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Space systems — Spacecraft interface requirements document for launch vehicle services

Systèmes spatiaux — Document d'exigences d'interface du véhicule spatial vis-à-vis du service de lancement

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 17401 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

Introduction

This International Standard gives guidelines for writing an interface requirements document (IRD) for launch vehicle (LV) services. The application of this International Standard is intended to facilitate the technical exchanges between spacecraft (SC) and launch vehicle agencies. By reducing the amount of work necessary for requesting launch services, this International Standard will minimize spacecraft contractor's and spacecraft manufacturer's costs.

In some cases, drawings are explicitly requested in order to provide comprehensive information. Explicit international system units are specified for all items. The corresponding scale may be adjusted if not appropriate.

SC organizations may include additional topics if required. Some sections of the IRD may refer to specificities that are not applicable to the launch services of interest, in which case they should be ignored.

Space systems — Spacecraft interface requirements document for launch vehicle services

1 Scope

This International Standard provides spacecraft (SC) organizations with the general format for presenting the interface requirement document (IRD) for launch vehicle services. The IRD provides a list of the major technical requirements spacecraft agencies provide to launch vehicle (LV) agencies when submitting an application for launch services.

The IRD addresses the definition of the SC mission, the mechanical and electrical interfaces, the overall environment requirements (mechanical, thermal, cleanliness, radio-electrical), the SC development and test programme and, finally, launch range facilities and support requirements.

This International Standard is applicable to all existing commercial LV and related launch facilities so as to permit SC contractors to prepare a single interface requirement document for a given SC mission, independently of the LV contractor to be selected.

The IRD, as defined in this International Standard, includes the basic SC input data needed by LV agencies to prepare the interface control document defined in the ISO 15863.

2 Terms, definitions and abbreviated terms

2.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1.1
usable volume
volume available to the payload within the LV fairing or carrying structure that the static envelope of the SC may not exceed in order to ensure that there is no physical contact between the SC and the LV in a dynamic environment

2.1.2
spacecraft adapter
SC adapter
structure that mates the SC to the LV and includes the separation system for SC/LV separation

NOTE The SC adapter is a part of the LV and does not separate with the SC.

2.2 Abbreviated terms

EIRP equivalent isotropic radiated power

EMC electromagnetic compatibility

IRD interface requirement document

LV launch vehicle

RF radio frequency

SC spacecraft

Y/N yes/no response

3 Spacecraft mission description

3.1 Mission description

The IRD shall describe the following items:

— purpose of the mission;

— orbital characteristics;

— in orbit view of SC, with drawing

3.2 SC description (optional)

The IRD may describe the following items:

— SC platform

— SC payload

4 Mechanical interfaces

4.1 Mechanical configuration

The IRD shall provide the following information:

— SC mechanical drawing (launch configuration);

— SC coordinate system, with drawing;

— maximum height above interface plane, in metres;

— SC maximum diameter, in metres;

— SC/LV interface diameter, in metres;

4.2 SC fundamental frequencies

The IRD shall provide the fundamental natural frequencies (specify boundary conditions):

— axial frequencies, in hertz;

— lateral frequencies, in hertz.

4.3 Usable volume

The IRD shall provide the following information:

— static envelope, with drawing;

— SC protrusions below interface plane, with dimensioned drawings;

— SC volumetric displacement, in cubic metres;

— SC free air volume, in cubic metres;

— special clearance requirements, with drawing.

4.4 Spacecraft (or SC adapter) mechanical interface

The IRD shall provide the following information:

a) mechanical interface, with drawing;

b) diameter, in metres;

c) attachments at SC interface;

d) material;

e) Young's modulus, in newtons per square metre;

f) coating:

   1) surfaces in contact,

   2) other surfaces;

g) roughness, in metres;

h) flatness/perpendicularity;

i) stiffness (for clampband mating system):

   1) applicable length (height), in metres,

   2) section area, in square metres,

   3) inertia (with respect to centre of gravity of section), in metres to the power of 4 (m^4);

j) stiffness (except for clampband mating systems):

   1) radial direction, in newtons per metre,

   2) tangent direction, in newtons per metre.

NOTE This section of the IRD applies to the lower adapter interface ring for a SC provided adapter.

4.5 Connectors and microswitches (SC side of the interface)

The IRD shall provide the following information:

a) manufacturer and part number;

b) quantity;

c) location and mechanical interface, with drawing:

   1) angular position, in degrees,

   2) radial position, in metres,

   3) height from separation plane, in metres;

d) push-on and push-off loads, in newtons;

e) energy released, in joules;

f) keying index.

4.6 Purges and fluid connection interface

The IRD shall provide the following information:

a) definition;

b) location and mechanical interface, with drawing:

   1) angular position, in degrees,

   2) radial position, in metres,

   3) height from separation plane, in metres.

4.7 Encapsulated spacecraft access

For each access requirement to payload, the IRD shall specify the following items:

a) location in SC coordinates, in metres, with drawing:

   1) X_S,

   2) Y_S,

   3) Z_S;

b) minimum size of access door, length and height in metres;

c) purpose.

NOTE The symbols X_S, Y_S, Z_S are the generic coordinates of any point in SC axes (or in axes parallel to the SC axes).

5 Electrical interfaces

5.1 Umbilical wiring diagram

Drawings for SC to LV and SC to ground facilities wiring shall be provided.

5.2 Umbilical connectors

The IRD shall provide the following information:

— number of connectors required;

— LV supplied (Y/N, to specify);

— manufacturer;

— part number;

— number of pins needed for user;

— polarizing key orientation;

— insert key location, with drawing;

— location, with drawing;

— backshell shielding requirement;

— harness shielding requirement.

5.3 Umbilical wiring links (for each connector pin)

The IRD shall provide the following information:

— pin number;
— function(s);
— wire type;
— twisting and shielding characteristics;
— maximum voltage, in volts;
— maximum voltage at lift-off, in volts;
— maximum current, in amperes;
— maximum current at lift-off, in amperes;
— maximum one way resistance, in ohms;
— maximum voltage drop, in volts;
— line start point;
— line end point;
— maximum voltage at separation (if applicable), in volts;
— maximum current at separation (if applicable), in amperes;
— signal type;
— signal frequency, in hertz.

5.4 Electrical commands dedicated to spacecraft

5.4.1 Pyrotechnic commands

The IRD shall provide the following information:

— number of commands required;
— electrical circuit drawing, with drawing;
— command identification;
— number of initiators per command;
— time of command initiation;
— minimum time interval between commands, in seconds;
— pulse width, in seconds;
— voltage, in volts;
— minimum all fire current, in amperes;
— maximum no fire current, in amperes;
— output isolation, in ohms;
— wire gage;
— wire type;
— wire length from LV-SC interface to pyrotechnic devices, in metres;
— circuit connectors to pyrotechnic devices;
— initiator characteristics.

5.4.2 Dry loop commands

The IRD shall provide the following information:

— number of commands required;
— command identification;
— number of redundant commands;
— time of command initiation (on ground or in flight);
— resistance (ON/OFF configurations), in ohms;
— maximum, minimum and nominal output voltage, in volts;
— maximum current, in amperes;
— on-board circuit isolation, in ohms;
— grounding requirements;
— SC circuit configuration, with drawing.

5.4.3 Electrical commands

The IRD shall provide the following information:

— number of commands required;
— command identification
— number of redundant commands;
— time of command initiation (on ground or in flight);
— minimum time interval between commands, in seconds;
— maximum, minimum and nominal output voltage, in volts;
— maximum current, in amperes;
— current profile characteristics;
— command duration, in seconds;
— grounding requirements;
— SC circuit configuration.

5.5 Separation status transmission

The IRD shall specify the measurement used to confirm SC separation.

5.6 SC in-flight telemetry

The IRD shall provide the following information:

— number of channels;
— type of measurements;
— transducer range;
— signal voltage, in volts;
— sample rate;
— encoding format;
— source impedance, in ohms.

5.7 Power supply required from LV

The IRD shall provide the following information:

— ground phase (Y/N, to specify);

— flight phase (Y/N, to specify);

— voltage and stability, in volts ($\pm \Delta V$);

— current required, in amperes;

— frequency, in hertz;

— maximum ripple noise, in percent.

5.8 Earth potential continuity

The IRD shall provide the following information:

— location of reference point on SC;

— maximum resistance between SC metallic elements and reference point, in ohms;

— maximum resistance for SC interface plane, in ohms.

6 Radio-frequency and electromagnetic interface

6.1 Characteristics of radio-electrical systems

The IRD shall provide the following information:

a) number of units;

b) type of units;

c) unit designation;

d) function of unit;

e) frequency band (L, S, C, Ku, Ka);

f) carrier frequency, in hertz;

g) bandwidth, in hertz, corresponding to

   1) −3 dB attenuation,

   2) −60 dB attenuation, or

   3) 99 % bandwidth;

h) carrier modulation:

   1) type,

   2) index,

   3) bit rate, in bits per second,

   4) subcarrier frequency, in hertz;

i) carrier polarization;

j) receiver frequencies, in hertz (if required by LV contractor):

   1) local oscillator,

   2) first intermediate,

   3) second intermediate (if applicable);

k) transmitter power (EIRP): maximum and nominal values, in watts;

l) field strength of receiver antenna: maximum, minimum and nominal values, in watts per square metre;

m) antenna description:

   1) location, with drawing,

   2) pattern and gain;

n) SC transmission plan.

6.2 RF telemetry and command link

6.2.1 SC RF-link definition for ground operations

The IRD shall provide the following information:

— number of sources and corresponding frequency bands;

— type of link requested (if several options are available);

— purpose of link;

— link destinations;

— events corresponding to link activation and timetable.

6.2.2 SC antenna coordinates

The IRD shall provide the following information:

— identification;

— coordinate measures in the SC reference frame, in metres;

— field of view, with drawing.

6.2.3 RF-link implementation

The IRD shall provide the following information:

— RF source;

— SC location;

— purpose;

— RF-receivable location.

6.2.4 RF-link budget

The IRD shall provide the following information:

a) SC telecommand
   1) at SC test equipment output:
      i) frequency of signal, in hertz,
      ii) bandwidth, in hertz,
      iii) output power (maximum, minimum, nominal), in watts,
      iv) modulation type and index;
   2) at SC omnidirectional antenna:
      i) frequency of signal, in hertz,
      ii) power density (maximum, minimum, nominal), in watts per square metre.

b) SC telemetry
   1) at SC omnidirectional antenna:
      i) frequency of signal, in hertz,
      ii) bandwidth, in hertz,
      iii) output power: EIRP (maximum, minimum, nominal), in watts;
   2) at SC test equipment input:
      i) frequency of signal, in hertz,
      ii) power density (maximum, minimum, nominal), in watts per square metre.

6.2.5 Base band signal characteristics

The IRD shall provide the following information:

a) telemetry:
   1) number of channels;
   2) digital:
      i) encoding,
      ii) bit rate, in bits per second;
   3) analog:
      i) modulation type and index,
      ii) frequency, in hertz;
   4) acceptable input from SC:
      i) level, in volts (with tolerance),
      ii) offset, in volts;
   5) adjustable output to electrical support equipment:
      i) level, in volts (with tolerance),
      ii) offset, in volts;

b) telecommand:
   1) number of channels;

2) digital:
   i) encoding,
   ii) bit rate, in bits per second;
3) analog:
   i) modulation type and index,
   ii) frequency, in hertz;
4) acceptable input from electrical support equipment:
   i) level (with tolerance),
   ii) offset, in volts;
5) adjustable output to SC:
   i) level (with tolerance),
   ii) offset, in volts.

7 Spacecraft mission characteristics

7.1 SC input data for mission analyses

7.1.1 Mass and inertia characteristics

The IRD shall provide the following information, for the launch configuration and separation configuration, if they are different:

a) mass, in kilograms (with tolerance);

b) centre of gravity (origin on centreline, at interface plane), in metres (with tolerance):
   1) X_S,
   2) Y_S,
   3) Z_S;

c) static unbalance, in metres (with tolerance);

d) moments of inertia (with respect to SC centre of gravity), in kilograms square metres (with tolerance):
   1) I_{xx},
   2) I_{yy},
   3) I_{zz},
   4) I_{xy},
   5) I_{xz},
   6) I_{yz};

e) dynamic unbalance (for spinning SC), in degrees (with tolerance).

Reference axes shall be parallel to the SC reference axes defined in 4.1.

NOTE The symbols X_S, Y_S, Z_S are the generic coordinates of any point in SC axes (or in axes parallel to the SC axes).

7.1.2 Sloshing masses (pendulum-type)

The IRD shall provide the following information:

a) type of tank (bladder, material, etc.);

b) type of propellant;

c) maximum volume of tank, in cubic metres;

d) filled volume, in cubic metres;

e) fluid fill factor, in percent;

f) mass of liquid, in kilograms;

g) coordinates of the centre of gravity of wet tank in SC reference frame, in metres:

   1) X_S,

   2) Y_S,

   3) Z_S;

h) slosh model (to be defined for a 1g and a low-g gravity environment):

   1) mass (corresponding to sloshing fraction), in kilograms,

   2) length, in metres,

   3) coordinates of the location of attachment point with respect to the tank, in metres:

      i) X_S,

      ii) Y_S,

      iii) Z_S;

   4) first sloshing frequency (1g model), in hertz.

7.1.3 SC mission constraints (when applicable)

The IRD shall provide the following information:

— aerothermal flux;

— solar aspect angle;

— telemetry data acquisition;

— angular accelerations/velocities;

— deployment of appendages;

— use of inertial units;

— other.

7.2 SC orbit parameters (with tolerances)

The IRD shall provide the following information:

— inclination, in degrees (with tolerance);

— altitude of perigee, in metres (with tolerance);

— altitude of apogee, in metres (with tolerance);

— argument of perigee, in degrees (with tolerance);

— longitude of descending node with respect to the Greenwich meridian, in degrees (with tolerance).

7.3 Launch window

7.3.1 Launch window constraints (when applicable)

The IRD shall provide the following information:

— solar aspect angle;

— sun eclipse;

— moon eclipse;

— ground station view angle.

7.3.2 Preferred window

The IRD shall specify the launch period and the launch window.

NOTE For dual or multiple launches, refer to LV user's guide.

7.4 SC pointing and separation

The IRD shall provide the following information:

a) allowable angular rate:
   1) spin, in revolutions per minute (with tolerance),
   2) roll, pitch and yaw (3-axis stabilized SC), in degrees per second (with tolerance);

b) separation attitude:
   1) separation velocity, in metres per second (with tolerance),
   2) maximum allowable pointing error (cone angle) in degrees,
   3) maximum allowable tip-off rate, in degrees per second,
   4) maximum allowable angular acceleration, in degrees per second squared.

NOTE Refer to LV user's guide for reference frame definition.

8 Environment requirements

8.1 General

Requirements in 8.2 to 8.7 apply to both flight and ground processing operations, including SC transportation (as applicable).

8.2 Mechanical environment

The IRD shall provide the following information:

— maximum allowable acceleration (static and dynamic) longitudinal, in g;

— maximum allowable acceleration (static and dynamic) lateral, in g;

— allowable longitudinal sine vibration curve, with drawing;

— allowable lateral sine vibration curve, with drawing;

— allowable longitudinal random vibration curve, with drawing;

— allowable lateral random vibration curve, with drawing;

— allowable acoustic curve, with drawing;

— allowable shock curve, with drawing.

8.3 Thermal environment

The IRD shall provide the following information:

a) allowable air temperature range:
   1) ground processing with SC “ON”, in degrees Celsius,
   2) ground processing with SC “OFF”, in degrees Celsius,
   3) after encapsulation, in degrees Celsius,
   4) pre-launch phase, in degrees Celsius;
b) allowable humidity range:
   1) SC processing, in percent,
   2) after encapsulation, in percent,
   3) pre-launch phase, in percent;
c) maximum pre-launch air impingement velocity, in metres per second;
d) maximum ascent heat flux:
   1) pre-fairing jettison, in watts per square metre,
   2) post-fairing jettison, in watts per square metre;
e) maximum free-molecular heat flux:
   1) at fairing jettison, in watts per square metre,
   2) following fairing jettison, in watts per square metre;
f) heat dissipation:
   1) SC processing, in watts,
   2) after encapsulation, in watts,
   3) pre-launch phase, in watts;
g) thermal analysis required from LV contractor (Y/N, to specify).

8.4 Static pressure

The IRD shall provide the following information:

— maximum allowable ascent depressurization rate, in pascals per second;

— maximum allowable ascent differential pressure, in pascals per second.

8.5 Contamination and cleanliness control

The IRD shall provide the following information:

— fairing air cleanliness, in class of cleanliness;

— maximum deposit on SC surfaces, in kilograms per square metre;

— outgassing — total mass loss, in percent;

— outgassing — volatile condensable material mass loss, in percent.

8.6 Radio frequency and electromagnetic environment

The IRD shall provide the following information:

— SC radiation spectrum diagram, with drawing;

— SC radiated susceptibility, with drawing.

8.7 Environment monitoring

The IRD shall provide the following information:

a) in-flight environment data acquisition:
   1) temperature (Y/N, to specify),
   2) pressure (Y/N, to specify),
   3) accelerations (low frequency vibrations) (Y/N, to specify),
   4) shocks (Y/N, to specify);

b) launch range operations and transport data acquisition:
   1) temperature (Y/N, to specify),
   2) humidity (Y/N, to specify),
   3) cleanliness (Y/N, to specify),
   4) accelerations (low frequency vibrations) (Y/N, to specify),
   5) shocks (Y/N, to specify).

9 SC Development and test programme

9.1 Mechanical environment qualification tests

The IRD shall provide the following information:

a) qualification rationale

b) list of applicable tests:
   1) static load (Y/N, to specify),
   2) modal survey (Y/N, to specify),
   3) sinusoidal vibration (Y/N, to specify),
   4) acoustic noise (Y/N, to specify),
   5) random vibration (Y/N, to specify),
   6) separation shock (Y/N, to specify);

c) flowchart and test schedules, with drawing.

9.2 LV/SC compatibility tests

The IRD shall provide the following information:

a) list of applicable tests:

   1) match-mate (Y/N, to specify),

   2) separation (Y/N, to specify),

   3) umbilical connector pull-out (Y/N, to specify),

   4) clearance measurement (Y/N, to specify),

   5) EMC (Y/N, to specify),

   6) end-to-end electrical (Y/N, to specify),

   7) RF link (Y/N, to specify),

   8) other (Y/N, to specify);

b) operations flowchart and test schedules, with drawing.

10 Launch range operations: facilities and support requirements

10.1 General logistics requirements

10.1.1 General

The requirements listed in 10.1.2 to 10.1.14 shall be defined in the IRD for each relevant facility and each item.

10.1.2 SC container and ground support equipment physical envelopes

The IRD shall provide the following information:

— height, in metres;

— width, in metres;

— length, in metres;

— mass, in kilograms.

10.1.3 Material handling equipment

The IRD shall specify the material handling equipment.

10.1.4 Electrical power for SC and ground station

The IRD shall provide the following information:

a) voltage, in volts;

b) frequency, in hertz;

c) power, in watts;
d) special requirements (Y/N, to specify):
    1) stability of power, in percent,
    2) other;
e) back-up power:
    1) continuous (Y/N, to specify),
    2) during specific periods (explain) (Y/N, to specify).

10.1.5 Umbilical lines and ground lines

The IRD shall provide the following information:
— number of lines;
— purpose;
— type of lines (electrical characteristics);
— connectors provided by SC (Y/N, to specify);
— umbilical shielding;
— ground reference.

10.1.6 Gas and fluid lines

The IRD shall provide the following information:
— number of lines;
— purpose;
— type of lines;
— type of fluid or gas;
— operating pressure, in pascals (with tolerance);
— connectors provided by SC (Y/N, to specify).

10.1.7 Clean room

The IRD shall provide the following information:
a) working dimensions:
    1) area, in square metres,
    2) height, in metres;
b) cleanliness class;
c) special sampling technique.

10.1.8 Environmental controls for SC and ground station

The IRD shall provide the following information:
a) temperature, in degrees Celsius (with tolerance);
b) humidity, in percent (with tolerance);
c) checking frequency, in number of times per day;

d) downtime allowable in case of failure, in seconds;

e) back-up air-conditioning system required (Y/N, to specify);

f) back-up power:

   1) continuous (Y/N, to specify),

   2) during specific periods (explain) (Y/N, to specify).

10.1.9 Clothing (safety and cleanroom)

The IRD shall provide the following information:

— location for use;

— type of hazardous operations;

— type of garment;

— type of protection;

— availability.

10.1.10 Area

The IRD shall provide the following information:

— area available for SC, in square metres;

— area available for ground station, in square metres;

— area available for office space, in square metres;

— area available for other ground support equipment, in square metres;

— area available for storage, in square metres.

10.1.11 Storage (non hazardous items)

The IRD shall provide the following information:

a) list of items to store;

b) environment:

   1) temperature, in degrees Celsius,

   2) humidity, in percent,

   3) other.

10.1.12 SC pre-launch activities calendar

The IRD shall provide the following information:

a) assembly and testing (specify timeline);

b) hazardous operations (specify timeline):

   1) balancing,

   2) turn-on of high power radio frequency system,

   3) initial pressurization,

   4) hazardous ordnance installation,

5) fuel loading,
6) mating operations;

c) SC battery charge;

d) SC system's control.

10.1.13 Special technical support equipment

The IRD shall provide the following information:

a) weighing device:
   1) scale, in kilograms (with tolerance),
   2) load cells available (Y/N, to specify);

b) dynamic balance machine:
   1) capacity, in kilograms,
   2) spin rate, in revolutions per minute (with tolerance),
   3) type of interface.

10.1.14 Other

The IRD shall specify any other general logistics requirements.

10.2 Specific requirements for solid propellant motor facilities (Y/N, to specify)

10.2.1 Solid propellant motor storage

The IRD shall provide the following information:

a) size area, in square metres;

b) environment:
   1) temperature, in degrees Celsius,
   2) humidity, in percent,
   3) other;

c) electrostatic discharge protection available (Y/N, to specify).

10.2.2 Pyrotechnics storage

The IRD shall provide the following information:

a) size area, in square metres;

b) environment:
   1) temperature, in degrees Celsius,
   2) humidity, in percent,
   3) other;

c) electrostatic discharge protection available (Y/N, to specify).

10.3 Specific requirements for X-ray facilities

The IRD shall provide the following information:

— X-ray equipment available (explain) (Y/N, to specify);

— turntable available (Y/N, to specify);

— film processing available (Y/N, to specify);

— cold soak available (Y/N, to specify).

10.4 Specific requirements for hazardous operations facilities

10.4.1 Gases

The IRD shall provide the following information:

— specification;

— procured by user (Y/N, to specify);

— quantity, in cubic metres;

— supply pressure, in pascals (with tolerance);

— sampling (Y/N, to specify).

10.4.2 Liquid propellant

The IRD shall provide the following information:

a) specification;

b) procured by user (Y/N, to specify);

c) quantity, in cubic metres;

d) supply pressure, in pascals (with tolerance);

e) sampling (Y/N, to specify);

f) storage:

   1) period and duration, in days,

   2) size area, in square metres,

   3) environment:

      i) temperature, in degrees Celsius,

      ii) humidity, in percent,

      iii) other;

g) transfer conditions.

10.4.3 SC purge requirements

The IRD shall specify the SC purge requirements.

10.4.4 SC fluid requirements

The IRD shall specify the SC fluid requirements.

10.5 Payload handling and transport requirements

The IRD shall provide the following information:

a) payload to transport (SC, composite or other)

b) itinerary and timelines (optional), with drawing;

c) type of transport and handling operations;

d) transport and handling equipment;

e) payload transportation configuration;

f) weight of payload, in kilograms;

g) container for transportation supplied by SC agency (Y/N, to specify);

h) environmental conditions (see Clause 8);

i) SC purge (Y/N, to specify);

j) SC fluids (Y/N, to specify);

k) general:

   1) weather forecast (Y/N, to specify),

   2) security (Y/N, to specify).

10.6 Communication requirements

The IRD shall provide the following information:

— external lines (telephone);

— internet link;

— range telephone network;

— operational intercom system;

— closed circuit television;

— countdown clocks;

— time reference.

10.7 General range services

The IRD shall provide the following information:

— chemical analysis laboratory (specify analysis type);

— mechanical and electrical workshop available (Y/N, to specify);

— optical and photographic workshop available (Y/N, to specify);

— measuring instruments laboratory available (Y/N, to specify);

— security service available (Y/N, to specify);

— industrial waste disposal available (specify type) (Y/N, to specify);

— weather forecast available (including time range) (Y/N, to specify).

11 Other requirements

The IRD shall provide information for any other requirement that the SC contractor wishes to add to the standard list given in Clauses 3 to 10.

Bibliography

[1] ISO 14303, *Space systems — Launch-vehicle-to-spacecraft interfaces*

[2] ISO 15863, *Space systems — Spacecraft-to-launch-vehicle interface control document*

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