IMPLEMENTING MULTI-SCALE AGRICULTURAL INDICATORS EXPLOITING SENTINELS

REVIEW PLAN

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1. BACKGROUND OF THE DOCUMENT

1.1. EXECUTIVE SUMMARY

The Copernicus program is the EU response to the increasing demand for reliable environmental data. The objective of the Copernicus Land Service is to continuously monitor and forecast the status of land territories and to supply reliable geo-information based upon (i) Earth observation data provided by the Copernicus Space Component, (ii) ground measurements collected by the Copernicus In-situ Component. ImagineS intends to continue the innovation and development activities to support the operations of the Copernicus Global Land service, preparing the use of the future Sentinel data in an operational context. Moreover, ImagineS aims to favor the emergence of downstream activities dedicated to the monitoring of crop and fodder production, that are key for the implementation of the EU Common Agricultural Policy, of the food security policy, and could contribute to the Global Agricultural Geo-Monitoring Initiative (GEOGLAM) coordinated by the intergovernmental Group on Earth Observations (GEO).

The main objectives of IMAGINES are to (i) improve the retrieval of basic biophysical variables, mainly LAI, FAPAR and the surface albedo, identified as Terrestrial Essential Climate Variables, by merging the information coming from different Sentinel sensors and other GMES contributing missions; (ii) develop qualified software able to process multisensory data at the global scale on a fully automatic basis; (iii) propose an original agriculture service relying upon a new method to assess the biomass, based on the assimilation of satellite products in a Land Data Assimilation System (LDAS) in order to monitor the crop/fodder biomass production together with the carbon and water fluxes; (iv) demonstrate the added value of this agriculture service for a community of users acting at global, European, national, and regional scales.

As the ImagineS systems have to be fully validated and developed according to industry standard, it is necessary to set-up a review procedure to guaranty the quality and the robustness of the developments.

The Review Plan presents the reviews that will be held during the processing line development according to the specificity of each processing line version.

1.2. SCOPE AND OBJECTIVES

Because the teams involved in the development of processing lines and in the operations (HYGEOS, CNES, VITO) are entities with a large experience in development of operational systems, we agree on a review process defined by each partner according to its own experience and adapted to the specificities and maturity of each product line.

The objective is to guaranty the quality of the developments, of the products and, at final, of the whole system while avoiding wasting time and efforts in a too huge formal process not adapted to developments planned in short periods.

1.3. CONTENT OF THE DOCUMENT

The first section describes the general context, the second section details the defined review process depending on the maturity of each processing line development. A summary is made in the third section.

1.4. RELATED DOCUMENTS

1.4.1. Inputs

Overview of former deliverables acting as inputs to this document.

Document ID	Descriptor
ImagineS_DoW	Description of Work
ImagineS_RP1.1	Users Requirements
ImagineS_RP1.2	Service Specifications
ImagineS_RP7.2	Scientific Validation Plan
ImagineS_MIN_KOM	Minutes of Kick-Off Meeting

1.4.2. Output

Overview of other deliverables for which this document is an input:

Document ID	Descriptor
ImagineS_RP7.3	Review Reports

1.4.3. External Reference Document

Document ID	Descriptor
ECSS-E-ST-40C	ECSS Space engineering, Software, ESA-ESTEC

2. INTRODUCTION

The ImagineS portfolio contains 12 product lines describing the continental vegetation and the energy budget: some are variables derived from Earth Observations, others are variables simulated by the Land Data assimilation System. The development cycle of processing lines generating EO-derived biophysical variables is shared in many steps with a role clearly identified for each ImagineS team (Table 1):

- Definition of the retrieval methodologies
- Development of the processing lines
- Validation of the products and processing lines
- Demonstration service

ID	Name	Sensor	Type	Algorithm definition	Processing line Development	Demonstration service
01	LAI, FAPAR, FCover	Proba-V, S3	D	INRA	HYGEOS, CNES	VITO
02	Albedo	Proba-V, S3	D	Meteo-France	HYGEOS, CNES	VITO
06	FAPAR per class	Proba-V, S3	D	INRA, UCL, M-F	HYGEOS, CNES	VITO
07	Surface reflectance	S2	P	INRA	HYGEOS, CNES	CNES
08	FAPAR	Proba-V, S3, S2	P	INRA, UCL	HYGEOS, CNES	CNES

Table 1: Teams involved in design, development and demonstration of ImagineS satellite product. D means “demonstrator”, P means “Prototype”.

The global products will be generated in NRT in a pre-operational infrastructure. They are considered as Demonstrators (D). Their level of maturity is higher than HR products that will be generated only over a limited number of sites and are only considered as Prototypes (P).

The reviews are formal milestones planned during the main phases of the product life to check the compliance of developments with the requirements and specifications. Due to the difference in product maturity the review procedure described in this document will be only applied on the demonstration products.

The review content is based on the European Cooperation for Space Standardization (ECSS) document related to Space Engineering Software (ECSS-E-ST-40C).

3. REVIEW PROCESS

3.1. GENERAL CONSIDERATIONS

This review plan deals with the LAI, FAPAR FCover biophysical variables derived from the Proba-V & Sentinel-3 sensors (Products #1 in Table 1).

The algorithm definition is made by INRA. The processing line is developed in several versions by HYGEOS. CNES is involved in the review of the processing line development and VITO will perform the operational production.

On 22nd February 2013, during the first meeting of the Advisory Board, the Joint Research Center, in charge of the technical coordination of the Copernicus Global Land service, recommended that ImagineS brings 300m products based upon PROBA-V sensor data into pre-operational level for the beginning of 2014 growing season. Following this recommendation, the ImagineS work plan has been revised so that a qualified processing line ingesting PROBA-V data can be delivered in due time to the GIO Global Land service for starting a NRT demonstration production over Europe in May 2014.

Due to these planning constraints the formal review process has been simplified for the first version of the Proba-V processing line. This suited review strategy is described in the second section.

3.2. GENERAL REVIEW STRATEGY

The general review strategy is a quality control over the development lifecycle, where the deliverables associated to each milestone are analyzed by a review team. This team identifies the actions closed and in progress, the risks related to the remaining activities, their impact on the next steps, and the mitigation measures with an order of priority. The conclusions of the critical analysis are discussed during a formal review meeting: a report presents the GO/NO-GO decision with a potential list of remaining actions or recommendations.

The formal meeting reviews are the following:

3.2.1. System Requirement Review (SRR)

The System Requirement Review aims at reaching the approval of the software requirements baseline by all the partners involved in the software development. The SRR checks the completeness and consistency of the requirement documentation in term of algorithm description (ATBD), operation, performance, validation.

The SRR review verifies also that the requirements are realistic in terms of complexity, effort and time.

3.2.2. Preliminary Design Review (PDR)

The Preliminary Design Review (PDR) aims at reviewing:

- the compliance of the technical specification with the requirements baseline
- the software architecture and interfaces
- the development, verification and validation plans

The PDR checks that development plan is adapted to realize the development matching schedule and requirements, that the proposed design fits the requirements, and that the test plan is representative of the nominal work of the processing line.

3.2.3. Critical Design Review (CDR)

The Critical Design Review (CDR) aims at reviewing:

- the design definition file, including software architectural design, detailed design, code and user's manual
- the design justification file, including the completeness of the software unit testing, integration and validation with respect to the technical specification.

The PDR checks that the proposed technological design matches the requirements, is justified and adapted to reach the expected performances.

3.2.4. Acceptance Review (AR)

The Acceptance Review (AR) aims at accepting the software product in the intended operational environment.

The AR reviews that the test plan gives the expected results, and the completeness of final version of documentation. It includes the assessment of algorithmic performance in a pre-operational environment, based on the Development Dossier.

3.3. REVIEW STRATEGY FOR VERSION 1

The version 1 of product line #1 shall process operationally the PROBA-V data in May 2014. The draft of the ATBD has been delivered mid-April 2013.

In order to secure this short development planning CNES and HYGEOS propose to lighten the content of the formal reviews. This easing focuses on the duration (one day) of

each review in order to save the planning, and on documentation content in order to analyze the most important documentation for the next phases.

The SRR will be held at HYGEOS premises mid-June, with the presence of CNES, HYGEOS and INRA people. The review will check the content of the following documentation: ATBD, operation requirements, Detailed Processing Model (DPM) documentation, Service Specifications. The SRR review will also go a bit further and include some objectives of the PDR related to the clarity and compliance of the available technical documentation (DPM).

The PDR and CDR reviews will be merged in a unique review named Design Key Point which will be held in September. This Key Point will check the consistency of the current design with the technical specification and assess the expected performances. This review takes place just between SRR and AR, with enough time after the SRR review to progress in the analysis of the current achievement, and with enough time before the AR to take into account the recommendations.

The AR will be held beginning of December 2013 and will be based on the results of the industrial acceptance tests performed at HYGEOS premises, just before the final delivery to VITO.