



# ASTRI INITIATIVE CALL FOR PROPOSAL: AVIO PROJECT P1

## 1. TITLE

Feasibility of application of Vega Space System to the Extended Orbital Experience.

## 2. DEFINITIONS

APT	Astri Project Team. The core team of project, mandated to reach the work scope. It is based on selected graduates of ASTRI participant universities.
Board	Astri Board, in the function of approval of projects, as well as of selection of teams.
Avio CTO	Chief Technical Officer in Avio, as tutor of the APT and enabler of Avio infrastructure and resource availability.
Avio Technical Director	arranges and chairs the review board.

## 3. SUBJECT

Define mission requirements, perform system feasibility studies and preliminary design for the elements for the innovative Vega Space System, which is intended to recursively extend the space transportation service offered by Vega family.

The scope of the Vega Space System (VSS) is to offer a unified complete set of solution and services for orbital exploitation and space transportation, including exploration missions, based on Vega family launch vehicles and on a set of specific modules (possibly third party as SSMS, Venus, Space Rider), most of them existing or, to different extents, currently under development.

The distinctive characteristic of the Vega Space System is to define standard interfaces versus payloads and a Kit approach to mission, which allows the lower cost for any mission.

Vega Space System will provide a world of opportunities to space segment users:

- Periodic IOD/IOV charter to Low Earth Orbit.
- Download to airstrip of orbital payloads up to 800kg through Space Rider.
- Constellation satellite deployment to Final anomaly.
- Significant Orbital Transfer or Orbital Plane Change of single or multiple Payloads.
- Long orbital life and deorbiting for non-separated Payloads.



- Extended Orbital Experience, enabling payload to drive AVUM bus, getting on demand services of Attitude Control, Orbital propulsion and maneuvers, Telemetry, Power.

## 4. WORK SCOPE DESCRIPTION

The team, supported by Avio expertise and tutored by Avio chief technical officer has the objective to build-up a concept, feasibility and preliminary design phase, for the innovative Vega Space System, including set-up of Mission Requirement Definition, General Specification, General Interface Specification, and Technical Requirement Specification for the main subsystems.

## 5. PHASING

The workscope shall be phased in three main phases.

### **Phase T Team Set-up**

Duration of the activity is tentatively 1 month, (to be verified after selection from Board).

$T_{ini}=T_0$ ,  $T_{final}=T_0+1m$

#### ***TASK DESCRIPTION:***

A preliminary phase, specific for the set-up of the APT, implies a focused training, to allow team members to operate in the industrial environment: i.e. acquaintance to Vega System (including main documentation), to relevant ECSS, to Avio infrastructure, tool set-up.

### **Phase 0 Mission Requirements**

Duration of the activity is tentatively 4 month, (to be verified by APT).

$T_{ini}=T_0+1m$ ,  $T_{final}=T_0+5m$

#### ***INPUT:***

Vega Space System High Level Requirements, Vega Space System existing elements MRD, Vega System documentation.

#### ***TASK DESCRIPTION:***

On the basis of High Level requirements perform a mission analysis phase for the VSS, including required mission and performances, ending up to a mission requirements for the whole spectrum of missions currently devised for Vega Space System. Several mission studies based on use cases as orbital transfer, long orbital stay, IOD/IOV, multiple deployment, Extended Orbital Experience are foreseen within the scope of the activities. Different missions will be compared in terms of pairing through the satellite database and evaluated with regards of the competitive market. Outcomes will be reviewed in a Mission Definition Review.

#### ***OUTPUT:***

VSS MRD justification document,

VSS MRD

### **Phase A Mission Requirements**

Duration of the activity is tentatively 7 month, (to be verified by APT).

$T_{ini}=T_0+5m$ ,  $T_{final}=T_0+12m$



**INPUT:**

VSS MDR outcomes.

**TASK DESCRIPTION:**

On the basis of MDR outcomes and the data from Mission Phase, define a preliminary system architecture and an operation logic. Define and consolidate the functional and product breakdown, identify a technical solution and a model philosophy.

Verify the technical and program feasibility, of the VSS missions, on the basis of the selected architecture. Identify possible critical technologies.

The task will be closed by a Preliminary Requirement Review.

**OUTPUT:**

VSS Preliminary Technical Specification,

VSS Interface Specification

Vega Extended Interface with Payloads

Vega General Specification preliminary update

Feasibility File

## 6. EXPECTED OUTPUT

The team will document and trace the tasks through deliverable documents. Outcomes will not be checked by Avio (unless required by team to tutor). The team will be responsible for the content.

The team will submit the work to formal review at project cornerstones (i.e. MDR and PRR). The board, chaired by Avio Technical Director, will authorize the step ahead to next phase.

## 7. TEAMWORK AND REQUIRED DISCIPLINE

The ASTRI Project Team (APT in the followings) will be largely autonomous in project organization, starting from work breakdown, establishment of functional and product breakdown, phasing and planning, design choices and structure of documentation. The teamwork will be addressed by Avio CTO and main outcomes will be reviewed by a peer board chaired by Avio Technical Director and including academic stakeholders.

Avio engineering will support the team, providing tutoring when necessary, a suitable infrastructure and services, as well as complementing in engineering tasks not available at core team level (i.e. drafting, thermal and dynamic analysis, subsystem expertise....). Avio will make available a standard set of toolbox for the system task, but APT may decide to rely on different tool, when necessary.

Disciplines considered as necessary for the APT are listed in the followings:

- System Engineering
- Mission analysis (Orbital)
- Propulsion (chemical and electrical)
- Avionics



- Structures

Working competences required:

- Basic skill on Project Management
- Basic knowledge of european aerospace norms

The readiness of APT to the task will be evaluated at selection time by the Academic partners and ASTRI board. A correct level of readiness is mandatory to start-up of the project.

The share of roles and responsibilities within the team shall be defined by the team members and duly disclosed to Avio tutor (Avio CTO).

## **8. STUDENTS AND SELECTIONS**

Three students, from at least two universities for 12 months, with a competence blending coherent to enabling discipline, a large level of autonomy, and a remarkable commitment to success.

It is understood that selection of graduates applying to the call is performed at partner University level and approved at Astri Board.

Avio CTO may contribute to the selection process.

## **9. FORM OF CO-OPERATION**

Two options are available for students:

Option 1 six months of internship followed by limited contract for the remaining duration.

Option 2 full period covered by internship

Option 3 full period covered by limited contract

Avio will contribute to relocation expenses.

## **10. CONSTRAINTS**

### **WORKING PLACE**

The vast majority of the activities will take place in Avio SpA facilities in Colleferro (Italy), subjected to the relevant site regulations.

### **DURATION**

The project shall start in first quarter of 2018. It shall last for no more than 14 months.

### **INTELLECTUAL PROPERTY RIGHTS**

Avio will own intellectual property for the work done in the frame of the project. Avio will agree with the team participants specific conditions and reserve the right to protect intellectual property by suitable mean.

Avio requires team members to subscribe a non-disclosure agreement as far background information are concerned.