Format for application to use Ariane — Annex 4

1. Introduction

SPACECRAFT description and mission summary:

Include a 3D view drawing of spacecraft in orbit, an exploded view and the coverage zones (if applicable).

Manufactured by	**Model**	
MASS • Total mass at launch TBD kg • Mass of satellite in TBD orbit TBD kg	*DIMENSIONS* • Dimensions TBD m • Dimensions stowed for launch TBD m • Dimensions deployed on orbit TBD m	
STABILIZATION • Spin* • 3 axis*	*LIFETIME* TBD years	
MISSION SUMMARY • TBD operational channels of TBD bandwith • Travelling wave tube amplifiers: TBD (if used) • Transmit Frequency range: TBD W • Receive Frequency range. TBD W • EIRP: TBD	Telecommunication* Direct broadcasting* Meteorological* Remote sensing*	Scientific* Radiolocalisation* Others*
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 TBD W End of life power TBD W Batteries description TBD (type, capacity)		
ATTITUDE CONTROL Type: TBD		
COVERAGE ZONES OF THE SATELLITE TBD (figure)		

(*) To be selected.

2. Mission characteristics

2.1. Orbit description (if not standard GTO)

Specify elements:

- semi major axis,
- eccentricity,
- inclination,
- argument of perigee,
- any other elements constrained by the spacecraft,
- performance required.

2.2. Launch window(s) definitions

2.2.1. Constraints and relevant margins

Solar aspect angle, eclipse, ascending node, inclination, right ascension...

2.2.2. Preferred window

Computed using the reference time and reference orbit described in the AR4 User's Manual, the resulting launch window must include at least the ARIANE dual launch window as specified in the User's Manual for any launch period, and is preferably supplied as an electronic file (MS Excel). Constraints on opening and closing shall be identified and justified.

2.3. Separation conditions

2.3.1. Attitude pointing

The desired direction of the S/C longitudinal axis is to be indicated and defined by reference to the following unit vectors:

u = radius vector with its origin at the center of the earth, and passing through the intended orbit perigee.

v = perpendicular to u in the intended orbit plane, having the same direction as the perigee velocity.

w = perpendicular to u and v, such that u, v, w form a right handed system.

The desired orientation of one lateral axis is to be similarly specified for 3-axis stabilized separations.

2.3.2. Separation mode and conditions

Spinning or three axis stabilization (spin rate, depointing...).

2.4. Roll and Attitude Control System (SCAR/SCA) sequence

Any particular constraints on SCAR/SCA sequence, launcher commands required.

2.5. Sequence of events after separation until final orbit (for information only)

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

3. Spacecraft description

3.1. Spacecraft Systems of Axes

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).

3.2. 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,...). Preferably, a 3D model (IGES extension) shall be supplied with the DUA.

3.3. Mass alignment inertia's (Nominal values and tolerances)

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

3.3.1. Table

Element (i.e. s/c adaptor)	Mass (kg)	C of G coordinates (mm)			Coefficients of inertia Matrix (kg. m2)					
		X_G	Y_G	Z_G	I_{xx}	I_{yy}	I_{zz}	I_{xy*}	I_{yz*}	I_{zx*}
Tolerances	(kg)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	mini maxi	mini maxi	mini maxi

Notes:

- C of G coordinates are given in spacecraft axes with origin of the axes at the separation plane.
- Inertia matrix is calculated in spacecraft axes with origin of the axes at the Center of gravity.
- The coefficients of the Inertia matrix must be given under 1 g conditions.

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

3.3.2. Range of major/ minor inertia axis ratio

3.3.3. Dynamic out of balance (if applicable)

Indicate the maximum dynamic out of balance in degrees.

3.3.4. Propellant / pressurant characteristics

TANKS			1	2	3	4
PROPELLANT			NTO	MMH	NTO	MMH
DENSITY	(kg/m^3)		1450	876	1450	876
TANK VOLUME	(l)					
FILL FACTOR	(%)					
LIQUID VOLUME	(l)					
LIQUID MASS	(kg)					
CENTER OF GRAVITY		Xs				
OF PROPELLANT		Ys				
LOADED TANK		Zs				
SLOSH MODEL Under TBD g	PENDULUM MASS	(kg)				
	PENDULUM LENGTH	(m)				
	PENDULUM	Xs				
	ATTACHMENT	Ys				
	POINT	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				

3.3.5. Angular momentum of rotating components

3.4. Mechanical Interfaces

3.4.1. Spacecraft using Ariane supplied adaptor

3.4.1.1. Interface geometry

Provide a drawing with detailed dimensions and nominal tolerances showing:

Spacecraft interface ring and keyway, spring seats and supports, umbilical connectors location and supports, separation sensors (if any), equipment in close vicinity of separation clampband (super insulation, plume shields, thrusters).

3.4.1.2. Interface material description

For each spacecraft mating surface in contact with ARIANE adaptor and clampband, give: material, roughness, flatness, surface coating, rigidity (frame only), inertia and sufface (frame only).

3.4.2. S/C providing its own adaptor

Define adaptor and its interface with the launch vehicle (see specifications ST-0-P-19-01 and ST-0-P-19-02).

Define the characteristics of the separation system including:

1) Separation spring locations, type, diameter, free length, compressed length, spring constraint, energy.

2) Tolerances on the above.

3) Dispersion on spring energy vectors.

4) Dispersion of separation system.

5) Clampband tension.

6) Dispersion on pyro device actuation times.

3.4.3. Spacecraft accessibility requirements through shroud (fairing, SPELDA, SYLDA)

Indicate items on the spacecraft to which access is required through shroud and give their exact locations in spacecraft coordinates.

3.5. Electrical interfaces

3.5.1. Umbilical connectors(s) definition

3.5.2. Umbilical cable link between the spacecraft on tower and launch center and the spacecraft blockhouse console or COTE located in the launch center, the payload room CMCU, or the launch table, respectively.

Indicate voltage and current during launch preparation and also at POE extraction in the following tables.

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)

POE extraction (Lift-Off)

Function	Max voltage (V)	Max current (mA)

3.5.3. Description of components, inserted mast junction box (if used)

Mechanical interface: max dimensions TBD.
Electrical interface: power: 1 kVA, 50 or 60 Hz.

3.5.4. Block diagram showing lines functions on spacecraft side and blockhouse side

3.5.5. Data links requirements (baseband and data network) between spacecraft and check-out system

3.5.6. Description of additional links, used after spacecraft erection on launch vehicle, for test or ground operations

3.5.7. Spacecraft earth potential reference point location on spacecraft interface frame

3.6. Radioelectrical interfaces

3.6.1. Radio link requirements and disruption between spacecraft, launch center, spacecraft check-out system and preparation buildings S1, S3

3.6.2. Antenna(e) diagrams and directivity

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

3.6.3. Spacecraft transmit and receive systems

3.6.3.1. Description of spacecraft telemetry and telecommand systems

3.6.3.2. Description of payload telecommunications system (for information only)

3.6.3.3. System characteristics

3.6.3.3.1 On board system

For each TM and TC and 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	Designation Location Gain Pattern			

3.6.3.3.2. Satellite ground station network

For each group station to be used for acquisition and GTO operations (nominal and back-up stations) please indicate the geographical location (latitude and longitude) and the radio-electrical horizon.

3.6.3.4. Spacecraft transmission plan

Source	Function	During preparation on launch pad	After H0-1h30 until 20s after separation	In transfer orbit	On station
S1					
S2					
S...					

3.7 Environmental characteristics

3.7.1 Fundamental modes (lateral, longitudinal) of spacecraft hardmounted at interface

3.7.2 Thermal characteristics during launch preparation and boost phase including thermal limits

3.7.3 Dissipated power during countdown and boost phase

3.7.4. Contamination characteristics and constraints

4. Operational requirements

4.1. Provisional range operations schedule

Include the definition of CCU interface and of the spacecraft lifting device

4.2 Spacecraft Preparation in building S1 (if applicable)

4.2.1 Main operations list and description

4.2.2 Power requirements

Indicate Voltage, Amps, # phases, frequency, category (standard or no break).

4.2.3 Facility equipment requirements

4.2.4 RF and hardline links requirements

4.2.5 Telecommunications requirements

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

4.2.6 Miscellaneous

4.3 Solid Motor and pyro equipment preparation in building S2 (if applicable)

4.3.1 Main operations list and description

4.3.2 Power requirements

Indicate Voltage, Amps, # phases, frequency, category (standard or no break).

4.3.3 Facility equipment requirements

4.3.4 Miscellaneous

4.4 SPM X-Ray in building S4 (if applicable)

4.4.1 SPM description

4.4.2 GSE description

4.4.3 Facility equipment requirements (cold soak, films...)

4.5 Spacecraft fillinq and assembly in building S3

4.5.1 Main operations list and description

4.5.2 Power requirements

Indicate Voltage, Amps, # phases, frequency, category (standard or no break).

4.5.3 Facility equipment requirements

4.5.4 RF and hardline link requirements

4.5.5 Miscellaneous

4.6 Spacecraft preparation at servicing tower

4.6.1 Main operation list and description

4.6.2 Power requirements

Indicate Voltage, Amps, Frequency.

4.6.3 Facility equipment requirements

4.6.4 Miscellaneous

4.7. Transportation requirements

Give also dimensions and weights of any non standard container.

4.8 Hazardous items storage requirements

4.8.1 Propellants

4.8.2 Pyrotechnic devices

4.9 Fluids and propellants requirements

4.9.1 List of fluids

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

4.9.2 Chemical and physical analysis to be performed at the range

Indicate for each analysis: type and specification.

4.9.3 Safety garments needed for propellants loading

Indicate number and type.

5. General

5.1. Estimated packing list (including heavy and large container characteristics)

Indicate designation, number, size (L x W x H in m) and mass (kg).

5.2. Technical support requirements

Workshop, instrument calibration.

5.3 Hotel and cars reservations

Estimate number of hotel rooms and rental cars required for the campaign.

5.4. Miscellaneous services

6. Spacecraft development plan

7. Tests

7.1. Spacecraft test plan (vibration, acoustic, shocks...)

Define the qualifcation policy, qualification (protoflight or qualification model).

7.2. Requirements for test equipment (ACU's, clampband volume simulator...)

7.3. Tests on the user's premises

7.4. Tests at the range

8. Definitions, acronyms, symbols

ANNEX Safety Submission Phase 1

The User 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

1.8. 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).
- 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 Umbilicals

- 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