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TITLE
Evaluation and improvement of Open-Concept preliminary design tool

PREPARED Quagliarella Domenico DATE 15/12/2020

APPROVED Quagliarella Domenico DATE 15/12/2020


AUTHORIZED Mingione Giuseppe DATE 15/12/2020

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TITLE:

Evaluation and improvement of Open-Concept preliminary design tool

ABSTRACT:

Improvement and validation of the original Open-Concept preliminary design tool aimed to improve and expand the Regional Aircraft analysis and design tool based on Open-Concept.

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1 INTRODUCTION

At present, the main challenge in the aeronautical community is to reduce environmental impact. One of the most promising solutions is to introduce electrical or hybrid electrical propulsion.

One of the limitations of electrical propulsion is battery endurance. Thus, this solution is applicable for small general aviation aircraft, and several prototypes have been developed, but it is challenging for large passenger aircraft. Nevertheless, to have a global benefit, it is necessary to address commercial transport aircraft.

Therefore, the first step could be to evaluate the feasibility of electrical/hybrid propulsion on Regional Transportation Aircraft.

There is a need for preliminary design tools reliable and able to simulate hybrid electrical aircraft. Several companies have developed new preliminary design tools. The most promising is the Open-Concept tool [2]. CIRA is interested in evaluating and use the Open Concept tool since it has already performed a preliminary assessment and evaluation. Open-Concept is an Open source tool adapted explicitly for electrical/hybrid aircraft design, optimization, which includes modules to evaluate electrical component cooling.

Nevertheless, this tool is not user friendly and has been specifically designed for general aviation aircraft.

1.1 Scope

The applicant is requested to improve and validate the original Open-Concept preliminary design tool and to:

1. Improve and expand Regional Aircraft analysis and design tool based on Open-Concept
2. Study and improve thermal management software section
3. Modify the tool for the simulation of Hydrogen fuel-cell propelled aircraft
4. Together with CIRA modify the tool to include simulation of non-conventional configurations such as Distrusted Propulsion Aircraft

The activities performed in this contract framework are identified as ‘The Project’ in this document.

1.2 Applicability

This document is performed in the framework of the REG-CLEAN SKY IRON project [1]

1.3 References

- [1] IADP Regional Aircraft Grant Agreement for Members – Clean Sky 2 Annex 1 - Year 2020 – 2021
- [2] B. J. Brejle and J. R. R. A. Martins. Development of a Conceptual Design Model for Aircraft Electric Propulsion with Efficient Gradients. Electric Aircraft Technologies Symposium, 2018.

2 ACTIVITY DESCRIPTION AND MAIN GOAL

The project is structured with work packages, as described in the following.

Four Workpackage have been identified:

2.1 WP 1: Improvement of Regional aircraft design tool

The applicant will study the Open concept tool, install the tool on its own machine and will support CIRA in installation of the tool on CIRA machine, and modify the Open-Concept tool for a Regional aircraft simulation.

The item to be modified will include, but not only:

- a. Updated weight module for Regional aircraft simulation
- b. Volume management module addition
- b. Integration and improvement of DOC module
- c. Optimization module update and expansion

The applicant will provide the updated version to CIRA with the limitation described in paragraph 7.

D1.1: Report describing tool update (M0+1)

D1.2: Provision to CIRA updated Open-Concept system (M0+1)

2.2 WP 2: Study of Open Concept Thermal management module

The applicant will study and test the thermal management tool included in Open-Concept. If required, he will propose and will implement modifications.

D2.1: Report describing thermal management module and provision to CIRA updated Open-Concept system (M0+6)

2.3 WP 3: Introduction of Fuel Cells and Hydrogen propulsion models in Open Concept

The applicant will perform a study to evaluate the required modification of the Open-Concept tool to implement Fuel Cell simulation.

D3.1: Report describing Fuel cell implementation (M0+12)

D3.2: Provision to CIRA updated Open-Concept system including Fuel Cell simulation module (M0+12)

2.4 WP 4: Impact of introduction of non-conventional solutions (DEP, Tip propellers ...)

The applicant will perform this activity in cooperation with CIRA. The impact on the Open-Concept tool for the simulation of non-conventional configurations such as Distributer Propulsion will be studied and evaluated.

Modification to the Open-concept tool will be implemented and tested.

D4.1: Report describing required modification for non-conventional configuration study and provision to CIRA updated Open-Concept (M0+12)

2.5 WP 5: Open Concept training

The applicant will support CIRA in implementing the Open-Concept tool on CIRA machines and will provide several training sessions to learn the tool use.

The training session will be performed remotely, via Microsoft-Team or equivalent tool. The applicant will provide training with the following schedule:

1. Session 1: Introduction of Open-Concept, installation use, and application to a Regional aircraft at M0+1
2. Session 2: Open-Concept thermal management tool at M0+6
3. Session 3: Open-Concept Fuel cell implementation at M0+12

3 MILESTONES

The following Milestones and review are planned:

M1	Provision of deliverables D1.1 and D1.2 and training session 1	M0+1
M2	Provision of deliverables D2.1 training session 2, D3.1	M0+6
M3	Provision of deliverables D3.2, training session 3, D4.1	M0+12

4 MEETING AND PROJECT REVIEW

A progress meeting is planned (via Microsoft Team) each month. In addition to the periodic meeting, two reviews are planned:

- a. A design review at month 1 to verify the fulfillment of Milestone 1
- b. A Critical Design review at month 6 to verify the fulfillment of Milestone 2

5 TIME SCHEDULE

WP	1	2	3	4	5	6	7	8	9	10	11	12
WP 1: Extension of Open Concept to Regional aircraft class												
WP 2: Study of Open Concept Thermal management module												
WP 3: Introduction of Fuel Cells and Hydrogen propulsion models in Open concept												
WP 4: Impact of introduction of non-conventional solutions (DEP, Tip propellers ...)												
WP 5: Open Concept training												

6 PAYMENTS

The cost of the activity is evaluated in 19,500 euros.

The payment will be divided into two parts:

1. First payment at Month 1 after Design review 1 (10,000 euro)
2. Second and final payment after the work completion

7 INTELLECTUAL PROPERTIES REQUIREMENTS

7.1 Background

The applicant shall notify in the offer the Background needed for the execution of the project to which they shall grant Access Rights.

CIRA at contract assignment will notify the Background that will be provided to the applicant for the execution of the project.

The Background list may be updated along the duration of the project.

All Background is and will remain the exclusive property of the Party owning it (or, where applicable, the third Party from whom its right to use the Background has derived) and except as otherwise provided for herein, no Party will be entitled to any right or license to any of the other Party's Background.

Unless otherwise agreed:

- each of the partners shall be entitled to use Background only for non-commercial royalty-free internal research activities basis, and without requiring the prior consent of the other joint owner(s), and
- each of the joint owners shall be entitled to otherwise Exploit Background only if the owners are given:
 - (a) at least 45 calendar days advance notice; and
 - (b) Fair and Reasonable compensation or alternative agreement is reached.

7.2 Results

The results obtained in this project have to be considered joint work subject to joint ownership.

Unless otherwise agreed:

- each of the joint owners shall be entitled to use their jointly owned Results for non-commercial research activities on a royalty-free basis, and without requiring the prior consent of the other joint owner(s), and
- each of the joint owners shall be entitled to otherwise Exploit the jointly owned Results and to grant non-exclusive licenses to third parties (without any right to sub-license), if the other joint owners are given:
 - (a) at least 45 calendar days advance notice; and
 - (b) Fair and Reasonable compensation or alternative agreement is reached.

The applicant and CIRA will nominate one or more reference person that will be in charge of joint results ownership management (ownership manager).

If within 45 days after the joint results exploitation advance notice given by one of the Party to the other party ownership manager this will not reply the exploitation will be considered approved. Nevertheless, granting a non-exclusive license to a third party will require explicit approval from the other Party.

7.3 Dissemination of Results

Each Party is encouraged to disseminate the results of the project. Nevertheless, a party willing to disseminate jointly-owned project results is requested to inform the other Party. If the other Party does not provide comments within 15 (fifteen) days, the dissemination can be considered authorized.

For the avoidance of doubt, a Party shall not publish Results or Background of another Party, even if such Results or Background is amalgamated with Party's Results, without the other Party's prior written approval.

The Parties undertake to cooperate to allow the timely submission, examination, publication, and defense of any dissertation or thesis for a degree which includes their Results or Background. However, confidentiality and publication clauses have to be respected.

7.4 Non-disclosure of information

All information in whatever form or mode of transmission, which is disclosed by a Party (the "Disclosing Party") to any other Party (the "Recipient") in connection with the project during its implementation and which has been explicitly marked as "confidential", or when disclosed orally, has been identified as confidential at the time of disclosure and has been confirmed and designated in writing within 15 days from oral disclosure at the latest as confidential information by the Disclosing Party, is "Confidential Information".

Evaluation and improvement of Open-Concept preliminary design tool

The Recipients hereby undertake in addition and without prejudice to any commitment of non-disclosure for a period of 10 years after the end of the project:

- ✓ Not to use Confidential Information otherwise than for the purpose for which it was disclosed;
- ✓ Not to disclose Confidential Information to any third party without the prior written consent of the Disclosing Party;
- ✓ To ensure that internal distribution of Confidential Information by a Recipient shall take place on a strict need-to-know basis; and
- ✓ To return to the Disclosing Party on demand all Confidential Information which has been supplied to the Recipients including all copies thereof and to delete all information stored in a machine-readable form. If needed for the recording of ongoing obligations, the Recipients may, however, request to keep a copy for archival purposes only. However, Recipients, which are public institutes, may keep a copy of Confidential Information if and to the extent such information shall be kept according to mandatory national laws and regulations.

The Recipients shall be responsible for the fulfillment of the above obligations on the part of their employees and shall ensure that their employees remain so obliged, as far as legally possible, during and after the end of the project and/or after the termination of employment.

The above-mentioned obligations of confidentiality shall not apply for disclosure or use of Confidential Information, if and in so far as the Recipient can show that:

- The Confidential Information becomes publicly available by means other than a breach of the Recipient's confidentiality obligations;
- The Disclosing Party subsequently informs the Recipient that the Confidential Information is no longer confidential;
- The Confidential Information is communicated to the Recipient without any obligation of confidence by a third party who is in lawful possession thereof and under no obligation of confidence to the Disclosing Party;
- The disclosure or communication of the Confidential Information is foreseen by provisions of the Grant Agreement;
- The Confidential Information, at any time, was developed by the Recipient completely independently of any such disclosure by the Disclosing Party; or
- The Confidential Information was already known to the Recipient prior to disclosure.

The Recipient shall apply the same degree of care with regard to the Confidential Information disclosed within the scope of the project as with its own confidential and/or proprietary information but in no case less than reasonable care.

It is understood and acknowledged by the Parties that the disclosure of Confidential Information doesn't mean any transfer of or change in the ownership to such information.

Each Party shall promptly advise the other Party in writing of any unauthorized disclosure, misappropriation, or misuse by any person of Confidential Information as soon as practicable after it becomes aware of such unauthorized disclosure, misappropriation or misuse.

7.5 Duration

All requirements of paragraph 7 are applicable for 10 years after the completion of the project.

8 PERSONNEL TRAVEL AND ACCOMMODATION

The supplier shall take care of the travel and accommodation costs of its specialized personnel.

9 REQUIREMENTS OF THE APPLICANTS

The applicant should demonstrate the following mandatory capabilities:

1. Knowledge and capability to updated and modify Open-Concept preliminary design tool;
2. Knowledge and use of Python and MDAO based software;
3. Expertise in preliminary aircraft design;
4. Expertise in hybrid aircraft thermal management simulation;
5. Capability to implement and develop hydrogen and Fuel cell aircraft preliminary design tool based on OPEN-CONCEPT tool.

10 PRESENTATION OF THE OFFER

The applicant will provide a short technical offer. The offer shall contain four sections:

1. A section describing the activity to be performed. This section should contain an explicit acceptance of technical activities and conditions provided in this document, or in the alternative, describe how the proposed activities will differ from what is required in this document.
2. A section describing the company background on the specific topic described in this request for offer.
3. List of Background required for the execution of the project as described in section 7.1
4. Elements useful for the price construction (planned number of man-owner and number of involved personnel, other costs, ...).