Announcement of Opportunity
For
The Second Flight of
The VEGA Small Launcher
(VERTA 1 Flight)

AO Issue Date: **July 24th, 2008**

Proposals Due: **September 30th, 2008**

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1 Introduction

VEGA is a small launcher developed by ESA composed of three solid propellant stages and a bi-liquid upper stage. The launch system has been designed to carry a 1500 kg Spacecraft on its reference low earth orbit mission (700 km circular polar).

The development has started end 2000 and now the VEGA launch system is in its qualification phase. The qualification flight is planned in November 2009 and will be followed few months after, at the end of the technical exploitation of the flight data's, by a flight qualification review.

The VEGA Research and Technology Accompaniment program (VERTA) has been engaged since 2006, oriented along three axes: the procurement of five launch services (VERTA flights), the customer service improvement (CSI) and the technology accompaniment of the production activities.

The objective of the VERTA flights is to demonstrate the flexibility of VEGA launch system. These launches will carry in priority ESA missions such as AEOLUS, SWARM, LISA Path Finder and PROBA 3.

The main activity of the Customer Service Improvement consists in developing the multiple launch capability for VEGA.

The beginning of VEGA exploitation phase will start with the five VERTA flights as from early 2010. The launch system will be operated by Arianespace from the European Spaceport (Centre Spatial Guyanais) in French Guiana in addition to the existing launchers fleet, Ariane 5 and Soyuz, providing the necessary capabilities and flexibilities to cover all Customers' needs.

The objective of this Announcement of Opportunity is to engage the Spacecraft selection process for VERTA 1 flight (VEGA second flight). The selection process is organised in two phases, an international Announcement of Opportunity (AO) followed by a Call for Proposal (CFP).

This Announcement is open to all types of Spacecrafts fulfilling the criteria mentioned hereafter with no restriction of nationality.

2 VERTA 1 Mission Objectives

The primary objective of VERTA 1 is to demonstrate the multiple Spacecrafts launch capability.

The following Spacecraft accommodations under the VEGA fairing are currently foreseen and will be adapted depending on the results of this AO:

1) Two Spacecrafts of the range of 300-500 kg,
2) One 300-500 kg range Spacecraft and several 100-150 kg ones,
3) All in 100-150 kg range (with possibility of having lighter Spacecrafts).

In addition, the VERTA 1 mission will provide a flight opportunity for tiny educational Spacecrafts that will be subject to another AO led by ESA Education Office.

3 Description of the Opportunity

3.1 General

By means of this AO and of the subsequent evaluation and selection process, ESA offers the opportunity of a flight for suitable Spacecrafts within the constraints of the VERTA programme.

3.2 Final Orbital Parameters

The candidate orbit currently under consideration for VERTA 1 mission is a Low Earth Sun-Synchronous orbit, in the 500-800 km altitude range.

The selection of the target orbit will be made by ESA on the basis of the results of this AO and the best technical and economical compromise.

The Bidders are therefore requested to investigate the possibility of different orbits utilisation for their spacecraft, or clearly state the strict limitation of their proposal to a specific orbit.

3.3 Principles of Eligibility

Any private and public entities, with no restriction of nationality, are invited to respond to this AO.

3.4 Requirements for the Accommodation of Spacecrafts

Bidders proposing Spacecrafts for accommodation on the VERTA 1 flight shall fulfil the following requirements:

a. Full compliance with the technical and operational constraints of the VERTA 1 mission

b. The development costs of the spacecraft(s) for the VERTA 1 flight are borne by the Bidder,

c. The spacecraft(s) of the VERTA 1 flight shall be compliant with the latest version of the Vega User's Manual (download at http://www.arianespace.com/site/documents/vega_man_index.html) and the launcher/Spacecraft interface specification, as appropriate.

d. The spacecraft of the VERTA 1 flight shall be tested, at the charge of the Bidder, to meet all VERTA 1 requirements as well as any additional testing requirements deemed necessary to ensure that the Spacecraft entails no risk to the flight.

e. The planning of the spacecraft has to be compliant with the VERTA 1 schedule.

f. The Bidder shall agree to the principle that due to the nature of the flight, ESA or Arianespace are not taking any insurance and no compensation may be claimed from the ESA or Arianespace in respect of delays, modifications, cancellations or unsatisfactory results, such as underperformance or launch failure.

g. The Bidder shall commit to provide the necessary technical inputs and deliverables in accordance with the VERTA 1 flight milestones and launch campaign preparation needs, it being understood that, in case of delays in the submission of deliverables not deemed

compatible with the launch campaign preparation schedule, the hardware will not be considered accepted for the VERTA 1 flight, without any claim for compensation.

4 Selection Procedure and Criteria

4.1 General Scheme

The selection procedure involves two competition cycles:

- this Announcement of Opportunity leading to a pre-selection of candidate Spacecrafts and to the selection of a reference VERTA 1 mission, followed by
- a Call for Proposal leading to the final selection of Spacecrafts.

4.2 Responses to the AO

In response to this AO, the Bidder is invited to submit a "Demande d'Utilisation de Lanceur Arianespace" (DUA) form attached in Annex 2, to demonstrate that all requirements described in section 3.4 can be met and to propose a financial contribution for the VERTA standard launch services activities described in Annex 3.

It is recommended that the Bidder also sends as soon as possible to ESA the Notice of Intent attached in Annex 1.

The Bidders' responses to the AO are to be delivered to ESA by September 30th 2008.

Any written communication shall be addressed to:

ESA Launcher Directorate
Mr Benoit GEFFROY
VEGA Program
ESA Headquarter
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France

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Fax: +33/ 1 53 69 77 29
Mail: benoit.geffroy@esa.int

with copy Mr Marco BOCCIARELLI
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00044 Frascati
Italy

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4.3 Selection Criteria

- **Compatibility with the Technical Constraints**
  - Ability to couple the Spacecraft with others
  - Spacecraft orbital parameters flexibility

- **Compatibility with the Programmatic Constraints**

  - Compatibility with VERTA 1 objective schedule
  - Spacecraft's development status and risk
  - Operability (launch campaign operations, safety aspects…)

- **Management/Contractual Aspects**

  - Competence and experience of the Bidder's team in all relevant areas

- **Financial contribution**

  - Financial contribution for the VERTA standard launch service activities (Annex 3)

Order of preference of Bidders: 1) bidders from States participating to the VERTA programme co-funding the costs of the VERTA 1 flight, 2) bidders under the jurisdiction of ESA or EU Member States, 3) other bidders.

4.4 Selection Activities

4.4.1 Pre-Selection

An ESA assessment panel, involving Arianespace experts, will:

- verify that the Bidders' responses meet the requirements of section 3.4,
- assess and rank the Bidders' responses using the evaluation criteria of section 4.3 and
- recommend to the ESA Director General a list of pre-selected candidate Spacecrafts as well as a reference flight configuration for VERTA 1.

The ESA Director General will decide on the pre-selection and Bidders not retained in this pre-selection will be notified by ESA.

4.4.2 Call for Proposal and conclusion of Memorandum Of Understanding

Pre-selected Bidders will be invited by ESA and Arianespace to respond to a Call for Proposal including a draft Memorandum of Understanding (MOU).

An ESA/Arianespace assessment panel will :

- verify that the Bidders' proposals comply with the requirements of section 3.4,
- evaluate the proposals using the evaluation criteria of section 4.3 and
- recommend to the ESA Director General a selection of baseline (and possibly back-up) candidate Spacecrafts.

The ESA Director General will decide on the baseline and back-up Spacecrafts, in compliance with the preference policy (see end of section 4.3) decided by the ESA Member States participating to the VERTA programme.

Each selected Bidder will conclude with ESA a MOU which will be the basis for the negotiation of the Launch Service Agreement (LSA) and which will in particular define the Bidders' financial contribution to the VERTA standard launch service activities.

4.4.3 Preparation and signature of the Launch Service Agreement

After signature of the MOU, Arianespace and the concerned Bidder will negotiate and finalise a LSA covering all launch service activities (VERTA standard launch service activities and complementary activities). The actual signature of the LSA by Arianespace will occur after completion of the following steps :

- ESA confirmation to Arianespace of the VERTA 1 mission configuration,
- Joint Arianespace/Bidder notification to ESA that the finalised LSA are fully compliant with the signed MOUs.

It has to be noted that the signed LSA will be the only legal instrument under which the Bidder procures the VERTA-1 launch services.

Each Bidder shall have full responsibility for securing adequate funding for its project and the launcher/payload related activities as described in the relevant chapter of the VEGA User's Manual (e.g. Spacecraft - Launcher interface meetings, reviews, support to the launch campaign, to launch and operations… according to VEGA User's Manual Chapter 7).

The Bidders shall keep the necessary visibility of the launch flight data's as described in the VEGA User's Manual.

Any background information proprietary to the Bidders shall be kept confidential and shall not be used for any purpose than the launch operations and the flight.

5 Schedule

The schedule for VERTA 1 Spacecrafts and mission selection and preliminary milestones for VERTA 1 mission realization are outlined hereafter.

5.1 VERTA 1 Spacecrafts and Mission Selection Schedule

Issue of AO	: July 22nd, 2008
Notice of Intent	: September 1st, 2008
AO Response Submission	: September 30th, 2008
ESA/AE issuing of Call for Proposal	: October 20th, 2008
Signature of the MOU's	: December 15th, 2008

5.2 VERTA 1 Mission Preliminary Milestones

Contractual Kick-Off	: December 2008 – January 2009
Target Launch Date	: 2nd Quarter 2010

ANNEX 1 SPACECRAFT NOTICE OF INTENT FORM

VERTA 1

NOTICE OF INTENT FORM

NAME OF THE PROPOSER:

MAILING ADDRESS:

Tel.:
Fax:
E-mail:

NAME OF THE PROPOSED SPACECRAFT:

BRIEF DESCRIPTION OF THE PROPOSED INSTRUMENT:

- Target orbit: (Hp × Ha × inclination; ω; RAAN)
- Spacecraft mass
- Spacecraft dimensions (protuberances, mechanisms…)
- Peculiar requirements concerning the launch service

ANNEX 2 DUA FORM

DUA FORM

Application to use Arianespace's launch vehicle (DUA)

1 Spacecraft description and mission summary

Manufactured by	**Model / Bus**
DESTINATION Telecommunication* Meteorological* Scientific* Others* Direct broadcasting* Remote sensing* Radiolocalisation*	
MASS • Total mass at launch kg • Mass of satellite in target orbit kg	*DIMENSIONS* • Stowed for launch m • Deployed on orbit m
FINAL ORBIT • Hp × Ha × inclination; ω; RAAN	*LIFETIME* TBD years
PAYLOAD • _____ Operational channels of _____ bandwith • Traveling wave tube amplifiers: _____ (if used) • Transmit Frequency range: _____ W • Receive Frequency range. _____ W • EIRP: ___ W *ANTENNAS (TM/TC)* • Omniantenna direction and location	
PROPULSION SUB-SYSTEM Brief description: TBD (liquid/solid, number of thrusters..)	
ELECTRICAL POWER Solar array description ___ (L x W) Beginning of life power ___ W End of life power ___ W Batteries description ___ (type, capacity)	
ATTITUDE CONTROL Type: ___ *STABILIZATION* • Spin* • 3 axis*	
COVERAGE ZONES OF THE SATELLITE TBD (figure)	

Include a 3D-view drawing of the spacecraft in stowed configuration with an exploded view and exact locations of main equipment with coordinate system. Preferably, a 3D CAD model should be supplied limited to 30Mo (IGES or STEP extension).

Note : * - To be selected.

1.1 Mission characteristics

1.1.1 Orbit description

Orbit parameters and its dispersions:

	Separation orbit	Spacecraft final orbit (if different)
• Perigee altitude	_____ ±_____ km	_____ km
• Apogee altitude	_____ ±_____ km	_____ km
• Semi major axis	_____ ±_____ km	_____ km
• Eccentricity		
• Inclination	_____ ±_____ deg	_____ deg
• Argument of perigee	_____ ±_____ deg	_____ deg
• RAAN	_____ ±_____ deg	_____ deg

Orbit constraints

- Any element constrained by the spacecraft (injection time limitation, aerothermal flux, ground station visibility…)

1.1.2 Launch window(s) definitions

1.1.2.1 Constraints and relevant margins

Targeted launch period/launch slot

Solar aspect angle, eclipse, ascending node,…

1.1.2.2 Targeted window

The targeted launch window shall be computed using the reference time and reference orbit described in the User's Manual if any. The resulting launch window must include the dual launch window, when applicable, as specified in the User's Manual for any launch period. The launch window's data is preferably supplied as an electronic file (MS Excel). Constraints on opening and closing shall be identified and justified.

1.1.3 Flight manoeuvres and separation conditions

1.1.3.1 Attitude control during flight and prior to separation

Any particular constraint that the spacecraft faces up to injection in the separation orbit should be indicated (solar aspect angle constraints or others).

Any particular constraint that the spacecraft faces after injection, during the Roll and Attitude Control System sequence prior to separation , should be indicated (solar aspect angle constraints or others).

1.1.3.2 Separation conditions

1.1.3.2.1 Separation mode and conditions

Indicate spinning or three-axis stabilization (tip-off rates, depointing, etc., including limits).

1.1.3.2.2 Separation attitude

The desired orientation at separation should be specified by the User with respect to the inertial perifocal reference frame [U, V, W] related to the orbit at injection time, as defined below:

U = radius vector with its origin at the center of the Earth, and passing through the intended orbit perigee.
V = vector perpendicular to U in the intended orbit plane, having the same direction as the perigee velocity.
W = vector perpendicular to U and V to form a direct trihedron (right-handed system [U, V, W]).

For circular orbits, the [U, V, W] frame is related to the orbit at a reference time (specified by Arianespace in relation with the mission characteristics) with U defined as radius vector with origin at the Earth center and passing through the launcher CoG (and V, W as defined above).

In case of 3-axis stabilized mode, two of the three S/C axes [U, V, W] coordinates should be specified. In case of spin stabilized mode, the S/C spin axes [U, V, W] coordinates should be specified.

Maximum acceptable angular rate and relative velocity at separation shall be indicated.

1.1.3.3 Separation conditions and actual launch time

Need of adjustment of the separation attitude with regard to the actual launch time (relative to the sun position or other) should be indicated.

1.1.3.4 Attitude adjustment

For specific multiple launch, Mission Analysis may lead Arianespace to request a slight adjustment of the desired orientation.

1.1.3.5 Sequence of events after S/C separation (for information only)

Describe main maneuvers from separation until final orbit including apogee firing schedule.

1.2 Spacecraft description

1.2.1 Spacecraft Systems of Axes

The S/C properties should be given in spacecraft axes with the origin of the axes at the separation plane.

Include a sketch showing the spacecraft system of axes, the axes are noted Xs, Ys, Zs and form a right handed set (s for spacecraft).

1.2.2 Spacecraft geometry in the flight configuration

A drawing and a reproducible copy of the overall spacecraft geometry in flight configuration is required. It should indicate the exact locations of any equipment requiring access through shroud, lifting points locations and define the lifting device. Detailed dimensional data will be provided for the parts of the S/C closest to the "static envelope" under shroud (antenna reflectors, deployment mechanisms, solar array panels, thermal protections,...). Include the static envelop drawing and adapter interface drawing.

Preferably, a 3D CAD model limited to 30Mo (IGES or STEP extension) shall be supplied.

1.2.3 MCI properties

The data required is for the spacecraft after separation. If the adaptor is user supplied, also add spacecraft in launch configuration with adapter, and adapter alone just after separation.

1.2.3.1 The fundamental modes (lateral, longitudinal) of spacecraft hardmounted at interface

1.2.3.2 Range of major/ minor inertia axis ratio

1.2.3.3 Dynamic out of balance (if applicable)

Indicate the maximum dynamic out of balance in degrees.

1.2.3.4 Angular momentum of rotating components

1.2.3.5 MCI Properties

Element (i.e. s/c adapter)	Mass (kg)	C of G coordinates (mm)			Coefficients of inertia Matrix (kg. m^2)					
		X_G	Y_G	Z_G	I_{xx}	I_{yy}	I_{zz}	I_{xy*}	I_{yz*}	I_{zx*}
Tolerance					Min/Max	Min/Max	Min/Max	Min/Max	Min/Max	Min/Max

Notes: - CoG coordinates are given in S/C axes with their origin at the separation plane.

- Inertia matrix is calculated in S/C axes with origin of the axes at the Center of gravity and 1 g conditions.

(*) - The cross inertia terms must be intended as the opposite of the inertia products (Ixy = -Pxy).

1.2.4 Propellant/pressurant characteristics

TANKS			1	2	3	4
PROPELLANT			NTO	MMH	NTO	MMH
DENSITY (kg/m^3)						
TANK VOLUME (l)						
FILL FACTOR (%)						
LIQUID VOLUME (l)						
LIQUID MASS (kg)						
CENTER OF GRAVITY OF PROPELLANT LOADED TANK		Xs				
		Ys				
		Zs				
SLOSH MODEL Under TBD g	PENDULUM MASS	(kg)				
	PENDULUM LENGTH	(m)				
	PENDULUM ATTACHMENT POINT	Xs				
		Ys				
		Zs				
	FIXED MASS (if any)					
	FIXED MASS	Xs				
	ATTACHMENT	Ys				
	POINT (if any)	Zs				
	FUNDAMENTAL SLOSHING MODE NATURAL FREQUENCY (Hz)					

	PRESSURANT HELIUM			
TANKS	1	2	3	4

VOLUME (l)					
LOADED MASS (kg)					
CENTER OF GRAVITY (mm)	Xs				
	Ys				
	Zs				

1.2.5 Mechanical Interfaces

1.2.5.1 Customer using Arianespace standard adapters

1.2.5.1.1 Interface geometry

Provide a drawing with detailed dimensions and nominal tolerances showing:

- The spacecraft interface ring;
- The area allocated for spring actuators and pushers;
- Umbilical connector locations and supports;
- The area allocated for separation sensors (if any);
- Equipment in close proximity to the separation clamp band (superinsulation, plume shields, thrusters); and
- The energy of separation and the energy released in the umbilical connectors (for distancing analysis).

1.2.5.1.2 Interface material description

For each spacecraft mating surface in contact with the Vega adapter and clamp band, indicate material, roughness, flatness, surface coating, rigidity (frame only), inertia and surface (frame only), and grounding.

1.2.5.2 Customer providing its own adapter

Define adaptor and its interface with the launch vehicle according to Arianespace's specifications.

Define the characteristics of the separation system including:

- Separation spring locations, type, diameter, free length, compressed length, spring constraint, energy.
- Tolerances on the above.
- Dispersion on spring energy vectors.
- Dispersion of separation system.
- Clampband tension.
- Dispersion on pyro device actuation times.

1.2.5.3 Spacecraft accessibility requirements through Fairing (fairing, dual launch structure – if any)

Indicate items on the spacecraft to which access and RF windows are required through the fairing, and give their exact locations in spacecraft coordinates.

1.2.6 Electrical interfaces

Provide the following:

- A spacecraft to EGSE links description and diagram as well as a definition of umbilical connectors and links (indicate voltage and current during launch preparation as well as at plug extraction if any);

  The umbilical links at launch preparation:

S/C connector pin allocation number	Function	Max voltage (V)	Max current (mA)	Max voltage drop (ΔV)	OR	Expected one way resistance (Ω)

  The umbilical links at umbilical connector extraction (Lift-Off):

Function	Max voltage (V)	Max current (mA)

- A block diagram showing line functions on the spacecraft side and the EGSE side;
- Data link requirements on ground (baseband and data network) between spacecraft and EGSE;
- A description of additional links used after spacecraft mating on the LV for the test or ground operation;
- The location of the spacecraft ground potential reference on the spacecraft interface frame; and
- Electrical link requirements (data, power, etc.) during flight between the LV and spacecraft.

1.2.7 Radioelectrical interfaces

1.2.7.1 Radio link requirements for ground operations

Provide the radio link requirements and descriptions between spacecraft, launch site, spacecraft check-out system and PPF, HPF and UCIF (including re-rad).

Include transmit and receive points location of antenna(e) to be considered for radio links during launch preparation.

1.2.7.2 Spacecraft transmit and receive systems

- Provide a description of spacecraft payload telecommunications systems (for information only)

- Provide a description of spacecraft telemetry and telecommand systems

For each TM and TC system used on the ground and during launch, give the following:

SOURCE UNIT DESIGNATION		S1	S2	S…
Function				
Band				
Carrier Frequency, F_0 (MHz)				
Bandwidth centered	-3 dB			
Around F_0	-60 dB			
Carrier	Type			
Modulation	Index			
Carrier Polarization				
Local Oscillator Frequencies				
1st intermediate Frequency				
2nd intermediate Frequency				
EIRP, transmit (dbm)	Max			
	Nom			
	Min			
Field strength at antenna, receive (dbμ V/M)	Max			
	Nom			
	Min			
Antenna	Type Location Gain Pattern			

The spacecraft transmission plan shall also be supplied as shown in table below.

Source	Function	During preparation on launch pad	After fairing jettisoning until 20s after separation	In transfer orbit	On station
S1					
S2					
S…					

Provide the spacecraft emission spectrum.

1.2.7.3 Spacecraft ground station network

For each satellite ground station to be used for spacecraft acquisition after separation (nominal and back-up stations) it is need to indicate the geographical location (latitude, longitude, and altitude) and the radio-electrical horizon for TM and telecommand and associated spacecraft visibility requirements.

1.2.8 Environmental characteristics

Provide the following:

- Thermal and humidity requirements (including limits) of environment during launch preparation and flight phase;
- Dissipated power under the fairing during ground operations and flight phase;
- Maximum ascent depressurization rate and differential pressure;
- Contamination constraints; and contamination sensible surfaces.
- Purging requirements (if any).

Indicate the following:

- Specific EMC concerns (e.g. lightening, RF protection);
- Spacecraft electrical field susceptibility levels;
- Spacecraft sensitivity to magnetic fields (if any)

1.3 Operational requirements

1.3.1 Provisional range operations schedule

Provide a main operations list and description (including launch pad activities) and estimated timing (with hazardous operation identification)

1.3.2 Facility requirements

For each facility used for spacecraft preparation PPF, HPF, UCIF, Launch pad provide:

- Main operations list and description;
- Space needed for spacecraft and GSE;
- Environmental requirements (Temperature, relative humidity, cleanliness);
- Power requirements (Voltage, Amps, # phases, frequency, category);
- RF and hardline requirements
- Support equipment requirements;
- GSE and hazardous items storage requirements

1.3.3 Communication needs

For each facility used for spacecraft preparation PPF, HPF, UCIF, Launch pad provide need in:

Telephone, Facsimile, Data lines, Time code, Telex...

1.3.4 Handling, dispatching and transportation needs

Provide

- estimated packing list (including heavy, large and non-standard container characteristics) with indication of designation, number, size (L x W x H in m) and mass (kg).
- A definition of the spacecraft container and associated handling device (constraints);
- A definition of the spacecraft lifting device including the definition of CCU interface;
- A definition of spacecraft GSE (dimensions and interfaces required);
- Dispatching list

1.3.5 Fluids and propellants needs

1.3.5.1 List of fluids

Indicate type, quality, quantity and location for use of fluids to be supplied by Arianespace.

1.3.5.2 Chemical and physical analysis to be performed at the range

Indicate for each analysis: type and specification.

1.3.5.3 Safety garments needed for propellants loading

Indicate number and type.

1.3.6 Technical support requirements

Indicate need for workshop, instrument calibration, offices space.

1.3.7 Security requirements

Provide specific security requirements (access restriction, protected rooms, supervision, and etc.)

1.4 Miscellaneous

Provide any other specific requirements requested for the mission.

1.5 Contents of the spacecraft development plan

The Customer prepares a file containing all the documents necessary to assess the spacecraft development plan with regard to the compatibility with the launch vehicle.

It, at least, shall include:

- Spacecraft test plan: define the qualification policy, vibrations, acoustics, shocks, protoflight or qualification model;
- Requirements for test equipment (adapters, clamp-band volume simulator, etc.);
- Tests on the customer's premises; and
- Test at the range.

1.6 Definitions, acronyms, symbols

Provide a list of acronyms and symbols with their definition.

1.7 Contents of Safety Submission Phase 1

The Customer prepares a file containing all the documents necessary to inform CSG of his plans with respect to hazardous systems. This file contains a description of the hazardous systems. It responds to all questions on the hazardous items check list given in the document CSG Safety Regulations V2F3, and summarized here below.

1. Electro-pyrotechnic devices

1.1. Category-A initiators (for operations which could be hazardous for personnel and/or equipment)

1.2. Category-B igniters(for operations which are not hazardous)

1.3. Location

1.4. Function

1.5. Type and manufacturer

1.6. Production serial number

1.7. Bridge resistance

1.8 No-fire current

1.9 All fire current

1.10. Firing current

1.11. Selected firing current

1.12. Checkout current

1.13. Probabilities associated to those currents and confidence level

1.14. Time required for installation on spacecraft

1.15. Location in spacecraft

1.16. Radio-sensitivity characteristics

1.17. Electrostatic sensitivity characteristics

1.18. Electrical initiation and control circuits

2. Solid propellant motors

2.1. International classification

2.2. Manufacturer and references

2.3. Previous use

2.4. Description (structure, weight, nature of propellant)

2.5. Ignition system

2.6. Firing and monitoring circuit

2.7. Storage and transfer containers

2.8. Associated ground support equipment

3. Liquid Propellants

3.1. Does the payload and/or associated ground equipment contain hazardous fluids. If so, indicate quantities and specifications

3.2. Description of the propulsion system

3.3. Location and operation procedures

4. Pressure vessels

4.2. Nature of fluids - Pressure

4.3. Tanks: type and manufacturer, structure, safety factor, qualification and acceptance tests

4.4. Associated ground support equipment

5. Batteries

5.1. Type of batteries - Description

5.2. Do they contain hazardous fluids ?

5.3. Charge

6. Radiation

6.1. Non-ionising radiations

- Antennas: locations, direction and characteristics.
- Radiation power, spectrum of frequencies, schedules and places of emission.
- Safety devices.

6.2 Ionising radiations

- Do the spacecraft or associated ground equipment transmit ionising radiations?
- Kind of radiation, activity, forseeable exposition, venting (radioactive gas).

6.3 Operations and safety regulations.

7. Interface (if not provided by the launcher authority)

7.1 Mechanical interfaces:

- Detailed description of the mechanical interface between the launcher and the payload (separation system).
- Detailed description of the mechanical and/or pneumatic between the launch tower and the payload.

7.2 Electrical interfaces

- Detailed description of the electrical interface between the launcher (adaptor) and the payload; separation devices, monitoring means, safety devices (separation switches).
- Detailed description of the electrical interface between the launch tower and the payload:
- Preparation and test equipment
- Operations (arming, battery charge,)
- List of voltages and currents on the umbilical cable conductors at the moment of plug release

7.3 Umbilical line

- Type and number
- Fixation and extraction methods

8. Miscellaneous

8.1 Are the CSG Safety Regulations complied with?

8.2 Is any waiver requested?

8.3 Other safety problems not so far dealt with

1.8 Contents of Spacecraft Operations Plan (POS)

The customer defines the operations to be executed on the spacecraft from arrival at the CSG, at the launch site, and up to the launch.

A typical content is presented here below.

1.8.1 General

1.8.1.1 Introduction

1.8.1.2 Applicable documents

1.8.2 Management

1.8.2.1 Time schedule

1.8.2.2 Table of weekly activities

1.8.2.3 Meetings – Organization – Interface

1.8.3 Personnel

1.8.3.1 Organizational chart for spacecraft operation team

1.8.3.2 Definition of responsibilities and tasks

1.8.3.3 Spacecraft organizational chart for countdown

1.8.4 Operations

1.8.4.1Handling and transport requirements for spacecraft and ancillary equipment

1.8.4.2 Tasks for launch operations

1.8.5 Equipment associated with the spacecraft

1.8.5.1 Brief description of equipment for launch operations

1.8.5.2 Description of hazardous equipment (with diagrams)

1.8.5.3 Description of special equipment (Launch centre, Launch tower)

1.8.6 Installations

1.8.6.1 Surface areas

1.8.6.2 Buildings (technical and logistic aspects)

1.8.6.3 Communications

1.8.6.4 Location of offices, assignment of personnel

1.8.7 Logistics

1.8.7.1 Accommodation

1.8.7.2 Transport facilities

1.8.7.3 Packing list

ANNEX 3

VERTA-1 STANDARD LAUNCH SERVICE

OVERALL MANAGEMENT

- Contract management according to the applicable management rules
- Meetings as necessary on:
  - Management / Contractual aspects
  - Documentation submission
  - Launch campaign at the launch base (daily)
- Reviews:
  - Preliminary Mission Analysis Review (RAMP)
  - Final Mission Analysis Review (RAMF)
  - Launch Vehicle Flight Readiness Review (RAV)
  - Launch Readiness Review (RAL)
  - Immediate Post Flight Review (CRAL at D+1)
- Overall launch vehicle product / quality assurance according to the applicable management rules
- Interface with CSG as necessary (pre-launch site survey)
- Documentation:
  - Interface control document (DCI)
  - Preliminary mission analysis document
  - Thermal analysis report
  - Final mission analysis document (including final CLA results)
  - Electrical Link Checkout procedure (part of the electrical interface test)
  - Range operations Document (DL)
  - Combined Operations Plan (POC)
  - Interleaved Operations Plan (POI)
  - Countdown sequence
  - Safety Statements (Phase 1 /Phase 2 /Phase3)
  - Injection data
  - Launch evaluation document (DEL)

MISSION ANALYSIS

- One Preliminary mission analysis[1] :

[1] Preliminary mission analysis assumes that the main mission characteristics are frozen: any feasibility, mission optimisation, or additional analysis is therefore not part of the standard launch services.

- Trajectory study
- Separation analysis (clearance, kinematics, collision risk)
- Accommodation Analysis (verification of S/C geometrical properties with Launch Vehicle)[2]
- Orbit characteristics and dispersion
- Dynamic coupled load analysis
- Radiofrequency compatibility analysis

- One Detailed mission analysis:
  - Trajectory study
  - Separation analysis
  - Accommodation Analysis[2]
  - Orbit characteristics and dispersion
  - Dynamic coupled load analysis
  - Thermal analysis
  - Electromagnetic and Radiofrequency compatibility analysis
- Fit check at the CSG
- Post-launch analysis:
  - Spacecraft orbit and attitude data from launch vehicle telemetry (at spacecraft separation)
  - Launch evaluation report (level 0 on spacecraft part)

GENERAL RANGE SUPPORT

- Transport services:
  - Spacecraft and associated GSE from ports of entry in French Guiana (Cayenne airport and/or Paramaribo harbour) to CSG, and return, for up to an equivalent of 12 ten-foot pallets in two batches
  - Inter-site transport of spacecraft, GSE and ancillary equipment (transfer of upper composite from EPCU to launch complex without air-conditioning, however with constant over-pressure)
  - Logistics support for shipment and customs clearance
- Range Operations:
  - Nominal working hours: 2 shifts of 8 hours per day, Monday to Friday. Access to the satellite and working areas shall be ensured 24 hours per day, 7 days per week (without any need for specific Range support outside nominal working hours).
- Payload preparation facilities (EPCU):
  - Clean-room: >300 m^2
  - Dedicated filling hall: >110 m^2, plus storage space for propellant and fuelling equipment (class 100 000), and associated check-out equipment office space.
  - Check-out stations area (LBC): >110 m^2, air conditioned
  - Offices and meeting rooms: >150 m^2, air conditioned, so as to accommodate a minimum of 35 persons
  - Equipment storage for all transport containers, spare GSE and ancillary equipment during launch campaign duration, plus a dedicated space for storage of electrical equipment with access to main power.

[2] Any specific analysis related to protrusions outside the nominal payload envelope are excluded

- Controlled access

- Fluids (industrial quality standards available in French Guiana):
  - Compressed air
  - GN2 N50, at 190 bar
  - GN2 N30 in S3 area only, at 190 bar
  - GHe N55, at 180 or 350 bar
  - LN2 N30
  - IPA
  - Demineralised water
- Safety equipment for hazardous operations, as required (e.g. protective clothing, scape-suits, gas-masks, leak-monitoring)
- Launch campaign duration:
  - 4 weeks from spacecraft arrival in French Guiana until completion of hazardous operations (e.g. spacecraft fuelling)
  - 1 week for combined operations (spacecraft encapsulation, transport to launch pad, launch preparations, launch) (To be specified by Arianespace)
  - 2 days for post-flight activities
- No-break power supply (CAT 3):
  - Offices: 10 UPS 1.4 kVA
  - LBC: 20/30 kVA
  - Spacecraft filling building: 15/30 kVA
  - BAF and Launch Pad: 15 kVA

- CAT 1/2 power supply:
  - 30 kVA in any of the areas used

- Communication links:
  - RF-link: S/C/Ku band; 1 TM / 1 TC
  - Baseband link: S/C/Ku band; 2 TM / 2 TC
  - CSG operational data networks for satellite integration, testing, fuelling and combined operations, including launch pad, specifically the following CSG communications subsystems: STFO, ROMULUS (V24 plus V11 links), PLANET configured as 3 Ethernet VLAN networks dedicated to the project, including fibre optics to Ethernet media converters as required.
  - One redundant dedicated fibre optic connection between the launch table customer room and the PPF, including fibre optic to Ethernet media converters as required.
  - Umbilical link: 2 sets of umbilical connectors 37 pins for main S/C umbilical connections
  - Paging system: 5 beepers
  - CSG Intercom systems for satellite integration, testing, fuelling and combined operations, including launch pad
  - CSG videoconference studio
  - VHF/UHF communication system: minimum 5 handsets
  - Use of the time distribution network at all sites used for satellite integration and testing as well as pre-launch checkout
  - CCTV network for continuous monitoring of the satellite (except during transfer from the EPCU)

- CSG point-to-point telephone system (TS)
- Telephone links set-up allowing dial-up international and local access as well as internal access in all areas used for satellite preparation (including office areas)
- Copy machines: 2
- Fax machines: 2

- Clean-room cleanliness monitoring, including a daily cleanliness control and a weekly report
- Support to Hazardous Materials Handling

LAUNCH OPERATIONS

- Ground and Flight safety
- Emergency medical service
- Launch vehicle integration:
  - Hardware
  - Propellant
  - Payload compartment
  - Vega standard payload adapter and associated separation system
  - Fairing
  - Vega standard umbilical interface connectors (2 sets -male and female)
  - One flight program
  - One mission logo
- Launch operations:
  - Launch vehicle operations
  - Combined operations Spacecraft / launch vehicle, including dress rehearsal
  - Countdown execution
  - Tracking until Spacecraft/upper-stage separation