

## **SECOND DRAFT**

Advanced Student Team Research in space Industry (ASTRI)

# **End-to-end Earth Observation constellation mission study**

An ASTRI project proposal by Thales Alenia Space & Telespazio

### **Objective :**

Scope of this project is to develop a mission/system analysis methodology for analysing a Constellation of Earth Observation satellites. The constellation includes combined optical, radar and hyperspectral sensors.

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## 1. Context

On June 21<sup>st</sup>, 2017, a group space industries (all members of Eurospace: Airbus Defence & Space, ArianeGroup, Avio, OHB, RUAG Space, Telespazio, Thales Alenia Space) and Universities (Conservatoire National des Arts et Metiers of Paris, Ecole Polytechnique Fédérale de Lausanne, KTH Royal Institute of Technology of Stockholm, University of Montpellier, La Sapienza University of Rome, Universidad Politecnica de Madrid, Von Karman Institute of Brussels) have signed at Le Bourget a memorandum of understanding on an education partnership agreement aiming - through their joint and coordinated efforts - at organizing for multi-nationality teams of students a structured transition between their educational path and their entry into the professional world.

- This is intended to take place by means of dedicated projects to be developed by teams of students coming from universities in different countries and working on industry's selected priorities, teams being selected by industry via competition of international teams.
- This initiative has been given the name of: "**Advanced Student Team Research in space Industry**" (ASTRI)
- Each ASTRI Programme is intended to devote globally eighteen months to carry out a project in industry premises and/or at the University
- **Telespazio** and **TAS** as member of the WorkingGroup 3 are presenting the current Project. "End to end study mission for a earth observation satellite constellations", with specific focus on the following items:
  - Develop a framework to implement end-to-end mission simulators and demonstrators for a combined multi-sensor (optical, radar, hyperspectral)
  - Design critical subsystem of the Ground Segment :
    - Constellation Flight Dynamics
    - Multisatellite/ multipayload Constellation Mission Planning
    - Innovative Security technique for ground to space communication
  - Define concept of operations for a Multisatellite/multipayload constellation

## 2. Proposed activities

The following activities are proposed:

- Define the needs (user req. document) and architecture, identify reusable assets,

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- Develop an end-to-end simulation infrastructure for earth observation missions
- Realistic demonstration consisting in optimizing the architecture of a constellation combining optical and radar sensors.
- Define architectures of Ground Segments with special focus on the critical topics like:
  - Constellation Flight Dynamics
  - Multisatellite/ multipayload Constellation Mission Planning
  - Innovative Security technique for ground to space communication
- Define preliminary concept of operations for a Multisatellite/multipayload constellation

The methodology used for the study will start by the stakeholder/client analysis and will conclude with a sound verification of the provided services (downstream) in order to allow verification of design not only at the level of space platforms or payloads but up to the ground segment and to the delivery of the service to the client.

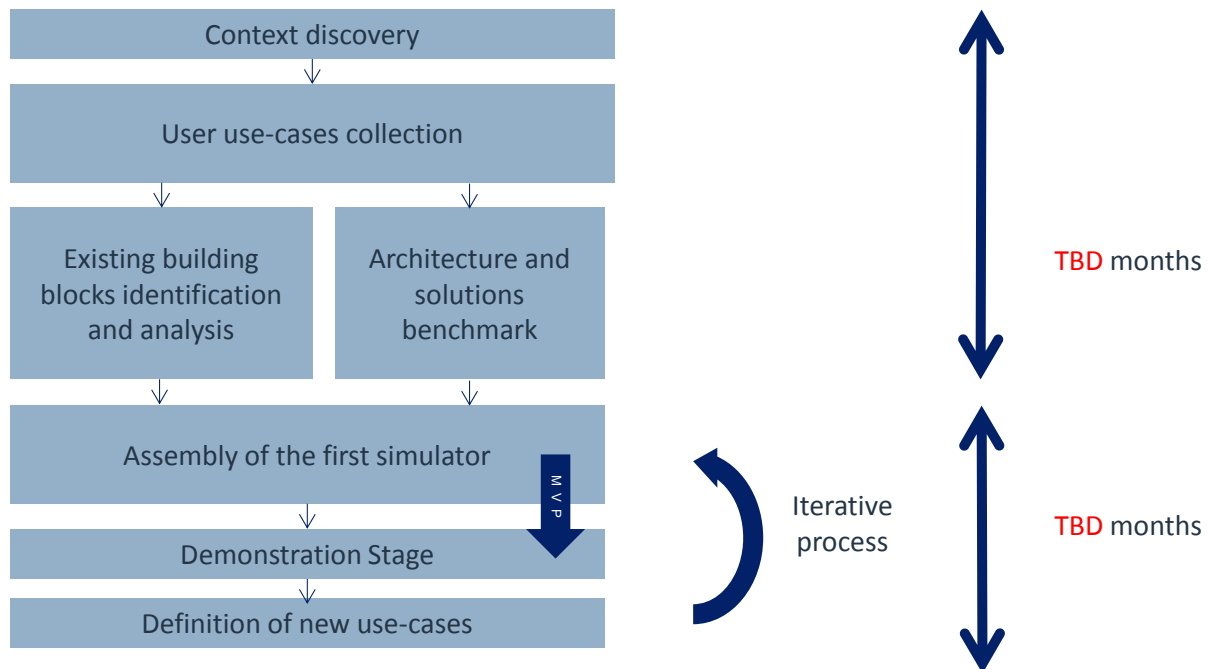
The project will include the analysis of the different simulation bricks already available in the different domains, and the selection of the suitable architecture and for each simulation domain (products, system, satellite, ground instrument, sub-system) integrate domain simulator in the framework.

The proposed development approach is based on the definition of several MVP (Minimal Viable Product) along the period ensuring that the user needs are captured and covered and enabling a progress monitoring at the end of each period through a viable demonstrator.

The final deliverable is a framework with a concrete demonstrator (in a form suitable for a display in a customer show-room) of an earth observation mission.

The following figure shows the Study Logic of the Project

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## 3. The team

### 1. Team composition

The team will be composed of maximum XXX students.

Day to day follow-on, guidance and advices will be performed by a team of composed of one person per industrial organisation (TAS-I, TAS-F, TPZ) called the core team.

The team will have interaction with the different domain experts and the work will be reviewed at each milestone by a steering board composed of users of the solution.

### 2. Ideal team competencies

According to the objectives of the project and the experience from industry, the following competencies has been identified, that will be , if necessary, either acquired by the team itself either compensated by industrial expertise

Competencies identification :

- data exploitation and downstream

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- mission analysis and operations
- optical/radar payload engineering / image quality
- satellite engineering
- mechanical/thermal engineering (TBC)
- software architecture and development

## 4. Way of working and values

The objective of the ASTRI project is to organize for multi-nationality teams of students a structured transition between their educational path and their entry into the professional world and this project is committed to this goal.

The concept of intercultural and inter-disciplinary team is central here and team work spirit is mandatory for this project.

The objective of the core team is to empower the student team over controlling it. We promote also experiment, testing and learning over plans. Agility and capability to deliver user value within the project time frame is key for the project.

We will adopt the concept of MVP (Minial Viable Product) where at the end of each 3 periods end we will have a product capable to deliver value for the users.

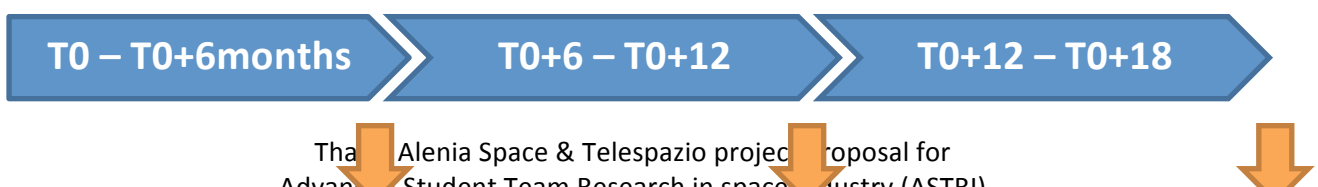


## 5. Planning

The project duration is 18 months split into 3 periods of 6 months (called P1, P2 and P3)

At each end of period a review with an extended industrial team (with regard to the core team flowing daily activities) will be held.

Obviously planning refinement will be discussed within the team except but for academic and legal



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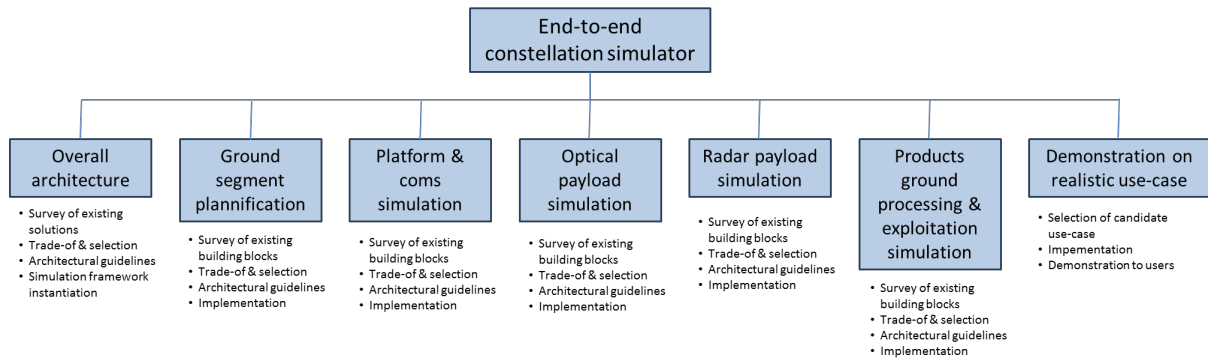


constraints the 3 periods of 6 (exactly) months are fixed.

## 6. Work packages

### 1. WBS

The intend here is not to define a rigid work-package breakdown structure but to spot the different tasks that has already been identified at this stage of the project.



### 2. Activities description

To be detailed

## 7. Constraints

### 1. Working Place

The working places are :

- Thales Alenia Space in France, 5 allée des Gabians, 06156 CANNES la BOCCA
- Thales Alenia Space in Italy, Via Saccomuro 19, 00131 Rome
- Telespazio in Italy , Via Tiburtina 965, 00156 Rome

It is foreseen for the team to be located alternatively at the three places following the scheme here after (which may be subject to change following discussion with the team).

Period	WP implied	Nb of person	Location
0-6 months		4	TAS France
6-12 months		2	TAS Italy
6-12 months		2	TPZ Italy
12-18 months		2	TAS Italy
12-18 months		2	TPZ Italy



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Should a different logistic organization better comply with proposed project needs, it will be considered and implemented in alternative with respect to the basic logistic assumption proposed here above.

## 2. Duration

The total duration of the project is 18 months, both industrials and student team are committed to that duration within the limits fixed in each individual internship contracts.

## 3. Intellectual Property Rights

All the intellectual property rights are vested to the hosting companies as mentioned in each individual internship contracts.