

## Earth Observation Payload Data Ground Systems Infrastructure Evolution 2011-2014



LTDP SAFE

### Processing Chain analysis trade-off

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# 1 Introduction

## 1.1 Purpose

The purpose of this trade-off is to improve the processing chain description in the Recommendations for Specialisation document clarifying how an EO-product is linked to the information regarding the processor(s) and auxiliary file types that can be used to derive higher-level products.

## 1.2 Scope

The scope of this document is to review the SAFE processing chain presented during the PDR-C in order to consolidate it for the PDR. This analysis has been requested as results of the PDR-C Actions (A05) within the LTDP-SAFE project. The results obtained from this analysis will be used as a basis to update the SAFE Recommendation for Specialisation document.

## 1.3 Document Structure

This document is structured as follows:

- Introduction.
- Processing chain analysis.
  - Processing chain structure defined for SAFE 2.0 Draft, presented at PDR-C.
  - Processing chain structure proposed for SAFE 2.0.
- Conclusion.

## 1.4 Document Status

This is the first version of the document issued for open discussion in the SAFE Wiki/Forum web page (<http://wiki.services.eoportal.org/tiki-index.php?page=LTDP+SAFE+Wiki>) before the PDR.

## 1.5 Applicable Documents

The following table lists the Applicable Documents that have a direct impact on the contents of this document.

Acronym	Title	Reference	Issue
[SAFE_PRIMER]	STANDARD ARCHIVE FORMAT FOR EUROPE PRIMER	PGSI-GSEG-EOPG-FS-010-0001	2.0
[SAFE_CORE]	STANDARD ARCHIVE FORMAT FOR EUROPE CORE SPECIFICATIONS	PGSI-GSEG-EOPG-FS-05-0001	2.0
[SAFE_REC_SPEC]	STANDARD ARCHIVE FORMAT FOR EUROPE RECOMMENDATION FOR SPECIALIZATIONS	PGSI-GSEG-EOPG-FS-05-0002	2.0
[SRR_REP]	SAFE SRR Review Report	SAFE-GMV-REP-001	1.0
[SSS]	Software System Specification	SAFE-GMV-SSS-001	N/A

**Table 1-1: Applicable Documents**

## 1.6 Reference Documents

Acronym	Title	Reference	Issue
[LTDP Guidelines]	European LTDP Common Guidelines	GSCB-LTDP-EOPG-GD-09-0002 – 30/09/2010	1.1
[GEN_IPF_SPEC]	Generic IPF Interface Specifications	MMFI-GSEG-EOPG-TN-07-0003	1

**Table 1-2: Reference Documents**

## 1.7 Acronyms and Abbreviations

Acronym	Meaning
EO	Earth Observation
LTDP	Long Term Data Preservation
PDGS	Payload Data Ground System
PDR	Preliminary Design Review
PDR-C	Preliminary Design Review - Core
SAFE	Satellite Archive Format for Europe
SAFE 2.0 Draft	SAFE 2.0 presented at PDR-C (Externalisation trade-off)

**Table 1-3: Acronyms**

## 1.8 Definitions

Acronym	Meaning
Product-type	All products of a same type.
PDR-C_A09	Action from the PDR-C. Analyse if one Specialisation Document per each product type (at different levels) is better than having just one single specialization document for all instrument products.

**Table 1-4: Definitions**

## 2 PROCESSING CHAIN ANALYSIS

The present section is arranged as follows:

1. Processing chain structure defined for SAFE 2.0 Draft, presented at PDR-C.
2. Processing chain structure proposed for SAFE 2.0.

### 2.1 Processing chain structure defined for SAFE 2.0 Draft, presented at PDR-C

Before evaluating the processing chain, it is considered relevant to know the processing chain previously defined in the [SAFE\_REC\_SPEC] for SAFE 2.0 Draft presented at the PDR-C.

This approach has several drawbacks:

- The information refers to a single product not to product types.
- The information is not clearly structured in the table defined in the [SAFE\_REC\_SPEC] for SAFE 2.0 Draft.
- The relationship between the processor's outputs and inputs for the next-higher products is not managed.

In this way, the minimum information about the processing chain that was included in the [SAFE\_REC\_SPEC] was the following:

- **Output Products**

All products (up to Level2) that can be generated from a specific instrument shall be identified.

The parameters identified are:

- Product Filename: The name of the file containing the product type data.
- Product Description: Brief description of the product.
- Product Level: The processing level of the product.
- Format: Brief description of the format.
- Processor: Identification of the processor where the product was generated.

- **Auxiliary Files**

All auxiliary files used in the processing chain shall be identified.

The parameters identified are:

- Auxiliary filename: Name of the file containing the auxiliary data.
- Auxiliary file description: Brief description of the file.
- Format: Brief description of the format.
- Processor: Identification of the processor where the auxiliary file was used.

- **Product Processing Steps**

Description of all processing steps involved in the product for each instrument.

The parameters identified are:

- Processing List: List of the processor used in the chain (from L0 to L1a, L1a to L1b...up to L2).
- Figure: Graphic summarising the overall processing and describing its relationships.

- **Processor Information**

Information related to each processor identified as part of the processing chain.

The parameters identified are:

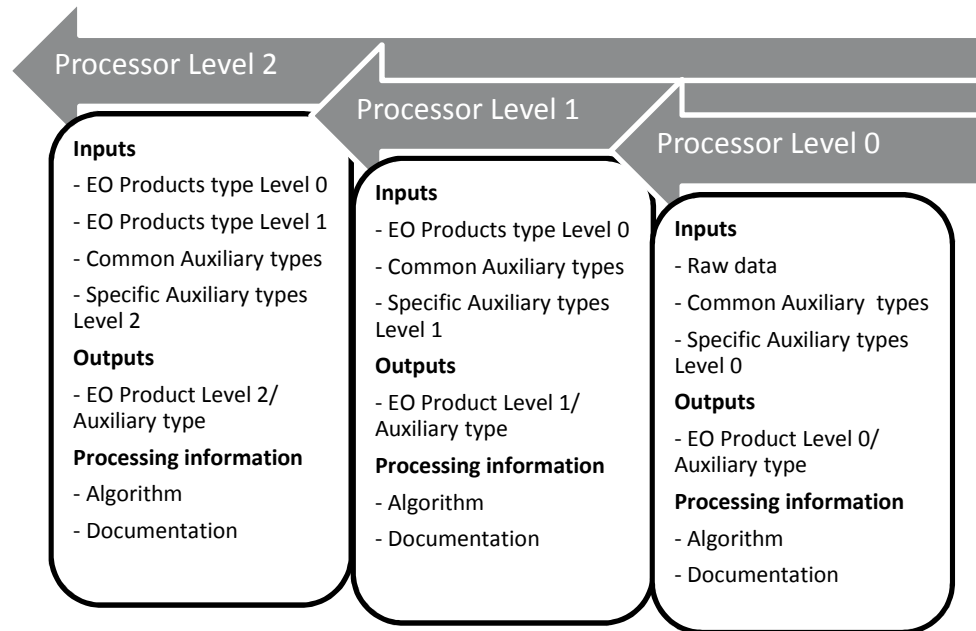
- Algorithm version: Version number of the applicable algorithm.
- Documentation references: References to algorithm specifications.
- Input files (filenames):
  - Auxiliary files.
  - Product from previous levels.
- Output files (filenames):
  - Output products / Auxiliary products.

## **2.2 Processing chain structure proposed for SAFE 2.0**

In this section it is foreseen to improve the previous processing chain defined for the SAFE 2.0 Draft and therefore solve the mentioned drawbacks.

For example, taking into account that the processing chain description refers not to a single product but to product types, then the term filename considered in the SAFE 2.0 Draft seen above should be modified in the SAFE 2.0 accordingly.

The following figure depicts the overall necessary information to generate the next-higher product levels up to L2 at least:



**Figure 2-1: Product levels up to Level 2**

Several missions and documents about the [GEN\_IPF\_SPEC] have been analysed, as a consequence the minimum information about the processing chain that has to be included in the [SAFE\_REC\_SPEC] and therefore in each Specialisation Control Book is structured as follows:

- **Product Processing Steps**

Description of all processing steps involved in the product for each instrument.

The parameters identified are:

- Processing List: List of the processor used in the chain (from L0 to L1a, L1a to L1b...up to L2). The information referred for each processor is detailed in the following point: Processing Steps Information.
- Figure: Graphic summarising the overall mission processing and describing its relationships.

- **Processing Steps Information**

Information related to each processor identified as part of the processing chain.

The parameters identified are:

- Algorithm version: Version number of the applicable algorithm.
- Documentation references: References to algorithm specifications.
- Input/Outputs:
  - Auxiliary files (Common and specific).
  - Products type.

These are detailed in the following point.

- **Input/Outputs**



The list of input, output and intermediate file types for each processor.

The parameters identified are:

- Products type

All products type (up to Level2) that can be generated from a specific instrument shall be identified.

The parameters identified are:

- Name: Type name of the file containing the product type data.
- Description: Brief description of the product type.
- Version: Version of the product type.
- Level: The processing level of the product type.
- Format: Brief description of the format.
- Status: state of the product type, for example: final, intermediate (break point), etc.
- Processor: Identification of the processor where the product was generated.

Note: The description and status are optional parameters.

- Auxiliary type

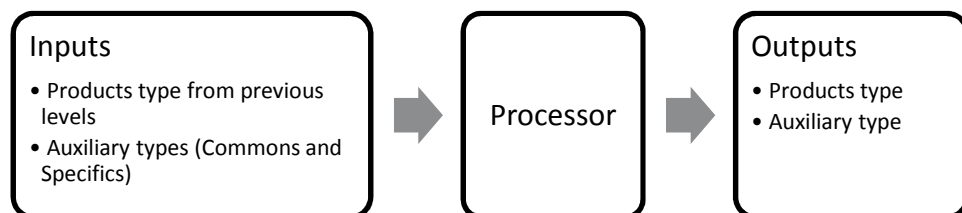
All auxiliary type files used in the processing chain shall be identified.

The parameters identified are:

- Name: Type name of the file containing the auxiliary type data.
- Description: Brief description of the auxiliary type.
- Version: Version of the auxiliary type.
- Format: Brief description of the format.
- Status: state of the auxiliary type, for example: final intermediate (break point), etc.
- Processor: Identification of the processor where the auxiliary file was used.

Note: The description and status are optional parameters.

Therefore the input/output information for each processor is depicted as follows:



**Figure 2-2: Product processing**

Note that the outputs of each processor could be used as inputs to other processors. This will be seen in detail in the following table.

The following table is proposed to structure the above information for each Specialisation Control Book:

Input	Processor	Output	Destination (next Processor Level)
<b>Level (e.g.: L0, L1a, L1b, ... , L2)</b>			
<b>Product type</b>	<u>Level:</u> <...> <u>Algorithm version:</u> <...> <u>Documentation reference:</u> <...>	<b>Product type</b>	<b>Product type</b>
<u>Name:</u> <...> <u>[Description:</u> <...>] <u>Version:</u> <...> <u>Format:</u> <...> <u>[Status:</u> <...>]		<u>Name:</u> <...> <u>[Description:</u> <...>] <u>Version:</u> <...> <u>Format:</u> <...> <u>[Status:</u> <...>]	<u>To processor level:</u> <...>
<b>Auxiliary type</b>		<b>Auxiliary file</b>	<b>Auxiliary file</b>
<u>Name:</u> <...> <u>[Description:</u> <...>] <u>Version:</u> <...> <u>Format:</u> <...> <u>[Status:</u> <...>]		<u>Name:</u> <...> <u>[Description:</u> <...>] <u>Version:</u> <...> <u>Format:</u> <...> <u>[Status:</u> <...>]	<u>To processor level:</u> <...>
<b>Level (e.g.: L0, L1a, L1b, ... , L2)</b>			
	<Other processor>		

**Table 2-1: Proposed processing chain table**

With the above table it is possible to establish the references between the inputs, outputs and the processors involved in the processing chain. Note that it can be added as many product types and auxiliary files as required.

The following table provides a high level example for the SMOS mission (L0 to L1a):

Input	Processor	Output	Destination (next Processor Level)
<b>Level 0</b>			
<b>Product type</b>	<u>Level:</u> L0 <u>Algorithm version:</u> 1.0 <u>Documentation reference:</u> ATBD and DPM documents.	<b>Product type</b>	<b>Product type</b>
<u>Name:</u> ACQ_REX <u>Description:</u> Raw data <u>Version:</u> 1.0 <u>Format:</u> Binary (.raw)		<u>Name:</u> MIR_SC_D0 <u>Description:</u> Science Data Dual Polarisation <u>Version:</u> 1.0 <u>Format:</u> Earth Explorer <u>Status:</u> final	processor level: L1a
<b>Auxiliary type</b>			
<u>Name:</u> AUX_ORBPRES <u>Description:</u> Orbit prediction file <u>Version:</u> 1.0 <u>Format:</u> Earth Explorer			
<b>Level 1a</b>			
<b>Product type</b>	<u>Level:</u> L1a	<b>Product type</b>	<b>Product type</b>

<u>Name:</u> MIR_SC_D0 <u>Description:</u> Science Data Dual Polarisation <u>Version:</u> 1.0 <u>Format:</u> Earth Explorer <u>Status:</u> final	<u>Algorithm versions:</u> 1.0 <u>Documentation reference:</u> ATBD and DPM documents	<u>Name:</u> MIR_CRU1A <u>Description:</u> Level 1A containing N Correlated Noise Injection sequences distributed in different orbit latitudes generated with the instrument pointing to the Sky <u>Version:</u> 1.0 <u>Format:</u> Earth Explorer <u>Status:</u> final	<u>To processor level:</u> L1b
<b>Auxiliary type</b>			
<u>Name:</u> AUX_GALAXY <u>Description:</u> L-Band Galactic Brightness Temperature Map <u>Version:</u> 1.0 <u>Format:</u> Earth Explorer			

**Table 2-2: Example of the proposed processing chain table**

Note that in this table only one product type (input and output) has been added for sake of the simplicity.

On the other hand, if the processing chain is changed, the Specialisation Control Book document should be also aligned accordingly to reflect this change. If this happens quite often, it is possible to provide a reference (in the Specialisation Control Book document) to a simpler document that could be easier to update. This will be analysed in the scope of the trade-off analysis that have to be done for PDR-C\_A09.

### 3 CONCLUSION

In this trade-off has been analysed the processing chain that has to be included in the [SAFE\_REC\_SPEC] and therefore in each Specialisation Control Book. To perform this trade-off several missions and documents about the [GEN\_IPF\_SPEC] have been analysed to be able to identify the minimum information about the processing chain.

As a consequence an improved structure of this processing chain has been detailed; adding more information about each element and enhancing the relationships between the inputs and outputs. Furthermore, with this new approach, the drawbacks from the processing chain identified in SAFE 2.0 Draft are solved.

Finally, the proposed definition for the processing chain has been performed taking into account the following applicable requirements of the [SSS]:

Requirement	Description	Covered
[SAFE-GEN-0150/2.0]	The SAFE core specification documents shall require to include in the specialisations the sensor processing chains from L0 to L2 with the following information: <ul style="list-style-type: none"> <li>• processing steps</li> <li>• sources needed for each processing step</li> <li>• description of the input product type for each processing step</li> <li>• description of the output product type for each processing step</li> </ul>	C
[SAFE-AUX-0040/2.0]	For each product level, SAFE shall preserve sufficient information to generate the next-higher product levels up to L2 at least.  <i>Comments: It may be sufficient to describe the processing chain in the control book or in a separate document referred to within the control book.</i>	C

**Table 3-1: Covered Requirements**

## Change Record

Issue	Revision	Date	Change Status	Origin
1	Pr1	19th November 2012	Initial version	Fernando Ibáñez Casado GMV

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