Sous-Direction
chargée de la Protection,
de la Sauvegarde et de l'Environnement
Division Sauvegarde et Environnement
Département Etudes et Réglementation

CSG SAFETY REGULATIONS

GENERAL RULES

VOLUME 1

Le Directeur
du Centre Spatial Guyanais

P. MOSKWA

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INFORMATION SHEET

Title :

CSG SAFETY REGULATIONS

GENERAL RULES

VOLUME 1

Quality Criterion			Safety Criterion			Safety-Protection Criterion		
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Author's summary :

The CSG Safety Regulations contain the rules to be applicable on the BLA to protect persons, property and the environment against potentially hazardous systems from the design stage through operations. The include general rules and specific rules depending on the nature of the system.

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SAFETY REGULATIONS

DOCUMENT ORGANISATION

VOLUME 1 : General Rules

VOLUME 2 : Specific Rules

PART 1 : Ground Installations

PART 2 : Spacecraft

PART 3 : Automatic Launchers and Test Specimens

PART 4 : Inter-sites

PART 5 : Manned Flights

VOLUME 3 : Applicable Analysis and Calculation Methods ; justificatory documents, technical memoranda

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FOREWORD

The French State is mandated by the European Space Agency, of which it is a Member, to perform launches of Ariane from its territory of French Guiana.

As a consequence, the CNES has elaborated a document entitled "CNES Safety doctrine" in which general principles to respect are stated.

All the arrangements intended to control technical risks stemming from programmes, projects, or activities contributing to the flight of a manned or unmanned space object are called "safety". Safety involves two complementary and inseparable aspects :

- Ground safety, which is the set of industrial safety rules and their extension within the particular framework of the activities carried out on the Ariane Launch Base in Guiana (BLA).

- Flight safety, following on chronologically from the preceding aspect, and which is characteristic of ground protection during launch vehicle flight and during spacecraft re entry.

Flight safety is the responsibility of the launching State, in accordance with the "Convention on international liability for damage caused by space objects", appended to Resolution No. 2777 adopted by the United Nations General Assembly, dated 29 November 1971.

For launches performed from the BLA, flight safety is ensured by the Guiana Space Centre (CSG), an establishment of the Centre National d'Etudes Spatiales (CNES).

Within the Guiana Industrial and Space Community (CISG), the operation of the sites is shared between:

- the Centre National d'Etudes Spatiales (Guiana Space Centre and Ground Sub-Department),

- firms located on the BLA ;,

- contracting firms ;

- outside contractors.

The present regulations cover the safety rules applicable by the users of the BLA. Each, insofar as he is concerned, will be required to apply and have applied the parts relating to him.

Each Head of establishment shall be responsible for safety on the sites operated by him. However, an establishment may entrust the safety function, by protocol, to the Guiana Space Centre (e.g., Arianespace-CSG protocol) : Range Safety is then responsible for working out the safety rules and checking their application on the sites operated by the establishment.

For an establishment which performs its safety function entirely, the present regulations apply only at the level of interfaces between establishments and in the inter-sites field. These rules and their conditions of application are specified in Volume 2, Part 4, "Inter-sites". Attached to the rules in Volume 1, they shall be applicable upon formal acceptance, by the establishment, of the convention binding it to the Guiana Industrial and Space Community.

CONTENTS

APPENDIX 1 Reference documents

APPENDIX 2 Terminology

APPENDIX 3 Abbreviations

APPENDIX 4 Summary of volumes 2 and 3

APPENDIX 5 Methodology for classification of a vehicle as intrinsically safe

1 INTRODUCTION

1.1 SCOPE OF DOCUMENT

For the launching of space vehicles, an international Convention adopted by France stipulates that the launching State is responsible for any damage caused by the launches performed by or for it.

The Centre National d'Etudes Spatiales is responsible for drawing up and having applied the general safety rules allowing control of the risks involved in space activities.

In order to permit to each Space Centre Manager, or to the Chief of the establishment if different and according to their respective prerogatives, to write down the safety rules to be applied on their centre or for their type of activity, the CNES has elaborated a document entitled "CNES safety doctrine", which :

- determines his part in the safety field ;
- defines the corresponding organisation precepts ;
- states the basic principles for the safety procedure construction in order to control the technical risks generated by space activities.

In pursuance of the CNES Safety doctrine, the CSG Safety Regulations stipulates the requirements and rules to be complied with in the field of safety by all users of the Ariane Launch Base (BLA). The demarcation of the various components of the BLA is stipulated in the terminology.

Numerous operations performed on the sites of the BLA generate risks for persons, property and the environment.

As a consequence, the activities carried out on these sites shall be performed in compliance with the French acts and regulatory texts and the international conventions signed by France, governing potentially hazardous activities and installations (documents listed in Appendix 1).

The Safety Regulations inventory, supplement and adapt, where necessary, the French regulations and specify the rules to be complied with by the users in order to ensure control of the risks involved in the operations carried out on the Base.

The Safety Regulations do not deal with questions of security/protection, neither in theory, nor on the level of measures to be applied.

The French version of the Safety Regulations shall take precedence over the English version.

1.2 APPLICABILITY OF DOCUMENT

The Safety Regulations are applicable to all activities relating to the programmes, projects, ground installations, ground support equipment, operations and works due to be performed, applied or installed on the BLA.

Accordingly, these regulations :

- cover the design, manufacturing, preparation and implementation (including flight) of the activities mentioned above, which, both on the ground and in flight, enable compliance with the required safety level within the scope of action of Range Safety,

- apply to all firms or departments carrying out a temporary or permanent activity on one of the zones of the Ariane Launch Base in Guiana (BLA),

- shall be referred to in all agreements, contracts or submissions relating, either directly or indirectly, to an activity due to be carried out on or from the BLA.

Any non-conformance with these regulations shall be submitted for analysis to Range Safety in accordance with a procedure described in 3.7.3.

If additional requirements have to be expressed for fields not covered by the present document, they must not be in contradiction with the requirements of the present regulations.

The Programme Management shall be responsible for enforcing the requirements of the present regulations on their industrial contractors by providing them with the present regulations or by preparing a specific application document approved by Range Safety of the Guiana Space Centre.

In the event of any divergence of interpretation, the present regulations shall take precedence over the specific application document.

1.3 REFERENCE DOCUMENTS

The list of reference documents is given in Appendix 1.

In the event that a Customer or Manufacturer were to use foreign standards or regulations, he shall submit them to Range Safety (see submission process). In the event of contradiction with the present regulations and their reference documents, these standards shall be handled as a non-conformance (see section 3.7.3).

1.4 TERMINOLOGY - ABBREVIATIONS

1.4.1 TERMINOLOGY

The terminology used is that adopted by the main participants in the activities of the BLA :

- European Space Agency,
- Centre National d'Etudes Spatiales,
- Guiana Space Centre,
- Arianespace.

Nevertheless, a number of terms are defined in Appendix 2 to facilitate reading of the present regulations.

1.4.2.4 Abbreviations

The meaning of the abbreviations used in this document is given in Appendix 3.

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2 DESCRIPTION OF THE SAFETY REGULATIONS

2.1 STRUCTURE

All the texts dealing with safety break down into several:

- International texts recognised by France, French acts and regulatory texts, supplemented by the application decrees and the various applicable laws; this body of texts was used as a basis for drawing up the CNES Safety doctrine and the Safety Regulations of the Guiana Space Centre ;

- the CNES Safety doctrine ;

- the Safety Regulations of the Guiana Space Centre, which are sub-divided into :

  . Volume 1, setting out the definitions, requirements and general rules,

  . Volume 2, which consists of five parts each covering a specific field :

    * Part 1 : Ground Installations,
    * Part 2 : Spacecraft,
    * Part 3 : Automatic Launchers and Test Specimens,
    * Part 4 : Inter-sites,
    * Part 5 : Manned Flights.

  . Volume 3, which contains the methods for analysis and calculation of specific parameters, the technical notes used for safety and the justificatory documents for certain requirements.

The detailed updated list of the volumes/parts making up the Safety Regulations of the CSG is given in the document "Répertoire du Règlement de Sauvegarde du CSG" ref. CSG-RS-090-CN.

A brief summary of Volumes 2 and 3 appears in Appendix 4.

- the application documents, which may consist of :
  . a compendium of instructions (for example : industrial safety instructions),
  . operation plans,
  . emergency operations plans,
  . procedures,
  . miscellaneous specifications,
  . service rules.

2.2 CONFIGURATION CONTROL OF THIS DOCUMENT

The Safety Regulations are contained in a document the configuration of which is controlled by the Guiana Space Centre in accordance with the conditions described in the document CSG-RS-SBX-000248-SEER.

Amendment proposals can be formulated by any of the operating companies on the BLA, for example in order to solve possible problems of application.

Such proposals, complying with the model shown in the document CSG-RS-SBX-000248-SEER are to be sent to:

CENTRE SPATIAL GUYANAIS

SERVICE CHARGE DE LA SAUVEGARDE

BP 726
F - 97387 KOUROU CEDEX
FRANCE

2.3 DISTRIBUTION TO THE DEPARTMENTAL INSPECTORATE FOR LABOUR

The rules supplementing or adapting the national regulations, as an internal rule, and due to ground safety particularities, are to be distributed to the French Departmental Inspectorate for employment and work (cf. CNES safety Doctrine).

3 GENERAL INFORMATION ON SAFETY

3.1 ESSENTIAL LEGAL PRINCIPLES TO BE COMPLIED WITH

The principles to be complied with are based on the Code of work and its application decrees, and the texts relating to installations classified for environmental protection.

However, the following particular points should be remembered :

- obligation to provide employees with practical training in safety at the work station,
- obligation for a contracting firms and for each of its outside contractor, to write down a prevention plans and to co-ordinate safety rules set by each of them ;
- obligation for the Centre Manager, or for the Establishment Chief if different, and according to their respective prerogatives, to ensure the general co-ordination of the ground safety measures set by the firms when several firms able to perform, simultaneously or not, risk activities on a same place or on different places of the same centre or establishment,.
- obligation to ensure that the consequences of the activity of an operating firm do not create any unacceptable risk for persons, property or the environment.

3.2 DEFINITION OF GENERAL PRINCIPLES

In compliance with the principles defined in the CNES Safety doctrine, the objective of safety is to ensure the protection of persons, property and the environment, by complying with the following priorities corresponding to the safety objectives stipulated in section 3.3.4 :

- external populations,
- persons working on the BLA but not directly involved in potentially hazardous operations ;
- persons working on the BLA and taking part in potentially hazardous operations ;
- property and environment external to the BLA ;
- property and environment inside the BLA.

In order that these principles may be complied with, Range Safety applies an iterative process aimed at controlling the hazards generated by the activities of the BLA, this process taking the concrete form of the "Submission" procedure.

This iterative process shall start at the beginning of project design and continue through to project operation. It shall be integrated into all the project activities. Risk identification and evaluation shall be performed on the basis of qualitative and quantitative analyses which allow the risk reduction process to then be undertaken.

On completion of these analyses, further work enables the identified risks to be reduced to an acceptable level :

- either by system design,

- or by a suitable operating procedure.

By taking into account the principles of safety as of the project design stage, subsequent application constraints can be reduced.

The task conductors, with the assistance of Range Safety when they have entrusted to it the corresponding function, shall make sure that the operations performed comply with the safety objectives and the accepted procedures. They shall handle non-conformance in real time.

In order to control potentially hazardous situations, Range Safety takes part in monitoring of the BLA activities, co-ordinates the potentially hazardous operations within its competence and activates the necessary means of intervention.

When the function has been entrusted to it, Range Safety is empowered to interrupt any operation to the extent that a risk appears which is unacceptable from the safety viewpoint. It shall have the system restored to safe condition. It may also, in certain situations, prohibit the enabling of potentially hazardous circuits.

During a launch, Range Safety may neutralise a launch vehicle in flight, before it becomes dangerous.

3.3 GENERAL SAFETY OBJECTIVES

3.3.1 DEFINITION

The general safety objectives are the qualitative and quantitative expression of the safety level required for all the activities of the BLA.

They consist of two parts : the definition of the undesirable event and a probabilistic level, estimated as being the maximum acceptable probability of occurrence of that event.

The higher level safety objectives are assessed in the CNES Safety doctrine.

3.3.2 METHODOLOGY

Any risk study must be based on an operating safety methodology which shall be submitted to Range Safety for information and any comments.

3.3.3 SEVERITY CLASSES

A risk is a two-dimensional quantity associated with a specific circumstance in the system's life and characterising an event undesirable due to the severity of its consequences and the probability of its occurrence.

The consequences of a risk are classified in five categories (cf. CNES Safety doctrine) and listed hereafter :

- catastrophic : loss of human life,
- severe : severe injuries to persons and major damage to property, including the environment,
- major : loss of mission (not dealt with in the field of safety),
- significant : slight injuries to persons; slight damage to (or minor) or deterioration of property, including the environment,
- insignificant : without consequence for persons, property and the environment.

3.3.4 QUANTIFICATION OF OBJECTIVES

The general safety objectives adopted in relation to industrial and operational activities are as follows :

Catastrophic :

loss of human life (accident in flight or on the ground),

a) public :	10^{-7}/campaign
b) populations flown over :	10^{-7}/launching 10^{-7}/return
c) personnel operating on the BLA :	10^{-6}/campaign [1]
d) crew of a manned flight (BLA share) :	in compliance with the programme objectives

severe :

severe injuries to persons, 10^{-4}/campaign

major damage to property (destruction of launcher, spacecraft, ground installations), and to environment ;

a) any potentially hazardous ground system :	10^{-6}/campaign
b) other installations :	10^{-4}/campaign

significant :

slight injuries to persons,

slight damage to property and to environment (deterioration),

objectives set by the project and accepted by Range Safety, for all categories having no project objective : 10^{-2}/year

The general safety objectives adopted for "out-of-campaign" activities are as follows :

catastrophic : 10^{-4}/year

These objectives are based on the regulatory texts applying to the pyrotechnic or petrochemical industry.

Note : The definitions of injuries to persons and damage to property are those adopted by the Pyrotechnic Regulations (quoted in the references).

[1] In conformance with the CNES Safety doctrine, the matter is a launch or return campaign, including recovery when CSG is in charge of it.

3.3.5 RISK CONTROL

The manager of any project shall demonstrate that it complies with the objectives assigned to it: quantitative objectives and qualitative requirements.

The non-conformance and deviations controlled by himself (control of critical parameters) shall be brought to the knowledge of CSG Range Safety.

One method, for example, is to determine the acceptable probability levels for scenarios linking failures of the various sub-systems to undesirable system-level events the criticalities of which are evaluated on a pre-defined criticality grid. This makes it possible to establish a ranking of risks and compare them with the acceptability criteria. The criticality grids shall be submitted to CSG Range Safety for approval.

A scenario which is classified in the region of unacceptability shall be subject to special monitoring.

3.4 SAFETY PROCEDURE

3.4.1 GENERAL

The safety procedure can be broken down into three phases :

- **prevention, i.e. :**

  . study the risks involved in the preparation and launching of the project in its normal environment,

  . study measures to reduce risks,

  . identify critical points,

  . study degraded situations to conceive measures and procedures making it possible to return to a non-hazardous situation, or at least limit the consequences of the event.

- **control, i.e. :**

  . check the compliance of the system and of operation implementation with the definitions and procedures defined above,

  . control identified critical points.

- **intervention, i.e. :**

  . implement preventive measures to prevent unplanned enabling of a potentially hazardous operation, to interrupt a sequence or to apply a suitable corrective procedure to restore safety,

  . implement measures to limit the consequences of an incident.

For the safety procedure to achieve its objectives and have maximum effectiveness, the activities entailed therein shall be :

- organised to ensure strict control of risks,
- incorporated into all project activities,
- co-ordinated with the "reliability" and "availability" aspects of Dependability.

3.4.2 PRINCIPLES OF SAFETY CONSTRUCTION

3.4.2.1 Safety studies

The safety procedure shall include precise studies of the risks due to systems, installations, ground support equipment, procedures, the environment and human errors.

It is an iterative and permanent process which shall take into account the experience acquired either during previous projects at the CSG, or outside projects.

It is designed to :

- identify and evaluate risks,
- initiate a programme of risk reduction by establishing a ranking of risks, and then controlling the risks.

The acquired experience makes it possible to :

- identify potential risks at a very early stage,
- evaluate risks,
- propose measures to minimise risks as of the project design stage.

The process of risk control is based on qualitative and quantitative analysis techniques.

The quantitative evaluation of a risk is a help, but it is not sufficient because :

- the models adopted do not strictly represent real conditions,
- certain parameters are very hard to quantify (insufficient data or experience concerning component reliability),
- difficulty in identifying certain causes of risk (allowance for human error in particular).

However, quantitative methods make it possible to :

- validate concepts,
- establish a ranking of risks,
- compare the solutions proposed for a given problem,
- quantify the relative weight of a parameter in the overall evaluation of risks.

To overcome any difficulties in the application of quantitative methods, it is acceptable to apply a qualitative approach. The method used shall be submitted to Range Safety during the submission phase for information and comments where applicable.

The installers and/or users of the BLA sites shall demonstrate theoretically that the supplies for which they are responsible meet the safety objectives allocated to them.

Concerning ground installations and equipment, assurance of durability over time is given by the application of an approved maintenance programme and by control of the configuration of those components.

3.4.2.2 Consistency with reliability and quality rules

The safety level is one aspect of a system's performance and, in general, the customary quality and reliability rules contribute to its improvement. As a consequence, the designers, constructors and users shall apply state-of-the-art practice and the standards recognised in their field.

3.4.2.3 Principle of single failure and double failure

Complex systems whose operation may involve risks shall comply with the following rules :

- Severe risk : **single failure criterion**

  No failure (simple fault or human error) shall entail a risk of severe (and, a fortiori, catastrophic) consequences. A commonly used designation for this is "Fail safe" (FS).

- catastrophic risk : **double failure criterion**

  No combination of two failures (fault or human error) shall entail a risk of catastrophic consequences (FS/FS or FO/FS).

  The double failure criterion does not apply to the combination of two human errors.

3.4.2.4 Barriers

Potentially hazardous circuits or systems can be enabled unexpectedly either due to a hardware failure or to a human error. To remedy such situations, barriers are introduced, the minimum number of which depends on the severity of the undesirable event : three barriers for an event of catastrophic consequences and two for an event of severe consequences. On potentially hazardous circuits, the device inserted in the circuit to control the fluid flow or the electric power, may be likened to a barrier.

Barriers opposing a given undesirable event shall be independent and, if possible, of different types. They may be mechanical, electrical, software barriers, etc.

Concerning circuits with catastrophic consequences, Range Safety requires that it have, on the one hand :

- either control of one of these barriers,

- or the ability to forbid barrier removal,

and, on the other hand, the status report for the barrier concerned.

This barrier is called a "disabling device".

The procedures shall be designed in such a way that several barriers in a given circuit cannot be removed simultaneously.

3.4.2.5 Interventions by Range Safety

When it appears that a decision generates a technical risk or grows up its former level, to a level which is not in compliance with the corresponding safety objective, Range Safety has to oppose this decision, and to report to the Space Centre Manager on whom he depends, and the Establishment Chief for whom he performs his functions (cf. CNES safety doctrine).

In case of trouble :

- Range Safety shall intervene on the ground, first by restoring the system to safe condition and, where applicable, by triggering an emergency plan,

- Range Safety shall intervene in flight by neutralising the launch vehicle when it violates the fixed limits.

3.4.3 PROCESS CONTROL

The Quality Assurance and Configuration Management provisions contribute to ensuring the safety levels demonstrated by the qualification studies and tests.

To check the correct performance of actions to obtain safety assurance and to ensure that these actions are incorporated in the general management of the project, a "**Safety**" section shall be systematically incorporated in the various project progress reviews and Range Safety shall be represented therein.

Where necessary, specific "Safety Reviews" can be organised to handle particular cases.

The management of anomalies and technical aspects also provides essential information and, accordingly, Range Safety shall be kept informed. It shall be associated with all studies to solve problems encountered which compromise compliance with the safety objectives.

3.4.4 NEED FOR FORMAL EXPRESSION BY A PROCEDURE

Due to the specific nature of the activities carried out on the BLA and to the need for performing them methodically and in satisfactory safety conditions, for all activities formal written documents shall be drawn up, known as procedures.

These procedures apply to the whole field of activities of the BLA and therefore cover the operations of application, integration, inspection, testing, maintenance, troubleshooting and transportation. They shall cover nominal activities and degraded situations: procedures for restoring safe conditions, safety intervention procedure.

These procedures, controlled in configuration by their issuer, shall, by their contents and presentation, allow easy, precise identification of the type of activity, decisive aspects and the risks involved.

The procedures, dealing with potentially hazardous operations or operations carried out in potentially hazardous areas, shall mandatorily be approved by Range Safety. No change may be accepted without further approval by Range Safety. Likewise, when an unplanned potentially hazardous operation is to be performed, the procedure for it shall be drawn up by the person in charge, and then submitted to Range Safety for approval before making a start on the operation.

3.5 BREAKDOWN OF RESPONSIBILITIES AND RELATIONAL ORGANISATION

3.5.1 RESPONSIBILITIES OF THE VARIOUS ENTITIES

In the field of safety, for a given activity, the responsibilities of the entities working on the BLA vary according to their function :

- Contracting firm ;
- Outside contractor ;
- Firm located on the BLA.

The definitions of these functions are reminded in Appendix 2.

Depending on the place in which a given activity is performed, each entity can have responsibilities of a contracting firm or of an outside contractor as defined by the Code of work, resulting from one or other of these functions.

3.5.2 SUPERVISION OF ACTIVITIES

The CSG Range Safety shall take part in monitoring of the BLA activities.

It shall monitor potentially hazardous operations on behalf of the CNES and those establishments which have entrusted their safety function to it. It shall co-ordinate potentially hazardous activities and the associated protection measures, in fulfilment of its mission of safety co-ordination (see Volume 2, Part 4, "Inter-sites").

The various operating companies will be required to comply with the constraints involved, in particular in case of incompatible activities.

3.5.3 THE INTERLOCUTORS OF RANGE SAFETY

For a given project, an interlocutor shall be nominally appointed by the project designer or by the Spacecraft Customer, as correspondent of the safety engineer in charge of the project.

Each firm located on the BLA shall appoint a principal correspondent to deal with safety matters in conjunction with CSG Range Safety (cf. Volume 2, Part 4, "Inter-sites").

3.6 MEANS AVAILABLE TO RANGE SAFETY

3.6.1 SAFETY DISPOSITIONS

For potentially hazardous operations, protection and intervention dispositions shall be defined and activated if necessary by Range Safety.

During potentially hazardous operations, the guard and fire protection means made available under particular disposition shall be put under the command of Range Safety.

The medical facilities shall be those of the Kourou Medical and Surgery Centre (CMCK) for the first alert. Specific operation plans shall deal with the alerting of facilities in other establishments of the region or in metropolitan France.

The meteorological information and forecasts required by Range Safety shall be supplied when needed, by the Meteorological Department.

Range Safety can also activate facilities for monitoring of land, air or sea zones recognised as liable to incur a risk inherent in the flight or in the consequences of certain events.

3.6.2 MATERIAL MEANS

The technical means available to Range Safety shall be designed so as to be able to fulfil their function in the degraded conditions which necessitated their use. They shall be the subject of dependability studies.

They shall provide unambiguous information.

Status reports shall be collected on active components and not only on their control circuits.

3.7 SUBMISSION PROCESS

3.7.1 GENERAL

The submission process provides a method of demonstrating theoretically :

- that the rules of the CSG Safety Regulations are complied with,
- that the safety objectives set for the project in question are actually achieved,
- that the implementation of the project will not create any unacceptable risk.

The submission process leads to formal approval by CSG Range Safety for a project or a programme, in the broad sense of those terms : ground installations, launcher, test specimen, flight trajectories, spacecraft, space plane, etc.

The submission procedure breaks down into four phases linked to the phases of project progress :

- Phase 0 - Feasibility : linked to the feasibility studies and the identification of potentially hazardous components or systems,
- Phase 1 - Design : linked to the systems definition,
- Phase 2 - Manufacturing : linked to systems manufacturing and testing,
- Phase 3 - Operation : linked to the operation of the systems at the CSG.

For each of these phases, the submission process shall take place iteratively between the designer, the user and Range Safety which shall study the documents supplied and give an answer, where applicable setting out :

- requests for additional information or studies,
- requirements concerning the equipment or procedures.

This dialogue shall continue up until formal approval by CSG Range Safety.

In the case of a system or product which can profit by heritage of a system or a product which has already been submitted to the CSG Safety Department, the Safety Submission process can be simplified (1/ a synthesis file of the previous Safety Submission process shall first have been established by the Submitter and archived by the CSG Safety Department : this file brings together all information transmitted to CSG and constitutes the Reference Submission; 2/ the following Submissions can then be achieved by difference with regard to this Reference Submission).

The documents making up the submission files, in particular those required for phase 0, shall be forwarded to the CSG as soon as possible.

The specific parts of Volume 2 define in detail the particular submission conditions.

3.7.2 MANAGEMENT OF SUBMISSION FILES

The documents to be drawn up by the submitters are described in the specific parts of Volume 2 and defined in detail in Volume 3.

All documents supplied by the submitters shall be written in French or English.

The file for each project, grouping together the various documents supplied, shall be updated by Range Safety until the end of the submission.

3.7.3 NON-CONFORMANCE

Non-conformance to the rules of the present regulations shall be presented in a justification file send to the CSG Manager, justifying and explaining in a detailed way :

- impossibility, in the studied case, to apply all the measures permitting to return to conformance ;
- the preconised measures to come as close as possible of conformance, including measures liable to be performed on the BLA ;
- the residual risk level resulting from the non conformance.

The file shall be evaluated by Range Safety which alone is competent to examine any request for waiver in its field.

In any case, a waiver is of an exceptional and provisional nature, related to the conditions of the operational environment at the time.

The decision shall be taken at the authorised hierarchic level, after obtaining the opinion of Range Safety, which in any case, must not receive delegation from the CSG Manager in matter of safety waiver.

3.8 ACCIDENT SITUATIONS

Whatever precautions be taken, an accident is always possible. It is important to be prepared, and this implies the existence of pre-prepared accident scenarios, indicating :

- for minor accidents, emergency measures or plans,
- for disastrous accidents, an Emergency Operations Plan (POI) or a Particular Intervention Plan (PPI).

3.8.1 ACCIDENT SCENARIOS

The scenarios of accidents liable to occur on the BLA or in flight, shall be identified on the basis of the danger studies performed during the development phase of each project.

An endeavour shall be made to inventory possible accidents, specifying for each of them the potential risks (fire, explosion, toxicity, etc.) and the extent of the corresponding hazardous areas.

3.8.2 EMERGENCY INTERVENTION PLANS

3.8.2.1 Minor accidents (severity class: significant or insignificant)

For minor accidents, conventional intervention measures shall be taken.

It must be possible to sound the alarm quickly (emergency switch, etc.) and activate devices to prevent the extension of the accident.

Intervention plans shall be prepared by the CSG fire-fighting draft to deal with each type of accident.

Given the specific nature of the substances used and the toxicity of some of them, "reflex" medical sheets shall exist and be displayed in the ambulances and in the emergency ward of the Kourou Medical and Surgery Centre.

3.8.2.2 Disastrous accidents (severity class : catastrophic or severe)

Disastrous accidents shall be dealt with in the special intervention plans called Emergency Operations Plan (POI) and Particular Intervention Plan (PPI) by virtue of the French interministerial instruction dated 12.07.85.

The POI shall be drawn up by the operating company and the PPI shall be prepared under the responsibility of the Prefect (regional French Government Authority).

The POI shall be applied by the operating company concerned by the accident. If the accident extends beyond the boundaries of the establishment, the CSG POI shall be triggered under the responsibility of its Manager or his representative. In the event that the consequences of the accident extend beyond the boundaries of the BLA, the PPI shall be triggered and placed in application under the responsibility of the Prefect.

The BLA shall have the resources required to organise rescue work relating to application of the POI.

An exercise simulating a disastrous accident shall be carried out at least once a year.

3.9 STAFF TRAINING

An important aspect of the safety procedure is staff training. The safety level of the BLA is directly dependent on the skill and qualifications of the operators and those performing control operations, at whatsoever level.

Although, for the sake of efficiency, it is logical to entrust the safety function to specialists, nevertheless all personnel working on the BLA shall be made aware of safety and trained for safety in their field of action.

Shall be authorised to perform a potentially hazardous operation only those staff members who have received the appropriate training and have the required qualifications.

Training involves two aspects :

- technical training in the staff member's speciality,
- safety training specific to the CSG.

3.9.1 TECHNICAL TRAINING IN THE SPECIALTY

Staff training and maintaining staff qualifications shall be the constant concern of all department managers and team leaders.

The employers operating on the BLA shall retain responsibility for training their personnel in industrial safety and the specific aspects of their speciality.

For this purpose, they shall undertake a commitment to Range Safety by certifying in writing the capability and qualifications of their personnel for the functions to be performed by them on the sites of the BLA, in potentially hazardous operations. Their commitment shall also specify the period of validity of this certificate. The monitoring and renewal of this certificate shall be the responsibility of the employer.

3.9.2 SAFETY TRAINING AT THE CSG

All personnel, whether resident or on assignment, who may move about without being accompanied on one of the BLA sites shall receive "safety" training.

Safety training involves three aspects :

- general training,
- specific training,
- particular training.

The content of the first aspect is defined by Range Safety. The corresponding training shall be provided by the employer or at his request by Range Safety.

The second and third aspects are implemented by the departments responsible for employing staff or receiving outside contractors in accordance with an approved training programme.

Approval of the programmes and training corresponding to the second aspect shall be given by Range Safety under the responsibilities delegated to it.

3.9.2.1 General training provided for all personnel entering the BLA

This training shall provide each staff member with a knowledge of the general risks which may be encountered on the BLA and the prevention measures to be adopted.

This shall be a condition for authorisation of access to the BLA.

3.9.2.2 Specific training depending on the work place

The aim of this training is to instruct personnel concerning the risks specific to each site, prevention and intervention measures, the characteristics of the equipment used and the procedures for use. This shall be a condition for authorisation of access to the sites in question.

3.9.2.3 Particular training

This training depends on the function of each staff member (fuelman, fireman, guard, pyrotechnician, operator) liable to intervene on a potentially hazardous circuit or take part in a potentially hazardous operation.

The purpose of this training is to familiarise the personnel employed in the functions mentioned above with the particular equipment and procedures used at the CSG. It is intended for specialists who are already thoroughly trained in their field.

3.9.3 TRAINING OF RANGE SAFETY PERSONNEL

Personnel due to take up a position in CSG Range Safety shall receive training before taking up their position.

Depending on their level of responsibility and the function they are to perform, they will receive in-house training allowing them to acquire the required specialisation.

This training is designed basically to train such staff on the one hand in the risk analysis methods used for the submission files and on the other hand in the procedures in force on the BLA and the reflex actions to be performed according to the scenarios in question. It shall also provide the staff with a good knowledge of the installations in service on the site, their protective systems and safety circuits, and the operations performed.

This training shall be supplemented by exercises simulating normal and degraded situations, with the application of intervention measures.

A qualification shall be delivered for this training.

3.9.4 TRAINING CONTROL AND PERIOD OF VALIDITY OF AUTHORIZATIONS

3.9.4.1 Technical training

An individual certification of capability shall be drawn up by the employer for each staff member taking part in potentially hazardous operations. It shall indicate capability for fulfilling a function and the scope of validity of the training acquired by the staff member. Presentation of this certification to Range Safety shall be a condition of authorisation to exercise the function mentioned on the sites for which safety is ensured by the CSG.

3.9.4.2 Safety training

Training certificate

For safety training, a sheet is drawn up, co-signed by the instructor and the person trained: the training supervisor shall certify that he informed the trainee of all applicable instructions and showed him or her the special features of the installation ; the person trained acknowledges receiving the requisite training and acquiring knowledge of the instructions in force. For any change in equipment or procedures, additional training shall be provided according to the same conditions. This training is compulsory before taking up any position.

When the training is provided by the employer, the latter shall attach the corresponding sheet to the certification provided for in the preceding section.

Periods of validity of safety training

- general training : three years, provided that the person trained has not been absent from the BLA for a time exceeding one year ;
- specific training : one year, provided that the person trained has not been absent from the BLA for a time exceeding six months ;
- particular training : for this training the period of validity is determined by safety regulations which prescribe this training or by Range Safety, as the case may be.

Registration for safety training sessions

CNES/CSG is responsible for registration of its own employees (permanent or missionary ones) and that of its sub-contractors for the required safety training sessions, taking into account periods of validity defined above.
For other ground facilities than the CNES/CSG established on the BLA, each establishment chief is responsible for registration of his employees and that of this sub-contractors for the required safety training sessions, taking into account periods of validity defined above.

3.9.4.3 Authorisations

When Range Safety has the employer's certification and training safety sheet, the personnel shall be considered "authorised" for the shorter period of validity of the two training courses.

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4 GROUND SAFETY UNDER THE RESPONSIBILITY OF THE CSG

4.1 INVENTORY OF MISSIONS

4.1.1 RESPONSIBILITIES OF RANGE SAFETY WITH RESPECT TO GROUND SAFETY

CSG Range Safety is responsible for working out, updating and controlling the application of the rules contained in the present regulations.

Within the general framework of the protection of persons, property and the environment from the risks involved in the activities of the BLA, and, taking into account the delegation received by it from the CSG Director and the protocol agreements signed between certain Establishments and the Guiana Space Centre, Range Safety is responsible for controlling the safety of all activities of the Establishments which have delegated this function to it, for the following two aspects :

- industrial safety,
- safety of operations carried out on the ground on space systems and ground support equipment, for protection of persons, property and the environment of the BLA.

Within this framework, it is responsible for :

- working out the hazard analyses and environmental impact studies required by the legislation relating to installations classified for environmental protection,
- approval of the design of all potentially hazardous systems relating to Spacecraft, Launchers, Test Specimens and ground support installations,
- approval of the manufacturing of said systems,
- approval of procedures and control of their application for potentially hazardous operations,
- the definition and co-ordination of prevention and protection measures and the means of intervention relating to potentially hazardous operations,
- ground safety support for operational activities,
- working out the rescue organisation plan in the event of an accident (Emergency Operations Plan),
- safety training for personnel and setting up of the associated pedagogic facilities,
- working out of industrial safety instructions and control of their correct application.

It is also responsible for the co-ordination of potentially hazardous activities on the BLA, within the limits specified in Volume 2, Part 4, "Inter-sites".

4.1.2 FIELD COVERED

The field of competence of Range Safety extends :

- on the design level, to all systems or installations due to be operated on the BLA, to their ground support equipment and their operation and maintenance procedures,
- on the operational level, to all operations within the BLA.

4.2 BASIC PRINCIPLES OF GROUND SAFETY

Range Safety shall ensure application of the basic principles for safety construction described in section 3.4 hereabove, which involve three aspects :

- studies,
- controls,
- intervention measures.

It deals in particular with the following points.

4.2.1 GENERAL PRINCIPLES

4.2.1.1 Risk analysis

For any potential source of accident a risk analysis shall be carried out by the submitter.

This analysis shall indicate :

a) the probability of accident,

b) the extent of danger areas.

The extent of hazardous areas shall be evaluated for the various effects of accidents :

- thermal flow,
- overpressure,
- projection of debris,
- toxicity, etc.

The calculation of hazardous areas shall be performed on the basis of the methods defined in the French pyrotechnic regulations (cf. appendix 1, G-2 and G-3).

For liquid explosive substances (liquid propellants), the determination of hazardous areas shall be adapted according to the results of experiments.

The analysis of toxicity risks shall be performed in accordance with the methods in use in the chemical industry. The SES.(Significant effects thresholds)are the tolerable thresholds to be taken into account for danger studies, and are defined in the note reference A.14.

4.2.1.2 Limiting personnel exposure in hazardous areas

The presence of persons in hazardous areas may be accepted or not depending on the risk level evaluated for each potential source of accident. A strategy for personnel evacuation from the BLA shall be defined as a function of the activity in progress (fuelling, tests, launching, etc.)

The personnel allowed inside the hazardous area of a potentially hazardous operation shall be limited to the strict minimum needed to perform the operation. The maximum number of operators and their functions appear in the procedure for the potentially hazardous operation. Special operators (photographers for example) shall be considered as forming part of the operational team.

Access by visitors will be authorised in a hazardous area only if the risk study shows that compliance with the safety objective with respect to the public is ensured.

All precautions shall be taken in order that the public may not be exposed to the risks and nuisances of the BLA; in particular, for launching and bench testing operations, a clearing procedure shall be applied in hazardous areas extending beyond the boundaries of the corresponding site.

4.2.1.3 Classification of circuits and operations

Range Safety defines the list of systems, potentially hazardous components and potentially hazardous operations for which special treatment is required.

4.2.1.4 Operator protection

In order to minimise the possible consequences of a residual risk, protective equipment shall be worn by operators.

4.2.2 OPERATIONAL PRINCIPLES

4.2.2.1 Principles of organisation in operation

Organisation during a launch or a test campaign shall always include the safety function. The role of Range Safety is to provide an assurance of the safety objectives : preventive role as adviser and role of intervention.

To perform this function, Range Safety shall be hierarchically independent of the operational teams.

In the course of a potentially hazardous operation, the organisation set up on the BLA can be schematically represented as follows :

- the task conductor on the site shall be completely responsible for the safety of the operations run by him,
- he shall be assisted by a safety team consisting, for example, during a campaign, of :
  - a campaign ground safety manager,
  - a ground safety engineer, adviser to the task conductor,
  - support and intervention means.

All the operations are inventoried in an "Operations Plan" and are detailed daily by operation follow-up.

The safety function is ensured permanently thanks to a system of persons on duty and by constant monitoring of the alarms.
The industrial safety rules are brought together in a collection of instructions at the disposal of the managers. Particular rules for a given building shall be displayed in that building.

Suitable protective equipment shall be worn by the personnel.

The general safety rules drawn up by each establishment shall be supplied to each operator working on one of the sites of the establishment.

4.2.2.2 Methods of action of Range Safety

Range Safety performs its action through co-ordination, monitoring and interventions.

The safety representatives may, in particular :

- attend any operation to check that the safety rules are appropriate and/or correctly applied,
- act on the operators or the task conductor to ensure that the safety rules are complied with,
- request the task conductor to stop a potentially hazardous operation and restore the systems to safe condition when the risk level is regarded as unacceptable.

In the event of disagreement between the task conductor and the safety representative, arbitration shall be performed at a senior hierarchic level.

As soon as a decision is taken by the relevant authority, in total knowledge of the technical risks, and as long as their level complies with the corresponding safety objectives (potential waiver), Range Safety provides its proficiency to define the means necessary for controlling accepted risks (CNES safety doctrine).

A potentially hazardous operation can be started only after obtaining the approval of Range Safety. Range Safety will check, before giving the authorisation, that the required conditions, specified for the normal environment, are complied with (facilities for fire-fighting, guarding, meteorological surveillance, alerting medical facilities, presence on the spot of a safety representative, evacuation of a particular zone, etc.), and will check compatibility with operations carried out at the same time.

Traceability of operation performance shall be obtained by recording significant activities (video, communications between operators, photographs, etc.).

Safety co-ordination

Range Safety performs the function of co-ordination via a Safety Co-ordination Office (BCS) whose missions are defined in Volume 2, Part 4, "Inter-sites".

This function of co-ordination does not supersede the safety functions specific to each establishment.

The safety representatives' consoles

To ensure more effective action by Range Safety, a Safety Representative Console (PRS) shall be installed on certain sites (ELA, EPCU, etc.) to perform decentralised monitoring. The console is operated by a safety representative when a potentially hazardous operation is to be carried out on the site in question.

Clustered on these consoles are the supervision systems, and in particular :

- the video facilities required to monitor operations on the site,
- the communications facilities to maintain a link with the team of operators and to ensure the collection and broadcasting of information or alarms, in conjunction with the Safety Co-ordination Office (BCS),
- status reports for disabling devices,
- the disabling commands available to Range Safety.

On-the-spot monitoring

Safety Representatives can attend any field operations at their initiative.

4.2.2.3 Support services

To ensure the safety of the BLA, various means are enabled for potentially hazardous operations :

- Range Security and Protection : controls access to and circulation on the BLA,
- Range Fire-fighting Draft : monitors fire and toxicity alarms, performs emergency interventions in case of need.
- Kourou Medical and Surgery Centre: is placed in alert by Range Safety in order to provide first aid, and possibly hospitalisation or sanitary evacuation in the event of an accident.
- Meteorology : forecasts and monitors the evolution of atmospheric conditions.

4.2.2.4 Operational procedures

In accordance with the principle set out in 3.3.4, all action or intervention processes relating to safety shall be formalised in written documents which may take the form of :

- procedures for nominal cases or degraded situations,
- safety instructions,
- documents laying down actions to be undertaken in the event of an incident or an accident.

The procedures for potentially hazardous operations shall be approved by Range Safety. They are designed so as to be reversible, i.e., so that at a certain number of keys points during the operation, it is possible to return to a situation in which the system is safe.

4.2.2.5 Work conditions in hazardous area

To ensure operator efficiency in operations requiring great attention and/or carried out in difficult environmental conditions, a maximum duration of continuous work shall be stipulated by the operation procedure. To go beyond this limit, a waiver must be granted by the task conductor following approval by Range Safety.
In an hazardous area, a means of permanent connection between Range Safety and operator(s) in this area is required.
In case of operating a potentially hazardous system, an operator team of two persons, or more if justified, is required.
In the case of operating in an hazardous area without any operation on a potentially hazardous system, a single operator can operate. The required permanent connection with Range Safety may be replaced in this case by a permanent connection with Fire Brigade.

4.2.3 PRINCIPLES RELATING TO MANNED FLIGHTS

In addition to the rules mentioned above, there are some general principles specific to manned flights.

4.2.3.1 Basic postulate

In supplement with section 3.2, the safety of personnel working on the BLA takes priority over the safety of a launch vehicle crew inside.

4.2.3.2 Boarding phase

The boarding phase shall be carried out with a launch system (manned vehicle, launcher and ground installations) under surveillance.

The configuration shall be as stable as possible while maintaining the launch system safe.

The evacuation means shall be in operational configuration.

Actuation of any ejection systems shall be inhibited.

The launch system configuration shall comply with the principles set out in Chapter 3. It shall be thoroughly well known and controlled.

During countdown, the boarding phase shall take place at a time which minimises the risks incurred by personnel working on the BLA and by the crew. It shall take place in the absence of any dynamic operation.

The residual risks shall be compatible with the safety objective relating to ground personnel working on the BLA.

The rules relating to the risks involved with confined atmospheres shall be complied with during boarding by the crew.

The means used for the boarding phase (vehicles, lifts, communication facilities, etc.) shall be compatible with explosible atmospheres.

4.2.3.3 Interruption of the boarding phase

The means of evacuation (see definition in Appendix 2, "Terminology") shall be sized taking into account the crew and the assisting ground personnel in the launch area.

The general training and capability rules shall be applied scrupulously to personnel assisting the crew at boarding.

The decision to evacuate and the type (normal or quick) shall be the responsibility of the relevant authority on the advice of Range Safety.

4.2.3.4 Ejection

Potentially hazardous operations which may lead to ejection (see definition in Appendix 2, "Terminology") of the crew on the launch pad shall be authorised only after withdrawing the assisting ground teams.

4.2.4 - RECOVERING ON A CSG'S AREA

The phase of safing after a space vehicle return on a CSG's area, is the period between stoppage of the vehicle on the ground and the return to a safety level in compliance with the objectives applicable to workers on the BLA (cf. § 3.3.4).

Upon its return, the space vehicle is considered a potential source of chemical, pyrotechnic, thermal, mechanical, pneumatic, etc. risks.

Before the touchdown of a vehicle, a restricted-access zone shall be set up around the designed zone, covering a sufficient area to include the hazardous areas generated by the vehicle, wherever it may stop.

Any access to this area is authorised only after the approval of Range Safety.

It must be possible to restore the vehicle to safe conditions from outside the vehicle : repositioning of safety barriers on each potentially hazardous system, inhibition of control of all systems actuating a potentially hazardous power component, etc.

Any emergency devices related to identified risks, shall be available.

In case of trouble, Range Safety shall trigger the requisite alert and the intervention of the rescue services.

Before reopening the restricted zone, range Safety shall ensure that the environmental conditions have returned to normal.

5 FLIGHT SAFETY

5.1 MISSIONS

5.1.1 RESPONSIBILITIES

The CSG shall protect persons, property and the environment against damage and nuisances due to launch and space vehicle manoeuvres during the phase of launching and the return phase when included in the corresponding launching phase.

This protection shall respect the priorities as defined in § 3.2. In particular, CSG shall analyse the fall down on Earth of the components scheduled to come apart from the space object, during the launch or the return phase in Guiana.

The aggressions to be averted come from :

- space craft in flight (launcher and payload) ;
- the surrounding environment (atmospheric phenomena, ground equipment).

In this framework, Range Safety is responsible for :

a) In the feasibility, design, realisation phases :

- working out the safety rules specific to launch-vehicle flight ;
- approving the design and implementation of ground and on-board devices permitting application of these rules during the launch phase and the return phase ;
- risk studies relating to the falling of space objects launched from the BLA and the impact on the environment of an in-flight explosion, within the framework of launch trajectory and return trajectory submissions ;
- approving, through return phase studies, the well-defined impact areas for the concerned components ;
- determining by preliminary studies, in the event of vehicle re-entry, the authorised impact zones for de-orbited components ;
- upgrading the safety philosophy and the procedures entailed by it.

b) In the ground operations phase :

- checking the correct operation of intervention devices (on-board and on the ground),
- issuing of zone reservation notices in anticipation of launching, or in anticipation of the return, for the benefit of air, sea and land users,
- working out of procedures.

c) **In the launch and return phases :**

- control of the risks generated on the ground and in the atmosphere by the launch vehicle,

- collection and transmission of information which relate to the hazardous components or hazardous products fall areas, in the framework of the Emergency Operation Plan (POI).

During a launch, CSG Range Safety can apply the intervention measures needed in order to assume these responsibilities.

5.1.2 FIELDS COVERED

5.1.2.1 Geographic field

The CSG's safety responsibility extends over all land or sea surfaces and air volumes for which a launch vehicle flight may represent a danger prior to placing into orbit, during its fall and during re-entry.

These surfaces and volumes are broken down into several zones :

- **the Protected Zone (ZP)**

  The Protected Zone is defined as the land, sea and air part for which a spacecraft flight does not create any higher risk level than the objectives of this present rule.

- **the Unprotected Zone (ZNP)**

  The Unprotected Zone is the land, sea and air complement of the Protected Zone.

- **the Precarious Unprotected Zone (ZNPP)**

  The Precarious Unprotected Zone is a subset of the Unprotected Zone. When the presence of personnel in a part of the Unprotected Zone is necessary, this one is named "precarious" and particular protection rules are to be applied to minimise consequences of a potential impact.

  The safety objective stipulated with respect to personnel working on the BLA applies to the Precarious Unprotected Zone (ZNPP). It covers the fall of components or component debris and the effects due to an explosion (thermal flux, toxicity below the set thresholds).

5.1.2.2 Systems concerned

- During the launch phase of a space vehicle, or during its return phase if included in the corresponding launch phase, the systems concerned by safety consist of :

  . orbiting or non-orbiting launcher stages,
  . boosters,
  . spacecraft,
  . manned or automatic launch vehicles.

5.2 BASIC PRINCIPLES OF FLIGHT SAFETY

The basic safety principles relating to a flight are designed to allow the execution of a launching or return flight, while controlling the risks inherent in those activities.

5.2.1 GENERAL PRINCIPLES

The safety objectives defined in section 3.3.4 of the present document can be achieved :

- **by the vehicle itself** depending on its design; it will then be classified as an "intrinsically safe vehicle",

  A vehicle is declared intrinsically safe if the following two criteria are met :

  * theoretical study shows that the risks resulting from launching are compatible with the safety objectives of the present regulations,

  * experimental study confirms the results of the theoretical study, both for normal dispersions and for incidents.

  For new vehicles, a study of similarity to existing models, taking into account the characteristics and technology and based on the dependability objectives, may momentarily replace experimental confirmation.

  The criteria for classification as an Intrinsically Safe Vehicle are given in Appendix 5.

- **by an intervention device**, which may be an on-board automated system or an on-board/ground device.

Assurance of risk control during a launch-vehicle flight is obtained by "submissions" relating to trajectories, to the risks generated for areas which may be flown over and to the on-board and ground equipment contributing to operational risk control. These submissions shall be made for nominal conditions and for degraded situations.

In the exceptional case in which the particular rules cannot be complied with, the probability of intervention on the vehicle shall be increased in order to maintain the overall safety objective.

5.2.2 PRINCIPLES RELATING TO DESIGN

a) Range Safety is associated with projects as of their design phase. This principle allows the projects to take into account safety requirements from the outset.

b) The powered flight of a launch vehicle which cannot be classified as an intrinsically safe vehicle, represents a risk the consequences of which are considered catastrophic. The double failure criterion shall therefore be applied.

One of the failures in question being vehicle malfunctioning during the flight, the single failure criterion shall be applied to ground facilities and on-board equipment.

c) The means made available to Range Safety shall be designed to enable it to know :

- the status of the Unprotected Zone,
- sites occupied in Precarious Unprotected Zone and the numbers present there,
- the launch-vehicle location in all cases,
- the launch-vehicle behaviour as of take-off,
- the potentially hazardous nature of the flight or not,
- the status of the on-board intervention system,
- the reaction of the on-board intervention system when activated,
- the nuisance zone due to an in-flight accident or to the enabling of the on-board intervention system.

d) The launch vehicles (except for intrinsically safe vehicles) shall be provided with an on-board intervention system which may be triggered from the ground by remote control, or on-board by an automated system.

This system shall comply with the following criteria :

- overall consistency with respect to reliability allocation, in particular between the on-board and ground devices,
- reliability levels for lead failure and lag failure consistent with one another (the lead failure of one function shall not lead to the lag failure of another function and reciprocally), and individually consistent with the safety objective.

e) The on-board intervention system shall allow the launch vehicle to be neutralised, i.e. :

- breakdown of thrust,
- inhibit the ignition of any powered stage,
- prevent any self-propulsion,
- ensure the dispersion of the liquid propellants, with or without combustion,
- prevent the detonation of solid or liquid propellants both at altitude and at ground impact where applicable,
- prevent the creation of floating wreckage in the event of falling in a sea zone.

The on-board intervention system shall be capable of performing the various functions below:

- **controlled neutralisation** : a radio-commanded order from the ground causes execution of the function. Where it is not possible to equip each stage with telecommand receiver equipment, this equipment shall be located so as to be able to cause neutralisation of the whole vehicle, during all the phases for which it is not safe with respect to persons and population.
- **instantaneous automatic neutralisation** : an automatic on-board system instantaneously triggers the function of "neutralisation" of all the stages, when a non-nominal stage separation or a stage rupture occurs. This function can also be triggered by an on-board automated device, in the event of drift from the specified conditions,
- **delayed automatic neutralisation** : an on-board automatic system triggers the function with a specified time lag, to neutralise a stage after nominal separation, without generating any risk on the upper stages and before impact on the ground, and ensuring the dispersal of remaining propellant.
- **inhibition of the on-board receiver equipment** : this equipment shall be inhibited when the safety mission is no longer relevant (safety objective achieved).

f) The operational logic principle of the on-board/ground system contributing to the safety mission shall be as simple as possible.

g) The electronic components of this system shall be of an identical quality and reliability level, and these levels shall be consistent with one another.

h) Each sub-unit and the system complete with its components (wiring, connectors, couplings, etc.) shall be qualified in operation by environmental tests (thermal, acoustic, mechanical, dynamic, electro-magnetic, etc.) and tested for acceptance after integration.

The specifications relating to environmental tests for any new equipment and/or any new vehicle shall form part of the submissions.

5.2.3 PRINCIPLES RELATING TO OPERATIONS

5.2.3.1 All flights shall be subject to formal acceptance by Range Safety

The CNES Manager can, Range Safety's advice being notified, and in the framework of the CNES Safety doctrine, accept a waiver when the demonstrated risk level is not in conformance with the objectives defined in § 3.3.4.

5.2.3.2 In operations, the application of safety measures is translated by :

- evacuation of the portion of the Unprotected Zone controlled by the CSG,
- broadcasting of a warning to national and international air and sea users,
- broadcasting of a warning to populations,
- training of operational personnel,
- neutralisation of the vehicle and its Spacecraft when the trajectory is of a potentially hazardous nature.

5.2.3.3 The time selected for neutralisation shall be optimised as a function of the real trajectory of the vehicle, the areas flown over, residual nuisances (impact, thermal effects, chemical effects, etc.), the flight corridor and the limits determined by Range Safety.

5.2.3.4 To control the risk in a Precarious Unprotected Zone, Range Safety has information relating to the evacuation of that zone and shall check the conformance of effective numbers present with the approved number. Launch authorisation is subject to such conformance.

To control the risk in a Protected Zone, Range Safety sets limits allowing it to decide on neutralisation of the vehicle. They are defined in the Volume 3.

5.2.3.5 Risk control requires that Range Safety may :

- evaluate at all times the dangerous character of the vehicle in flight,
- intervene at all times to neutralise the vehicle.

5.2.3.6 The location of the vehicle and its potential impact shall be presented as described in the Volume 3, and shall take into account :

- information updating,
- data restitution accuracy,
- various lead times and time lags.

At any time during powered flight, Range Safety shall have :

- location information defined in the Volume 3 ;
- the on-board intervention system, allowing it to transmit the various orders and sequences required,
- on-board information relating to Launcher operation (propulsion, navigation components) and control of the on-board intervention system.

5.2.3.7 Final checking of the on-board intervention system shall be performed in the flight configuration. For this purpose, a remote controlled disabling device is required. This disabling device must be controlled from the ground up until the last possible moment before take-off, as compatible with the launch procedure.

5.2.4 PRINCIPLES RELATING TO MANNED FLIGHTS

The rules set out in the present chapter also apply to manned flights. However, they are sometimes amended, or even supplemented, by this section.

5.2.4.1 Basic postulates

Complementing the rules defined in section 3.2 of the present document :

- the safety of persons on the ground takes priority over the safety of the crew of a manned launch vehicle,
- the safety of the crew takes priority over the safety of property and the environment.

5.2.4.2 Launch phase

The launch vehicle shall be equipped with an on-board intervention system to ensure protection of the populations flown over while not penalising the safety of the crew. It shall be designed to give priority to the safety of persons on the ground.

The on-board intervention system can be triggered from the ground or by an on-board automated system.

5.2.4.3 Return phase

The overall risk involved in the return phase of a space vehicle on the Earth is classified as a catastrophic risk.

The safety of the populations flown over shall be ensured by the on-board equipment. This equipment shall comply with the double failure principle.

The return phase of unrecovered components shall be designed to meet the same requirements as those concerning the fall of Launcher stages (see Volume 2, Part 3, "Automatic Launchers and Test Specimens").

5.3 SUBMISSIONS

All launches from the BLA shall be subject to formal approval by CSG Range Safety. This approval can be issued only after a submission procedure referring to two different aspects.

5.3.1 EQUIPMENT

The equipment contributing to safety during the flight phase, from launching through to the end of Launcher propulsion or during the fall, shall be dealt with as follows:

- on-board Launcher equipment : in conformance with Volume 2, Part 3, "Automatic Launchers and Test Specimens",
- ground equipment : in conformance with Volume 2, Part 1, "Ground installations",
- Spacecraft : in conformance with Volume 2, Part 2, "Spacecraft".

5.3.2 TRAJECTORIES

Trajectories are subject to a specific submission process described in Volume 2, Part 3, "Automatic Launchers and Test Specimens".

6 SAFETY OF ACTIVITIES OUTSIDE OF BLA

6.1 TRANSPORTATION OF EQUIPMENT SUBJECT TO REGULATIONS

For certain equipment subject to regulations, a particular procedure is required for transportation. The list of such equipment and the procedures to be applied for it are stipulated by the various regulations summarised in Appendix 1, H and I.

A transport permit application shall in such cases be presented to the CSG Safety Co-ordination Office.

The general principles relating to such transport operations are as follows :

- The transportation of equipment subject to regulations destined for the BLA shall be performed under the responsibility of the sender and the transporter so long as they are outside the enclosure of the BLA, in accordance with the regulations in force.

- When such equipment enters the BLA, it shall be controlled in conformance with the provisions set out in Volume 2, Part 4, "Inter-sites".

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APPENDICES

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APPENDIX 1

REFERENCE DOCUMENTS

The present list is not exhaustive. It contains :

- national or European regulatory texts, which, on the publishing day of the present document, are particularly important in the field of safety, and of workers health and safety ; when necessary, the reader must report to the different articles of the Code of work ;
- French, European or international standards, pointed out in order to orientate the reader toward equivalent documents.

A GENERAL TEXTS

1. Labour code volume II «Labour regulations, part III «Occupational health and safety» and related enforcement texts.
2. Order dated 11.07.77 relating to works requiring special medical surveillance, and enforcement texts.
3. Order dated 19.03.93. relating to the list of hazardous works for whom a prevention plan is to be written.
4. Order dated 04.11.93 relating to signposting for safety and workers' health.
5. Order dated 26.04.96 (...) relating to the adaption of some safety rules to be applicated to loading or unloading executed by an outside contractor.

B RADIATION

1. Decree No. 66-450 dated 20.06.66, amended relating to the general principles of protection from ionizing radiation.
2. Decree No. 86-1103 dated 02.10.86, amended, relating to the workers' protection against ionising radiation, and application texts.
3. Decree No. 2001-215 dated 08.03.2001, amending decree n° 66-450 listd above (enforcement of directive n° 96/29/Euratom of the Council dated 13.05.96).

4. Standard NF EN 60825-1 : Safety of radiation from laser devices - Part 1 : Classification of equipment - Instructions for user.

5. Standard EN 31252 (ISO 11252) : Lasers and equipment associated to lasers - laser sources - minimal requirements for documentation.

6. Standard EN 31253 (ISO 11253) : Lasers and equipment associated to lasers - laser sources - mechanical interfaces.

7. Standard NF ENV 50166-2 (C 18-610) : human exposure to high frequencies electromagnetic fields (10kHz to 300GHz).

8. Standard NF X 08-003 : graphic symbols and pictograms. Colours and safety signposts.

9. Recommandation 1999/519/EC dated 12/07/1999 concerning limitation of human exposure to electromagnetic fields (0Hz- 300GHz)

C INSTALLATIONS AND ELECTRICAL EQUIPMENT

1. Decree n° 78-779 dated 17.07.78, amended, relating to requirements for manufacturing of electrical equipment usable in an explosive atmosphere, and application texts.

2. Order dated 31.03.80 relating to requirements for electrical installations in classified establishments liable to set out explosion hazard.

3. Decree 88-1056 dated 14.11.88 relating to the protection of workers in establishments employing electric current.

4. Order dated 19.12.88 relating to the fitting up conditions for electrical equipment in places setting out explosion hazards.

5 Orders dated 9.11.72 and 19.11.75 relating to fitting out and operating rules for liquid hydrocarbon storage depots of first and second classes.

6. Decree n° 92-587 dated 26.06.92, amended, relating to electromagnetic compatibility of electrical and electronical devices, and application texts.

7. Order dated 05.05.94, amended, relating to dispositions for certification of devices usable in an explosive atmosphere.

8. Standard C 15-100 relating to low-voltage electrical installations.

9. Standard NF C 32-070 : classification attempt for electrical wires and leads through their behaviour against fire.

10. Standard NF S 61-950 relating to fire detection devices

11. Standards NF EN 50 014 to 50 020, 50 028, and 50 039 (C 23-514 to 520, 23-528, and 23-539) : electrical devices for explosible atmospheres

12. UTE guide C 79 -138 (cenelec R044-001) dated may 1999.

D HANDLING AND HOISTING INSTALLATIONS AND DEVICES

1. Decree n° 89-78 dated 07.02.89 relating to the health and safety specifications for lift trucks and their devices, and application texts.

2. Order dated 18.12.92 relating to the tests and in use factors applicable to hoisting machines and devices, and other equipment's for preventing risks from hoisting operations.

3. Order dated 09.06.93 relating to the conditions of checking of hoisting devices, the height of working posts or the transport of persons in elevation.

4. Standards E 52-xx relating to handling and hoisting.

E LIGHTNING

1. Order dated 28.01.93 relating to protection from lightning of classified installations, and enforcement texts.

2. Standard NF C 17-100 relating to the rules for the installation of lightning rods.

3. UIC guide - GESIP DT 67 dated october 2000 - recommandations related to protection from ligtning of classified industriel plants.

4. UTE GUIDE n° 15443- Protection f low voltage installations from overvoltage of atmospheric origin.

F PRESSURE VESSELS

1. Official Gazette collection No. 1498, volumes 1, 2, 3 and 4 (1987 edition), containing the texts relative to pressure vessels.

2. Circular n° 24929 dated 05.11.91 relating to pressure vessels out coming from foreign countries (countries extra CEE) - authentication of certificates required by French requirements.

3. Order dated 24.12.91 relating to agreed firms to certification of pressure vessels.

4. Order dated 17.12.97 relating to harmonization of french regulation regarding gaz pressure vessels with RID/ADR rules.

5. Order dated 08.12.98 relating to non metallic gaz pressure vessels.

6. Decree N° 99-1046 dated 13.12.99 relating to pressure vessels.

7. Order dated 21 .12.99 relating to pressure vessels classification and evaluation of conformity with regulation.

8. Order dated 15/03/2000 relating to pressure vessels operating.

9. Decree N° 2001-386 dated 03.05.2001 relating to portable pressure vessels.

G EXPLOSIVE SUBSTANCES AND ARTICLES

1. Act n° 79-519 dated 02.07.79 repressing failure of declaration for vanishing of explosive products.

2. Decree No. 79-846 dated 28.09.79 instituting a public regulation concerning the protection of workers from particular hazards to which they are exposed in pyrotechnic establishments.
3. Order dated 26.09.80 stipulating the rules for determining pyrotechnic isolation distances relating to pyrotechnic installations.
4. Decree n° 81-972 dated 21.10.81 amended, relating to signposting, acquisition, delivery, possession, transport et use of explosive products.
5. Order dated 03.03.82 relating to control of explosive substancies and articles movements.

H DANGEROUS SUBSTANCES AND PREPARATIONS

1. Order dated 21.02.90, amended, relating to classification criteria and signposting and packaging of dangerous preparations.
2. Decree n° 94-181 dated 01.03.94 relating to the principles for classification and declaration of dangerous substances and preparations.
3. Order dated 20.04.94, amended, relating to declaration, classification, packaging and signposting of dangerous substances.
4. Directive n° 67548/CEE amended, relating to classification, pakaging and labelling of dangerous susbtancies.
5. Directive 98/24//CEE relating to workers safety and health protection, regarding occupational chemical risks.
6. Directive n° 2000/93/CE, relating to application of directive 98/24/CEE.

I TRANSPORT OF DANGEROUS GOODS

1. Order dated 14.01.83 relating to international air transport regulations for dangerous goods (standard IATA - International Air Transport Association).
2. Order dated 23.11.87 amended approving the international maritime transport regulation for dangerous goods (IMDG Code - International Maritime Dangerous Goods Code).
3. Order dated 17.12.98, amended, tacking into account in french regulation the directive n° 96/35/CE of the Council dated 03.06.96 relating to the designation and professional qualifications of safety adviser for road, railway or inland waterways transport of dangerous goods.
4. Order dated 01.06.2001 relating to the european agreement for international transport of dangerous goods by road (ADR).
5. IMO - IMDG Code relating to international maritime transport of dangerous goods-2000 revised edition.
6. IATA - Regulation relating to air transport of dangerous goods - 2001 revised edition.
7. ICAO - Technical instructions relating to safety of air transport of dangerous goods-2001/2002 revised edition.

8. Circular dated 20.10.97 tacking into account in french regulation the directive n° 95/50/CE dated 06.10.95 relating to uniform procedures for dangerous goods road transports checking
9. *(Enghlish version not concerned with)*
10. Maritime harbours code.
11. Order dated 18.07.2001 relating to handling and transport of dangerous goods inside maritime harbours

J OTHER TEXTS

1. ECSS-Q-30 Space product assurance - Dependability.
2. ECSS-Q-40 Space product assurance - Safety.

K CNES TEXTS

1. CNES safety doctrine, SVG-RS-010-CNSP document.
2. Industrial safety instructions, CSG-SBS-000444-SEMS document..
3. CSG Quality Manual, CSG-MQ-QR-20038-QFQB document.
4. List of documents relating to official approvals of BLA classified plants regarding environment regulation, CSG-LD-SBX-000300-SEER document.
5. List of BLA plants safety studies regarding occupational safety, CSG-LD-SBX-000299-SEER document.

L ENVIRONMENT/CLASSIFIED PLANTS

1. Order dated 20.05.1953 relating to catalogue of classified plants in the field of environment protection..
2. Directive n° 77-1133 dated 21.09.1977, amended, relating to enforcement of act n°77-663 dated 19.07.1976.
3. Letter DPR/SE/JJ-SES dated 17.07.1996, from Ministry of Environment to DRIRE Antilles-Guyane..
4. Directive n° 96/82/CE dated 09/12/96 relating to hazards control in the field of major accidents involving dangerous substances (SEVESO II).
5. Decree dated 15.07.97 relating to dangerous wastes classification.
6. Order dated 02.02.98 relating to water supply and consumption, and to any kind of releases regarding classified plants in the field of environnement protection.
7. EC rules n° 2408/98 dated 06.11.98 amending EEC rules n° 259/93 relating to watching and control of wastes transfering inside, in the entry and the exit of European Community.

8. Circular dated 10.12.1999 relating to polluted sites and grounds.
9. Decree n° 99-1220 dated 28.12.1999 amending classified plants catalogue (in the field of environment protection).
10. Order dated 10.05.2000 relating to prevention of major accidents involving dangerous substancies and preparations which are staying in some kinds of classified plants submitted to authorization (in the field of environment protection).
11. Order dated 17.07.2000 enforcing article 17-2 of decree n°77-1133 dated 21.09.1977, amended.
12. Order n°200-914 dated 18.09.2000 relating to legislative part of the environment code.
13. Order Type n°385 quater relating to use and storage of radioactive substancies in sealed closed shields.
14. Environment code, especially parts listed hereafter :

• Volume V -	Part IV	Waste elimination and materials salvage
• Volume V -	Part 1	Classified plants in the field of environment Protection
• Volume I -	Part 1 - chapter III	Public inquiries relating to activities which could damage environment
• Volume II -	Part I	Water and watery surroundings
• Volume V -	Part VII	Prevention of acoustical and visual nuisances
• Volume II -	Part II	Air and atmosphere

APPENDIX 2

TERMINOLOGY

Allocation :

Probabilistic level assigned to the occurrence of an undesirable or specified event, during the working out of the safety objectives.

The sum of the allocations of all safety objectives of a project shall be less than the general objectives stipulated for the project.

Ariane Launch Base (BLA) :

Technical, industrial and operational complex grouping together the resources required for :

- the missions assigned to the CSG :
  - . general co-ordination of operations and works,
  - . safety on the ground and in flight, and environmental control,
  - . security/protection,
  - . operation and maintenance of the appropriate technical and logistic resources (location, telemetry, remote control, telecommunication, meteorology, optics, governed and operational facilities, energy, etc.),
  - . public and external relations,
- activities specific to Ariane,
- routine operation of the CSG and the industrial facilities that the Establishment makes available to the users, including CISG firms.

Ariane Launch Area :

All the installations located required for operation and control of an Ariane launcher for launching purposes.

Clearing procedure :

Action of search and evacuation carried out by the surveillance systems on land, air or sea zones, designed to ensure that no unauthorised persons remain in those zones when they are about to become potentially hazardous.

Confined atmosphere :

Atmosphere in which air renewal may be inadequate to eventually allow a person to stay there safely.

Contracting firm :

Receiving establishment where some operations are performed by workers of an outside contractor, when this personnel is not completely under the control of the contracting firm, a contractual relationship between these entities should exist or not. It may be the owner, the tenant, the operator or the manager of the place.

Customer :

Outside contractor conducting preparation and range spacecraft operation, before launching.

Disabling :

Interruption of the continuity of the potential tramping of an undesired or specified event in a potentially hazardous system. Its cancellation, under the Range Safety permission, is named "safety enable".

Ejection :

Operation consisting in moving the crew away from a launch vehicle, without making use of the ground installations (except for any remote controlled ejection system).

Evacuation :

Operation consisting in moving the ground personnel working on the launch zone and/or the crew away from hazards presented by the launch vehicle.

A distinction is made between normal evacuation and quick evacuation.

In normal evacuation, the exposed personnel can be moved outside the hazardous areas around the vehicle. This is performed with the facilities used for boarding.

Quick evacuation is of an emergency nature. It allows exposed personnel to reach a safe place within a time compatible with the prior notice given by the alert.

Explosive atmosphere :

An explosive atmosphere results of blending air with flammable matters in a state like gas, aerosol or dust, in such a concentration as an excessive temperature, electric arc, sparks or any other enough powerful ignition source is able to burst it up.

In a place where a hazard of explosion exists, three areas may be defined according to the hazard of appearance of an explosive atmosphere and according to their nature :

- hazardous area n°0 : area where an explosive atmosphere is present permanently or during long periods;
- hazardous area n°1 : area where an explosive atmosphere can be created during a regular operating;
- hazardous area n°2 : area where an explosive atmosphere cannot be created during a regular operating, and where such a creation, if it occurs, can only exist for a short period.

The extent of these hazardous areas shall be described in a document approved by the chief of the establishment.

To define the extent of these areas, except in case of a particular study,

- the recommendations of the Industrial Gas Council (IGC) good behaviour code for liquid hydrogen,
- and the rules for fitting out and operating of liquid hydrocarbon storage depot of first and second class (cf. appendix 1) for all hydrazined products (hydrazin, methylhydrazin, ammonia, UH25, etc.),

shall be applied.

Fail operational (FO) :

Mission capable after a failure.

Fail safe (FS) :

Safe after a failure. The condition of remaining safe after two separate failures is known as FS/FS.

Firm located on the BLA :

Any firm, part of the CISG and operating an establishment located on the BLA.

Flight phases of a spacecraft :

Launch phase

Commences when the launch space object has no more physical contact with the equipment's and ground installations which have permitted its preparing and its take-off. It continues as far as (and including) the physical separation of the onboard space object from the last stage of the launch space object, as soon as the latter reaches a true orbit around the Earth, or an interplanetary trajectory, or in the opposite case, as far as it impacts on the Earth.

Orbiting phase

Commences immediately after the physical separation of the onboard space object from the last stage of the launch space object into a true orbit around the Earth, and it ends with the re-entry in the atmosphere of the Earth, may be naturally or voluntarily instigated.

Return phase

Starts up with the re-entry of the space object in the atmosphere of the Earth and ends when stopped on the Earth.

Interplanetary phase

Starts up immediately after the physical separation of the onboard space object from the last stage of the launch space object into an interplanetary trajectory, and ends when the onboard space object enters into an orbit around a celestial body different from the Earth, or when re-entering in the atmosphere of the Earth, or when disintegrating. It possibly can be endless.

Guiana Space Centre (CSG) :

CNES establishment the main geographical entity of which is located in Guiana. It contains the whole installations and personnel placed under the direct authority of the Centre Manager or of the Chief of establishment.

Guiana Industrial and Space Community (CISG) :

Structure for co-operation by the firms operating a site located on the premises of the Centre National d'Etudes Spatiales in French Guiana.

Hazard analysis :

Study showing the main internal or external hazards that can be presented by installation, indicating the associated risks, justifying the specific measures to minimise their probability and effects, and specifying the assistance facilities in case of mishap.

Hazardous area :

Area that might be the location of any effects able to cause damage, because of the proximity of one or several potentially hazardous systems.

Hazardous product :

Product liable to create harm through its intrinsic properties (mechanical, physical, chemical, biological, nuclear, thermal, etc.), or through a reaction with the surrounding medium.

This formulation includes, in particular, all "dangerous substances and preparation" as defined in EU regulations, together with refrigerated liquefied neutral gases (nitrogen, helium, etc) in their capacity as cryogenic fluids, and hot fluids.

Health and safety instructions :

Instructions showing the compliance of the planned installations with the legal and regulatory provisions relating to personnel health and safety.

Independence (of systems or components) :

Two systems or two components are said to be independent if they have no common failure mode and if they generate none mutual interaction.

Injection (in orbit) :

Passage of a launch vehicle from the launch trajectory to the first orbit ; the moment of injection corresponds to the end of thrust applied by the engine(s) of the Launcher last stage.

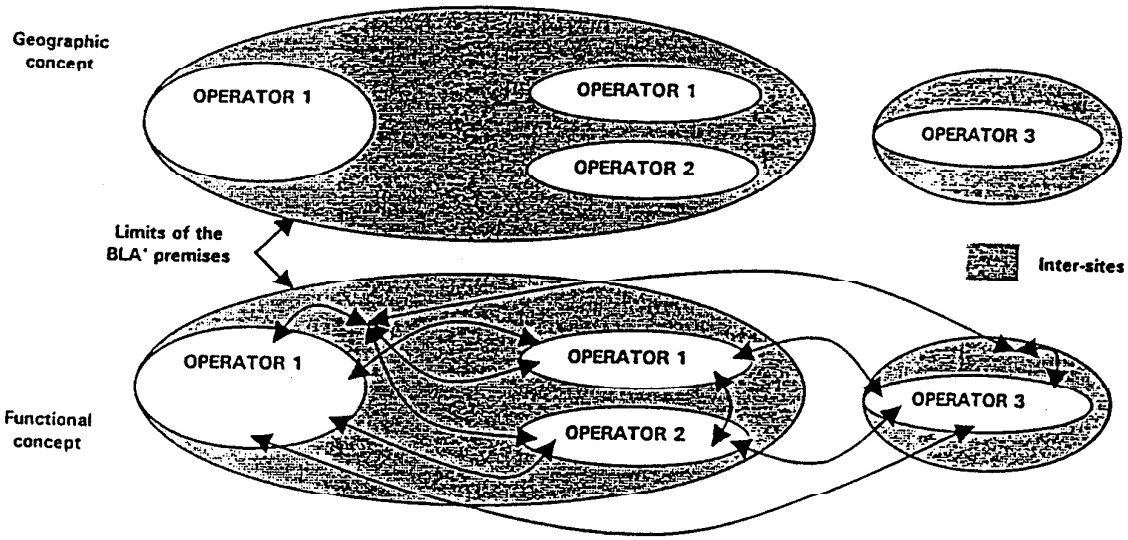
Inter-sites :

Geographical area including :

- the area inside of the CNES premises in Guiana and outside of the defined limits of each site,
- the installations on this area,
- the atmospheric environment and the underground of the CNES premises in Guiana.

Functional relationship existing or that might to exist between operators of a site and those of the geographical inter-site area, or between those of different sites.

These concepts are illustrated by the following diagram :



Impact study :

Study making it possible to assess the consequences of construction of a structure on the natural environment and presenting the measures taken by the operating company to compensate for any prejudicial consequences for the environment.

Lag failure :

Non-accomplishment of a function which is desired.

Lead failure :

Accomplishment of a function which is not desired.

Limit exposure value :

Maximum concentration of a toxic substance in the atmosphere of a working place, accepted by a worker, for a maximum exposure duration of 15 minutes, without any risk for this health.

Maximum expected operating pressure (Pms) :

Maximum relative pressure to which a pressurised fluid vessel, element or component could be subjected during its operational life, in the context of its operational environment. .

Neutralisation :

Intervention on the components of an in-flight space vehicle, tending to minimise the consequences on the ground and in the atmosphere of a vehicle failure.

Nominal :

Corresponding to the specifications or the performance levels announced by the Design Authority.

Normal environment :

All external constraints independent of the system's operation but imposed on it.

Operating company :

Legal or personal entity ensuring performing and use of a technical, industrial or operational installation, either fixed or mobile.

Outside contractor :

Firm juridically independent from the contracting firm, which is conducted to have its personnel working on a place of the contracting firm, selectively or permanently, a contractual relationship between these entities should exist or not. This concept is to be applied for any intervening firm or subcontractor.

Phlegmatize :

Reduce the sensitivity of a pyrotechnic substance or device to a given type of aggression.

Potentially hazardous component :

A constituent part of a system (function, proceeding, process, product, harware, software, procedure, operation, operator, etc.), or a fragment of a system, which can release a power or effluents, whatever this power or these effluents may be, liable to create a damage in case of failure.

Potentially hazardous operation :

Operation involving one (or several) hazardous product(s) or one (or several) potentially hazardous system(s), or performed in a hazardous area.

Potentially hazardous operations are classified in two categories according to the change of state of the system during those operations :

- potentially hazardous dynamic operation : potentially hazardous operation during which, at least one potentially hazardous component of the system undergo a change of state (mechanical, electric, pneumatical, chemical, etc.), either voluntarily or not ;

- potentially hazardous static operation : potentially hazardous operation during which none of the potentially hazardous components of the system undergo a change of state.

Potentially hazardous system :

System which complies with at least one of the following two criteria :

- it contains one or several potentially hazardous products,

- it consists of one or several potentially hazardous components.

Pyrotechnics, "high energy"

Pyrotechnic system which requires, for ignition, an electric current having the following characteristics :

- firing energy : 100 mJ
- firing voltage : 1500 to 2000 V
- current amperage : 1000 A

Pyrotechnics, "medium energy"

Pyrotechnic system which requires, for ignition, an electric current having the following characteristics :

- firing energy : 10 mJ
- firing voltage : 28 to 50 V
- current amperage : 5 A

Risk level :

Probabilistic estimation characterising the system unsafety with respect to an undesirable event, expressed by the probability of occurrence of this event.

Risk study :

Study required by the legislation on pyrotechnic installations.

This study aims at detecting all accident possibilities and establishing, in each case, the nature and severity of the risks incurred by the employees of the establishment.
It determines the measures to be taken to prevent accidents and limit their consequences.

Safe-life :

The required cycles and period during which a structure, even containing the largest undetected crack, is shown by anaysis or testing not to fail in the expected service load and environment.

Safety :

All the arrangements intended to eliminate the harmful causes for persons, property and environment, or to restrict their effects. (Astronautic dictionary)

All the arrangements intended to control technical risks stemming from programmes, projects, or activities contributing to the flight of a manned or unmanned space object.

The objective of safety is to ensure protection of people, public and private property and environment, against any harm or damage created by these programmes, projects, or activities, to the surface of Earth, or to the aircraft in flight, or to space objects in-flight, or in atmospheric or outer space.

Ground safety

All the arrangements :

- intended to control the technical risks generated by programmes, projects, or activities performed on ground and contributing to the flight of a manned or unmanned space object,
- and relative to complements and adjustments to the national industrial safety regulations, needed by the characteristics linked to these programmes, projects, or activities, (acceptance of some risks specific to these programmes, projects, or activities, specificities apart Code of work, gaps with it, requirements deficiency, etc.).

It is technically linked to industrial safety, the interface positioning being changeable according to the safety organisation chosen.

Flight safety

All the arrangements intended to control the technical risks during the flight of a manned or unmanned space object.

The objective of these arrangements is to ensure the protection of people, property, and the environment, against any damage caused to the surface of Earth, or to aircraft in flight, or to space objects in flight, or in atmospheric or in the outer space, stemming from the in-flight manoeuvre of the aforesaid space object.

Safety :

State of a system for which the whole predicable risks are acceptable. (Astronautic dictionary)

Ability for a product to maintain, all its life phases long, an acceptable risks level for mishap liable to cause a harm to personnel, or a major damage to the product or to environment. (CNES IM.00-00 & RG. Aéro 000 40).

State of a system - or a component - and its environment, for which the whole recorded risks stay at an acceptable level ; state of trust associated to it.

Safety barrier :

Function, product, equipment, software, human intervention that opposes the appearance or the tramping of an event prejudicial to safety.

This can be :

- a physical property ;
- an intrinsic design characteristic ;
- a technological device ;
- exceptionally, a statutory procedural measure.

The effectiveness of a barrier is evaluated by its reliability.

Safety Enable :

Action of Range Safety allowing an operator to perform control on a potentially hazardous system.

Safety factor :

Ratio between the allowable limit of a parameter characterising a system or a component and its maximum expected value during its normal running.

ultimate safety factor or burst safety factor (Jr):

Ratio between the admissible breaking limit of a parameter characterising a system or component, and its maximum expected value under normal operating conditions.

For any component of a pressurised fluid system, this is the ratio between admissible burst pressure (admissible burst pressure is the calculated relative burst pressure validated during qualification tests) and maximum expected operating pressure (Pms).

Safety level :

Probabilistic estimation charactcrising the system safcty ; it is the remainder to one of the global risk level of the system with respect to the whole recorded undesirable events.

Safety objective :

Quantitative and qualitative expression of the accepted risk level including :

- the description of the consequences of a undesirable or specified event (risk severity) ;
- the qualitative prevention rules permitting to avoid the appearance or the tramping of this event ;
- the occurrence probability of this event, evaluated the maximum acceptable value.

Safety study :

Most detailed hazard analysis supplemented by a critical examination performed by an outside organisation independent of the operating company.

Significant effects threshold (SES) :

Maximum concentration of toxic substance in the atmosphere which doesn't create on a human body, any irreversible effect for its health after being exposed during 30 minutes.

Site :

Ground area defined in the premises of a contracting firm and the inside installations, intended to be operated by the contracting firm or by an outside contractor.

Technical risk :

Risk proceeding from a technological, or manufacturing, or operative or natural cause. Expression used in order to differentiate technical risk out of any other risk (financial risk, safety-protection risk for installations, etc.).

Tracking :

Remote determination of the characteristic variables of the relative motions of a moving space object.

User :

Person or legal entity performing his activities on the premises of a CNES establishment.

APPENDIX 3

ABBREVIATIONS

AE	Arianespace
BCS	Safety co-ordination office
BLA	Ariane Launch Base
CHSCT	Committee for health, safety and working conditions
CIREA	Interministerial Commission on Artificial Radioelements
CISG	French Guiana industrial and space community
CNES	French national centre for space research
CSG	Guiana Space Centre
CU	Payload
DCI	Interface control document
DDE	French departmental directorate for equipment
DDTE	French departmental directorate for employment and work
DRIRE	French regional directory for industry, research and environment
ELA	Ariane Launch Area
EPCU	Installations for payload preparation
HSCT	Health, safety and working conditions
IPE	French inspectorate for explosive and powder
OPRI	French prevention office for ionising radiation
POI	Emergency operations plan
POS	Satellite operations plan

PPI	Particular intervention plan
RAL	Launch readiness review
RAMF	Final mission analysis review
RAMP	Preliminary mission analysis review
RCS	System concept review
RDS	System definition review
RQS	System qualification review
SES	Significant effects threshold
VLE	Limit exposure value
ZNP	Unprotected zone
ZNPP	Precarious unprotected zone
ZP	Protected Zone

APPENDIX 4

SUMMARY OF VOLUMES 2 AND 3

1 VOLUME 2

1.1 PART 1 : GROUND INSTALLATIONS

This part defines the specific principles to be applied for the design and operation of ground installations and ground support equipment, and for the specific ground support equipment for Launchers or Spacecraft.

It summarises the references of the main rules to be complied with for their design and for controlling their operational readiness : legislation relating to classified installations, pyrotechnic installations, establishments open to the public, and worksites.

It sets the standards to be complied with at the CSG in order to protect the personnel : non-ionising radiation, acoustic vibrations, etc.

The respective responsibilities of contractors and Range Safety are described in detail.

This part stipulates the procedure to be followed for project submission and indicates the practical conditions :

- for designing the project or modifying an existing installation,
- for preparing the documents needed to obtain operating authorisation from the local French administration.

Guides for hazard analysis and typical structures of an impact study and a pyrotechnic risk study are proposed.

1.2 PART 2 : SPACECRAFT

This part defines the specific rules, in addition to those required by Volume 1, applicable to Spacecraft.

After specifying the general principles for controlling the risks inherent in these systems during both the preparation and the flight phases, it defines the design rules and operational rules which must be followed in order to comply with the safety objectives.

These rules are described in detail for the various potentially hazardous systems or components:

- on the ground :

  . electrical systems,
  . fluids systems,
  . on-board pressurised systems,
  . pyrotechnic systems.

- in flight :

  . on-board devices contributing to safety but not safety-specific.

The studies and justificatory documents to be supplied for project submission are described and situated in the various phases of project progress.

1.3 PART 3 : AUTOMATIC LAUNCHERS AND TEST SPECIMENS

This part defines the specific rules, in addition to those required by Volume 1, applicable to automatic launchers and test specimens.

After specifying the general principles for controlling the risks inherent in these systems during both the preparation and the flight phases, it defines the design rules and operational rules which must be followed in order to comply with the safety objectives.

These rules are described in detail for the various potentially hazardous systems or components

- on the ground :

  . electrical systems,
  . fluids systems,
  . on-board pressurised systems,
  . pyrotechnic systems.

- in flight :

  . on-board intervention devices,
  . on-board devices contributing to safety but not safety-specific.

The studies and justificatory documents to be supplied for project submission are described and situated in the various phases of project progress.

1.4 PART 4 : INTER-SITES

This part defines and compiles the principles and rules applicable for optimum management, from the viewpoints of both safety/environment and efficiency, of all the activities taking place on the BLA.

The respective responsibilities and mutual obligations of the various entities are specified.

The attributions of the Safety Co-ordination Office are described in detail, with the practical conditions of co-ordination of potentially hazardous operations (drawing up of "operation sheets" in nominal situation and in degraded situation, planning).

The rules for alarm broadcasting and the measures to be provided for Emergency Operations Plans are stipulated.

Finally, this part indicates the procedure to be followed by autonomous firms for the submission of projects for the creation or modification of installations on the premises of the BLA.

1.5 PART 5: MANNED FLIGHTS

This part defines the specific rules, in addition to those required by Volume 1, applicable to manned flights, within the scope of responsibility invested in CSG Range Safety.

After specifying the general principles for controlling the risks inherent in manned launch vehicles, it defines the design rules and operational rules which must be followed in order to comply with the safety objectives.

These rules are described in detail for the various systems, components or procedures which are potentially hazardous :

- on the ground :

  . electrical systems,
  . fluids systems,
  . pyrotechnic systems,
  . relating to the environment,

- in flight :

  . on-board intervention devices,
  . on-board devices contributing to safety but not safety-specific.

The studies and justificatory documents to be supplied for project submission are described and situated in the various phases of project progress.

2 VOLUME 3 :

This volume ensures traceability of the rules required by the Safety Regulations and stipulates the methods recommended for use by Range Safety.

The volume is updated by Range Safety, but these updates are not subject to the formal procedure for configuration control of the Safety Regulations, nor do they have to go before the amendments committee, unless otherwise stipulated.

The volume brings together the information needed to specify some of the concepts used in the Safety Regulations :

- summary of the basic documents,
- methods for calculating parameters or operational limits,
- design calculation notes, etc.

Each of these documents is summarised so as to allow the reader to know the principles adopted. For the application of these documents, however, the original document must be referred to.

All the documents mentioned in this volume are archived and managed by Range Safety, which may issue them on request.

APPENDIX 5

METHODOLOGY FOR CLASSIFICATION OF A VEHICLE AS INTRINSICALLY SAFE

The theoretical risk study, which is the starting point for classification of a launch vehicle as an "intrinsically safe vehicle", is based on the dependability methodology, which must take into account :

- failure trees,
- possible failures and their effects,
- realistic scatters around the operating point,
- etc.

The failures to be selected are those which are liable to cause a catastrophic risk.

Once the reliability allocations have been established for these failures, the risk relative to the countries flown over is calculated according to the method recognised by the CNES.

If this risk is compatible with the safety objective, the vehicle can be classified as an "intrinsically safe vehicle". The application shall be sent to Range Safety which may express additional requirements depending on the vehicle type.

In this case, no on-board intervention device is required by Range Safety.

This classification is possible for components of a launch vehicle during a phase.

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