and experimental results for validation of defect models	R	T0+13
D4,2	SHM software output (maps) for subcomponents pristine vs flaws stressed by typical loads.	R/D	T0+15
D5.2	SHM software output (maps) for full scale component pristine vs flaws stressed by typical loads.	R/D	T0+18

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

Milestones:

Milestones (when appropriate)			
Ref. No.	***Title - Description***	***Type****	***Due Date***
M1.1	Comparison between virtual and experimental results for validation of defect models	R	T0+13
M2.1	Test Results (for specimens)	R/D	T0+8
M3.1	Test Results (for elements)	R/D	T0+12
M4.1	SHM software output (maps) for subcomponents pristine vs flaws stressed by typical loads.	R/D	T0+15
M5.1	SHM software output (maps) for full scale component pristine vs flaws stressed by typical loads.	R/D	T0+18

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

JTI-CS2-2019-CFP10-REG-01-18

Special Skills:

- ❑ Design CATIA V5 capability.
- ❑ Stress analysis, Nastran/Patran capability.
- ❑ Composite specimens fabrication facilities and capability.
- ❑ NDI facilities and capability.
- ❑ Mechanical test facilities and capability including impact damage.
- ❑ Software capability

Indicative Funding Topic Value: 450 K€ (RIA)

Duration of the action: 18 Months

Any questions?

Info-Call-CFP-2019-01@cleansky.eu

Last deadline to submit your questions:
5th July 2019 (17.00 Brussels Time)