GGOS User Requirements Database: A proposal

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Abstract

For the planning, implementation and future development of GGOS, a comprehensive database of describing the users, their qualitative and quantitative requirements, and the services and products provide by GGOS is a powerful tool to identify gaps in the observing system and to define priorities for the development of the system. Here, we propose an initial structure of the database. With respect to user requirements, a strategy for surveys is discussed. The information concerning the services and products provided is mainly available, though not in a easily accessible database. Tools for the identification of the system gaps appear not to be available directly and need to be developed.

1 Introduction

The implementation of an observing system such as GGOS should be guided by a comprehensive set of explicitly known user requirements (UR). *more to come ...*

In many cases, scientific observing systems are not defined on the basis of a rigorous set of URs but rather a set of scientific goals. An example is the set of requirements that are the goals of the VLBI2010 as postulated by the IVS Working Group 2 (see Niell & eight others, 2005). Often, the main requirement is to be as good as possible.

For less science-driven and more user-focused systems, the URs are mostly derived from specific applications and problems. Thus, both, IGOS-P and GEOSS are problem driven and so should be GGOS, at least partly. GEOSS requires that the UR database should allow for the determination of gaps in the observing system. Therefore, the UR database needs to be coupled with a database characterizing the observing system and its products. We denote this part of the database as the System Performance (SP) part.

In the following, we first review existing UR databases and summarize the considerations of GEO with respect to URs (Section 2. Then we briefly sketch the proposed layout for the GGOS UR and SP database (Section 3. The obstacles in identifying users and quantifying their requirements are addressed in Section 4 and a strategy for GGOS is proposed. Subsequently, we summarize the current status of the quantitative knowledge of user requirements for GGOS (Section 5, and give an overview concerning the information available with respect to the GGOS system performance (Section 6).

2 Review of existing UR and SP databases

2.1 The WMO/CEOS on-line database

The CEOS and WMO maintain an Online Database for observational requirements and system characteristics at http://alto-stratus.wmo.ch/sat/stations/SatSystem.html. Besides table for the observational requirements, the database also provides information on Space Agencies and Missions, Missions and Instruments, Instruments, parameters measured by space-based and in-situ instruments, as well as instruments that measure a specific parameter.

In terms of observational requirements, this database gives access to separate tables of requirements established for WMO, WCRP, GCOS, GOOS, GTOS, IGBP, ICSU, and UNEP. The tables list for each parameter the requirements in terms of horizontal and vertical resolution, observation cycle, accuracy, delay, confidence, and use. For each quantitative characteristics, both the optimal value and a threshold value are given.

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Table 1: The nine societal benefit areas identified by EOS-II (see Appendix 2 in GEO, 2005b).

Disaster:	reducing loss of life and property from natural and human-made disasters
Health:	understanding environmental factors affecting human health and well being
Energy resources:	improving management of energy resources
Climate:	understanding, assessing, predicting, mitigating, and adopting to climate variability and change
Water:	improving water resource management through better understanding of the water cycle
Weather:	improving weather information, forecasting, and warning
Ecosystems:	improving the management and protection of terrestrial, coastal, and marine ecosystems
Agriculture:	supporting sustainable agriculture and combating desertification
Biodiversity:	understanding, monitoring and conserving biodiversity

Table 2: Requirements for geodetic observables for the nine benefit areas.
The fields and their status are extracted from the discussion of the URs for the nine benefit areas in GEO (2005b). The status is indicated with the follow classes: 0: ok; 1: marginally acceptable accuracy and resolution; 2: could be ok within two years; 3: could be available in six years; 4: still in research.

Observable quantity	Status
Deformation monitoring, 3-D, over broad areas	3
Subsidence maps	3
Strain and creep monitoring, specific features or structures	2
Gravity, magnetic, electric fields - all scales	3
Gravity and magnetic field anomaly data	2/3
Groundwater level and pore pressure	4-1
Tides, coastal water levels	1
Sea level	2-1
Glacier and ice caps	2
Snow cover	2
Moisture content of atmosphere/water vapor	2
Extreme weather and climate event forecasts	3
Precipitation and soil moisture	3-1

The level of detail differs for the various systems and organisations. For example, the WMO table lists in a comprehensive way for a large number of quantities. For GTOS, as another example, the list of parameters is much shorter and appears to be incomplete. For UNOOSA, the list includes only one entry, while for ICSU, the list is empty.

2.2 GEOSS considerations

GEOSS has a strong focus on users, and the Reference Document (GEO, 2005b) to the 10-Year Implementation Plan (GEO, 2005a) is build around the 9 benefit areas identified by EOS-II (see Annex 2 in GEO, 2005b, for a list of the benefit areas, see Table 1). For these benefit areas, the Reference Document addresses the observational requirements in terms of quantity versus a set of applications, and for each of these pairs states the current status of availability.

Scanning through these observational requirements, Plag (2006) extracted a table of GEOSS requirements for geodetic observations (see Table 2).

2.3 Geodetic UR and SP databases

Here we should summarize the results of INDIGO and GAGOS, among others, and also give an overview waht information is available at the different services.

3 GGOS UR and SP database structure

In this section we provide some initial ideas for the structure of a UR and SP database. We separate this into two parts, namely a part that describes the users, applications, and requirements, and a part that describes the observations and products made available by the observation system. Matching these two parts against each other allows for a gap analysis.

Table 3: Contents of table QUANTITIES.

This table defines all quantities consider in connection with the geodetic observations and products and their applications.

No	Name	Description	Type	Key	Len
1	QUANTITY	Acronym identifing the quantity.	Char	I	F
2	DESCRIPTION	Brief description of quantity.	Char		V
3	REFERENCE	Reference to a comprehensive description	Char		V
4	TYPE	Type of quantity (observable, derived, modeled)	Char/R		F
5	UNITS	Physical units of quantity	Char/R		F

Table 4: Contents of table USERS.

This table summarizes the main generic users and user group of geodetic products.

No	Name	Description	Type	Key	Len
1	USER	Acronym identifing the user.	Char	I	F
2	DESCRIPTION	Description of user.	Char		V
3	CLASS	User classes (e.g. scientific, governmental, education, commercial)	Char/R		F

A table that links the two parts together is the QUANTITIES table with the colums as defined in Table 3, This table includes both observations and products. Quantities, or more general, objects can be so different as point coordinates, the geoid, local and global sea level, a reference frame, earth rotations, geocenter, coefficients in the Earth's gravity field representation, strain, etc.

The tables discussed here are a very preliminary set of tables for a relational database, which are meant to illustrate the general approach but not necessarily to cover all details.

3.1 The UR tables

In order to allow for maximum flexibility, different tables describe the users, applications, quantities (observations and products), and individual requirements separately. Relations that combine these tables are then defined in specific link tables.

The users are described in the USERS table, with the columns of this table defined in Table 4. However, the entries in the USERS table give a description that is as far as possible generic, without identifying specific users. Users are linked to applications and throught these applications to quantities and requirements. The extent and type of users can be very variable. Some examples of users are *coastal zone managers*, *geophysicists*, *teachers*, *climatologists*, *scientists*, and *offshore industry*.

The applications are described in the Application table with the columns of that table being defined in Table 5. Again applications are as far as possible described in a generic way. Applications can be rather different in extent and nature. Examples of applications are *hydrology*, *numerical weather forecast*, *ocean circulation studies*, *surveying*, or *outdoor activities*, *disaster prevention*, *early warning*. The applications are linked to certain requirements for specific quantities.

The quantitative user requirements are specified in the URS table, for which the columns are given in Table 6. Each requirement is given for a quantity specified in the QUANTITIES table (see Table 3) and associated with an application given in the APPLICATIONS table (see Table 5).

A simple LINKS table is then used to link the users to one or more applications. Similar applications that have different requirements in terms of accuracy (e.g. point positioning for surveying and out-door activities) have to

Table 5: Contents of table APPLICATIONS.

This table summarizes the main generic application of geodetic products.

No	Name	Description	Type	Key	Len
1	APPLICATION	Acronym identifing the application.	Char	I	F
2	FIELD	General field of application.	Char/R		F
3	BENEFIT	Benefit area.	Char/R		V
4	DESCRIPTION	Description of Application.	Char		V

Table 6: Contents of table URS.

This table provides an overview of the quantitative user requirements for selected geodetic quantities and derived products.

No	Name	Description	Type	Key	Len
1	NUMBER	Identification number of the UR.	Int	I	F
2	DESCRIPTION	Description of requirements.	Char		V
3	TYPE	Type of requirements (goal, threshold, ...).	CHAR/R		F
4	APPLICATION	Application key.	Char/R	F	F
5	QUANTITY	Physical quantity.	Char/R	F	F
6	SPAT_RES	Spatical resolution.	Real		F
7	TEMP_RES	Temporal resolution.	Real		F
8	REL_ACC	Relative accuracy.	Real		F
9	ABS_ACC	Absolute accuracy.	Real		F
10	TIME_ACC	Time accuracy, where applicable.	Real		F
11	LATENCY	Latency of the observation.	Real		F
12	LENGTH	Length of record (time series) required for application.	Real		F
13	REF_FRAME	Reference frame (local, national, regional, global).	Char/R		F
14	REPRO	Reproducibility, i.e. time window over which the stated quantity is reproducible with the stated accuracy.	Char		F

be specified as different applications.

3.2 The SP Tables

The quantity defined in the QUANTITIES table can be obtained in various ways, and their properties depend very much on how they actually were obtained. Here we propose to distinguish between quntities that are closely related to observations and those that are the results of considerable modelling. This distinction may seem arbitrary and may not prove to be very practical.

Physical quantities such as 3-d displacement, sea level, etc. can be measured with various techniques resulting in quite different properties. Even if we aim for a mainly generic description, the accuracy of the quantity depends very much on the observation technique used. For example a radar gauge has different properties from a bottom pressure gauge. Thus the observation SEA-LEVEL/R will have different characteristics than for example SEA-LEVEL/BP obtained with a bottom pressure sensor. And GPS has different accuracies and properties than SLR. Thus 3-D-DISP/SLR will have rather different characteristics from what 3-D-DSIP/GPS or 3-D-DISP/GLONASS would have.

For the example 3-D displacements, a product that would be directly linked to an application could be '3-D-displacement time series' and depending on the way the time series are created, the product would have rather different characteristics that may or may not meet the requirements for a particular application.

In order to account for this situation, we propose initially two tables. The OBS table with the structure as defined in Table 7 compiles all observations that are available in the system in a generic way. In this table, the column OBSERVATION identifies a given observations, e.g. *SEA LEVEL/BP*, for which the TECHNIQUE could be *Pressure Gauge* (to be defined in a separate TECHNIQUES table in more details), while QUANTITY would give the actual goal of the observations, e.g. the quantity *Local Sea Level*. All other columns would refer to this quantity, not to the measured quantity (which in our example is bottom pressure).

In the PRODUCTS table, the available products are listed, and this table has the columns as given in Table 8. Example related to the above example would be the product 'Monthly Mean Sea Level Time Series', or 'Hourly Sea Level Time Series' or 'Real time 3-D displacements'.

It is repeated here that the tables discussed here illustrate how such a UR and SP database could be structure. The actual design might in the end deviated considerably from these initial ideas.

Table 7: Contents of table OBS.

This table gives an overview of the observations currently carried out by the observational infrastructure in GGOS.

No	Name	Description	Type	Key	Len
1	OBSERVATION	Acronym identifing the observation.	Char	I	F
2	TECHNIQUE	Specifying the observation technique.	Char	I	F
3	QUANTITY	Key of quantity determined.	Char	F	F
4	DESCRIPTION	Description of the observation.	Char		V
5	TYPE	Type of quantity (observable, derived, modeled)	Char/R		F
6	UNITS	Physical units of quantity	Char/R		F
7	SPAT_RES	Spatical resolution.	Real		F
8	TEMP_RES	Temporal resolution.	Real		F
9	REL_ACC	Relative accuracy.	Real		F
10	ABS_ACC	Absolute accuracy.	Real		F
11	TIME_ACC	Time accuracy, where applicable.	Real		F
12	LATENCY	Latency of the observation.	Real		F
13	LENGTH	Length of record (time series) available.	Real		F
14	REF_FRAME	Reference frame (local, national, regional, global).	Char/R		F
15	REPRO	Reproducibility, i.e. time window over which the stated quantity is reproducible with the stated accuracy.	Char		F

Table 8: Contents of table PRODUCTS.

This table provides an overview of the products currently available quantitative user requirements for selected geodetic quantities and derived products.

No	Name	Description	Type	Key	Len
1	PRODUCT	Acronym identifing the products.	Char	I	F
2	DESCRIPTION	Description of products.	Char		V
3	QUANTITY	Key of quantity.	Char	F	F
4	TYPE	Type of quantity (observable, derived, modeled)	Char/R		F
5	UNITS	Physical units of quantity	Char/R		F
6	SPAT_RES	Spatical resolution.	Real		F
7	TEMP_RES	Temporal resolution.	Real		F
8	REL_ACC	Relative accuracy.	Real		F
9	ABS_ACC	Absolute accuracy.	Real		F
10	TIME_ACC	Time accuracy, where applicable.	Real		F
11	LATENCY	Latency of the observation.	Real		F
12	LENGTH	Length of record (time series) available.	Real		F
13	REF_FRAME	Reference frame (local, national, regional, global).	Char/R		F
14	REPRO	Reproducibility, i.e. time window over which the stated quantity is reproducible with the stated accuracy.	Char		F

4 Methodology to identifying the user requirements

Here we should write more about the Roling Review of Requirements of WMO, which is mentioned/recommended in the GEOSS Implementation Plan ...

A qualitative survey was done e.g. in Canada with respect to Earth observations.

4.1 INDIGO

INDIGO aims to develop data systems to enable geodetic studies that integrate data from multiple space geodetic techniques. To ensure that INDIGO will be responsive to the needs of the user community, an initial stated goal was to assess the current services and user requirements. In 2005, a survey was distributed to key science users of the four IAG geodetic services (IGS, ILRS, IVS, and IDS). The report resulting from the user assessment is available at http://indigo.nasa.gov/docs/assessrptv4.pdf. The primary users surveyed by the INDIGO team are those investigators developing multi-technique methods of analysis.

The three IAG services originally proposed to participate in INDIGO (IGS, ILRS, and IVS) were surveyed as well to discover commonalities in their operations. A table summarizing this survey is available at http://indigo.nasa.gov/docs/servass

4.2 The GAGOS Questionaire

In the frame of the GAGOS project, a questionaire was developed (see Appendix B Plag et al., 2006) addressing mainly the requirements of non-scientific users in the field of human induced hazards and monitoring of infrastructure. This questionaire was sent to a number of key users in Europe, which were selected in order to include preferably those that were representative of user groups.

The results of this survey are currently not available, but it could be considered to have similar surveys in other geographical regions.

5 GGOS User Requirements

Here we should/will give a preliminary overview of the URs ...

6 GGOS System Performance

Here we can insert ideas how to collect the SP info ...

7 Conclusions

A comprehensive UR and SP database is of considerable value for the planning, implementation and further development of GGOS. The establishment of such a database will not only provide a better knowledge of the users of geodetic products

References

GEO, 2005. The Global Earth Observing System of Systems (GEOSS) - 10-Year Implementation Plan, Distributed at and endorsed by the EOS-III Meeting, Brussels, 16 February 2005. Document prepared by the *Ad hoc* Group on Earth Observations (GEO) Impementation Plan Task Team IPTT. Avaliable at http://earthobservations.org.

GEO, 2005. Global Earth Observing System of Systems GEOSS - 10-Year Implementation Plan Reference Document - Draft, Tech. Rep. GEO 204/ESA SP 1284, ESA Publication Division, ESTEC, PO Box 299, 2200 AG Noordwijk, The Netherlands, Final Draft Document 204, prepared by the *Ad hoc* Group on Earth Observations (GEO) Impementation Plan Task Team IPTT. Avaliable at http://earthobservations.org.

Niell, A. & eight others, 2005. Vlbi 2010: Current and future requirements for Geodetic VLBI Systems, Tech. rep., International VLBI Service for Geodesy and Astrometry, IVS Coordinating Center, NASA Goddard Space Flight Center, Greenbelt, MD, USA, Available at http://ivscc.gsfc.nasa.gov.

Plag, H.-P., 2006. National geodetic infrastructure: status today and future requirements, Project report, Nevada Bureau of Mines and Geology, University of Nevada, Reno, Project report. In review.

Plag, H.-P., Kierulf, H. P., & Lilje Bye, B., 2006. Questionnaire: User requirements for geodetic monitoring of infrastructure and manmade hazards, Questionnaire used by the Norwegian Mapping Authority in a European-wide user survey.

Table 9: Structure of database sheets.

Name of Column	Explanation of content
No.	Number of attribute within structure
Name	Short name of the attribute
Description	Explanatory description of the attribute
Type	Data type and domain of the attribute
Key	Key type of attribute
Len	Length of input field in characters

Table 10: Different data types.

Abbreviation	Explanation
Char	Data type is 'ASCII-String'
Int	Data type is 'Integer number'
Real	Data type is 'Real number'
Sw	Data type is 'Logical', i.e. either T of F
Date	Date type is 'Calender data', i.e. yyyy-mm-dd-hh-mm-ss with the time being optional.
Vect/n	Vector of dimension n, given as n-tuple '(x1,x2,...,xn)'
Geo	Data type is 'Geographical Coordinate', i.e. a real number between -90. and 90. for latitude (negative numbers being S) and -180. to 180. for longitude (negative numbers being W)
Phone	Data type is 'Phone number', i.e. a string containing a leading + for international number, '(', and ')' to indicate the part to be omitted for international calls, '-' to separate parts of the number, 'x' to indicate that the following part is an extension, and the numbers from 0 to 9.
File	File name, given as a string
URL	Data type is 'URL'. Currently, the URL syntax is not checked, is for future use.
EMA	Data type is 'E-mail address'. Currently syntax is not checked. For future use.
IP-Ad.	Data type is an IP address. For future use.

A Syntax of table sheets

The structure of a table is displayed in a fixed tabular form. It consists of the columns described in Tab. 9.

The attribute numbers are just used within this text for reference purposes. The short names are provided for use in a database program for screen masks, while the long names may be used in listings or can be displayed on the screen as explanations of the short names.

Each attribute has a certain scalar data type, which to a large extent determines the input allowed for this attribute. A discussion of the available data types is given in the appendix. The data type is indicated by an abbreviation. These have the meanings given in Tab. 10

The domain of an attribute may be the complete set of a data type or it may be a subset. The subset is specified by a one letter abbreviation separated from the data type by a slash. The possible abbreviations are given in Tab. 11, and the key type of an attribute are listed in Tab. 12.

If the entry for Length is a 'V', the item has variable length and the input/output fields are increased to the size actually needed. If the entry is 'F', then the length is fix, though the maximum size is not yet specified.

Table 11: Data domain restrictions.

Value	Explanation of domain restrictions
R	Domain of attribute is restricted to certain discrete values of the corresponding data type. For each such attribute, a list of the allowed values must be given.
I	Domain of attribute is restricted to an interval contained in the complete domain of the corresponding data type.
D	Domain is dynamic, i.e. this attribute is a foreign key.

Table 12: The different key types.

Value	Explanation
I	Attribute is an identification key, i.e. it must be unique within the whole database
S	Attribute is a secondary identification key, i.e. it must be unique in combination with an identification key
F	Attribute is a foreign key, linking the present table to a higher level table. The domain of such a key is always dynamic.

B The GAGOS Questionaire

Questionnaire

User Requirements for Geodetic Monitoring of Infrastructure and Manmade Hazards

Scope and Goal

In the frame of the EU-funded project *Assessing and forward planning of the Geodetic and Geohazards Observing Systems for GMES applications* (GAGOS), one focus is on the compilation of user requirements for geodetic monitoring of large infrastructure and potential hazards associated with human activities. A preliminary set of requirements for the application of space-geodetic techniques to the monitoring of large infrastructure and areas with potential man-made hazards caused by subsidence, ground instabilities or failure of man-made infrastructure has been compiled on the basis of existing documents and experience of the project participants (see the attached brief summary). The purpose of the present questionnaire is to consolidate these preliminary requirements and to get a more comprehensive overview of the current and potential future applications of space-geodetic techniques in this field. The consolidated user requirements will be used to derive system specifications for the space-geodetic observing systems that would satisfy most of the user requrirements. These specifications will then be used to identify gaps in the current observing systems and to recommend to the European Commission steps that would help to close these gaps.

Distribution of Questionnaire

This questionnaire is distributed to major potential users of space-geodetic techniques in the field of energy and water supply and management, oil and gas exploitation, mining, transportation, coastal zone management and engineering, construction, and surveying. Where possible, we have addressed European organisations representing the users in a given area. If no such organisation exists, individual users are addressed on regional or national level.

Who are you?

Name/Company	______________________
Address	______________________
	______________________
	______________________
Contact person	______________________
Your position	______________________
Phone	______________________
Fax	______________________
E-mail	______________________

About your company/organisation:

Description		
Type	company	[___]
	society	[___]
	agency	[___]
	institute	[___]
Ownership	private	[___]
	public	[___]
	governm.	[___]
Number of employees	less 100	[___]
	100 to 1000	[___]
	more than 1000	[___]

Your main activities:

Description	
Electricity	[___]
Water management (reservoirs, regulations, waterways)	[___]
Water supply (groundwater)	[___]
Oil and/or Gas exploitation, including off-shore	[___]
Mining	[___]
Maintenance of roads and bridges	[___]
Airports	[___]
Harbours	[___]
Coastal zone management, including flood protection	[___]
Construction	[___]
Agriculture	[___]
Surveying	[___]
Others (please comment)	[___]

Comments ____

On the following three pages, we inquire your current and potential future applications of space-geodetic techniques as well as your requirements for these applications in terms of accuracy, latency, availability, and reliability. Please indicate your applications and requirements by marking all relevant boxes.

We use the following terms:

- **Current applications:** *applications of space-geodetic techniques currently carried out by your organisation.*
- **Potential future applications:** *application of space-geodetic techniques that your organisations would consider if the technological development of these techniques would meet your user requirements.*
- **Latency:** *acceptable time delay with which results become available.*
- **Monitoring:** *more or less continuous control of an object, for example, the stability of a platform or reservoir dam.*
- **Positioning:** *determination of accurate coordinates of a point, for example during surveying.*
- **(Geodetic) reference frame:** *realization of a coordinate system used to refer geodetic positions to.*

Your application of space-geodetic techniques:

Description	Current Applications	Potential Future Applications
Monitoring of reservoirs	[___]	[___]
Monitoring of pipelines	[___]	[___]
Monitoring of bridges etc.	[___]	[___]
Monitoring of off-shore infrastructure	[___]	[___]
Monitoring of large buildings	[___]	[___]
Monitoring of sub-surface infrastructure	[___]	[___]
Monitoring of dikes	[___]	[___]
Monitoring of land subsidence	[___]	[___]
Monitoring of land stability (land-slides, rock-fall)	[___]	[___]
Construction aids	[___]	[___]
Snow ploughing and other process controls	[___]	[___]
Surveying/positioning	[___]	[___]
Risk assessment (land slides, earthquakes, subsidence)	[___]	[___]

Comments ____
____
____
____

Your requirements in terms of latency:

Description	Current Applications	Potential Future Applications
Early warning in near-real time (minutes to hours)	[___]	[___]
Ultra-low latency monitoring (seconds to minutes)	[___]	[___]
Low latency monitoring of stability (days)	[___]	[___]
General monitoring of stability (weeks to months)	[___]	[___]
Positioning in near-real time (seconds to minutes)	[___]	[___]
General positioning (days or longer)	[___]	[___]

Comments ____
____
____
____

Your requirements concerning reference frame:

Description	Current Applications	Potential Future Applications
Local frame, relative accuracy	[___]	[___]
National or regional reference frame	[___]	[___]
Global reference frame	[___]	[___]

Your requirements in terms of accuracy:

Description	Current Applications	Potential Future Applications
Low (10 cm or more)	[___]	[___]
Medium (2 cm to 10 cm)	[___]	[___]
High (better than 2 cm)	[___]	[___]

Comments ____
____
____
____

Your requirements concerning long-term stability:

Description	Current Applications	Potential Future Applications
Low (mainly event detection on sub-daily time scales)	[___]	[___]
Medium (few mm/yr on seasonal time scales)	[___]	[___]
High (1 mm/yr level on interannual time scales)	[___]	[___]
Extreme (< 1 mm/yr level over several decades)	[___]	[___]

Comments ____
____
____
____

Your requirements concerning availability:

Description	Current Applications	Potential Future Applications
24 hours a day/7 days a week, including integrity	[___]	[___]
During working hours, including integrity	[___]	[___]
Episodic	[___]	[___]
Others:_______________________________	[___]	[___]

Comments ____
____
____
____

Your requirements concerning reliability and certification:

Description	Current Applications	Potential Future Applications
Fully certified system	[___]	[___]
Integrity information required	[___]	[___]
Own reliability control	[___]	[___]
Others:_______________________________	[___]	[___]

Comments ____
____
____
____