D2.1
System Engineering Report
Issue 1

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Document History			
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0.3	22/03/2018	Implementation plan of Release A	DLR
0.4	30/04/2018	Draft version of all sections	DLR
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1.0.F	26/06/2018	Final version	DLR

Table of Contents

List of Figures

List of Tables

List of Acronyms

API	Application Programming Interface
C&C	Command & Control Centre
CAMS	Copernicus Atmosphere Monitoring Service
CAP	Common Alerting Protocol
CMEMS	Copernicus Marine and Environment Monitoring Service
CMU	Crisis Management Unit
CP	Civil Protection
DB	Database
EC	European Commission
EMS	Emergency Management Service
EUW	End User Workshop
FR	First Responder
FRS	Fire and Rescue Service
FTP	File Transfer Protocol
GIS	Geographic information system
GOI	Geographical Location of Interest
GUI	Graphical User Interface
ISA	Impact Summary
LU	Local Unit
MODIS	Moderate Resolution Imaging Spectroradiometer
MS	Milestone
IMS	Internal Milestone
SatCom	Satellite Communication
SP	Service Platform
WP	Work Package

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Executive Summary

The intention of this deliverable is to report about the ongoing activities of HEIMDALL's Task 2.2 – System Engineering and Release Management, which started with the project beginning and will end in M42. The task focuses on two main objectives:

- To monitor the development activities (WP4, WP5 and WP6) in order to ensure interoperability of interfacing elements, consistency of mutual inputs/outputs, exploitation of mutual synergies between sub-systems and avoid parallel developments.
- To define and manage the different releases of the system in terms of requirements to be satisfied.

The system engineering approach followed during the HEIMDALL project is presented and the planned timing of all deliverables and developments is shown. This deliverable is the first issue out of five, presenting the status of the HEIMDALL technical work at M14. The follow up deliverables are due at M20, M27, M34 and M40 and will present the progress made and the current state at that point in time.

1 Introduction

The HEIMDALL project is structured in seven work packages (WPs) which are interrelated as indicated in Figure 1-1. The planned activities are divided in four areas:

- Management
- Stakeholder engagement, demonstrations and societal impact
- System engineering
- Dissemination, standardisation and business plan.

As can be seen in the following figure, the project management surrounds all activities and forms the basis of the project. The two pillars of the project are the stakeholder engagement and the technical developments, including the technical WPs 4-6. WP 2 is their steering WP and interlinks them with the stakeholder WP in active interaction. This allows for incorporation of user requirements and feedback identified in WP 3 into the engineering scope by means of deriving system and technical requirements and accordingly coordinating them with the technical WPs. Both pillars contribute to WP 7 the dissemination, standardisation and business plan.

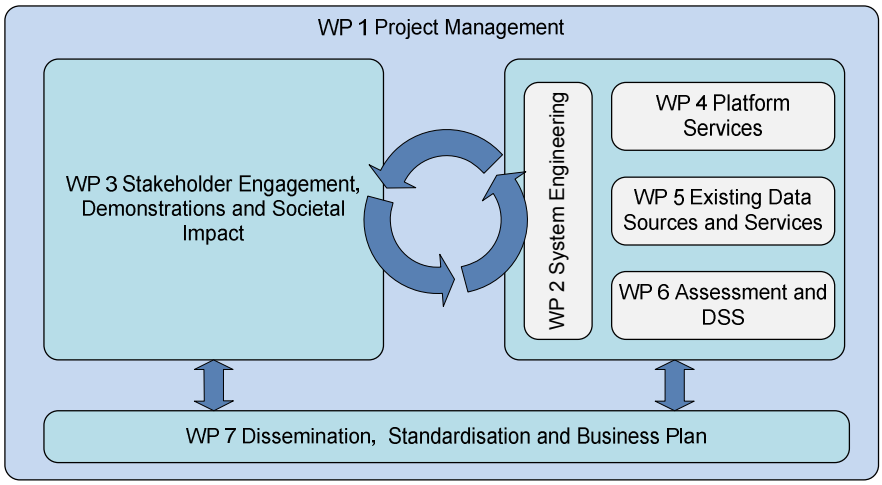

Figure 1-1: HEIMDALL project work package relation

This deliverable addresses the system engineering approach followed during the project and reports the status of the technical WPs. It is part of the ongoing activities in WP 2, more specific Task 2.2. As mentioned above, WP 2 is the umbrella activity of the technical developments that also develops the overall reference system architecture and ensures the coherence of all elements from a system engineering perspective. This includes the management of different system releases that are planned to facilitate the system development and maturity evolution up to TRL 7. The task has two main objectives: first, to monitor the development activities, performed in WP4, WP5 and WP6, in order to ensure interoperability of interfacing elements, consistency of mutual inputs/outputs, and exploitation of mutual synergies between sub-systems and avoid parallel developments. Second, to define and manage the different releases of the system in terms of requirements to be satisfied. The first results are presented in the following sections. More specifically, the document is organised as follows:

- Section 2 specifies the system engineering approach followed during the project.
- Section 3 describes the releases management and the planned requirements for the releases.
- In section 4 the current state and the progress until the submission date of the deliverable is presented.
- Finally, section 5 summarizes and concludes the document.

2 System Engineering Approach

This chapter describes the system engineering approach selected to design and implement the HEIMDALL system. The approach is based on iterative system releases and the Vee model.

2.1 The Vee Model

The engineering approach of HEIMDALL follows the Vee model for systems engineering according to the INCOSE Systems Engineering Handbook [1], shown in Figure 2-1. The approach involves an initial top-down synthesis that starts by consultation with stakeholders to clarify their needs and requirements. These requirements include mainly user requirements. In a next step they are translated into system requirements by a functional analysis, i.e. experts of the consortium on the topic evaluated the user requirements and create the necessary system requirements. They also design the solution, i.e. they define subsystems that are able to fulfil the system requirements and derive technical requirements on these subsystems.

A bottom-up assembly follows for integration, verification and finally system validation. For HEIMDALL the consortium agreed on the following definitions:

- Verification: confirmation, through the provision of objective evidence that specified requirements have been fulfilled [2].
- Validation: confirmation, through the provision of objective evidence that the requirements for a specific use or application have been fulfilled [2].

The overlap in time of the different system engineering phases represented in the Vee model allows feedback loops in both sides of the Vee. On the left side of the model, this allows an interaction with the stakeholder to carry out in-process validation, making sure that the developments really follow the requirements. At the same time, this allows looking down for the developer to carry out of-core opportunity and risk management. On the right side of the Vee, the time overlap of the different phases allows incremental integration, verification and system validation to minimise risks.

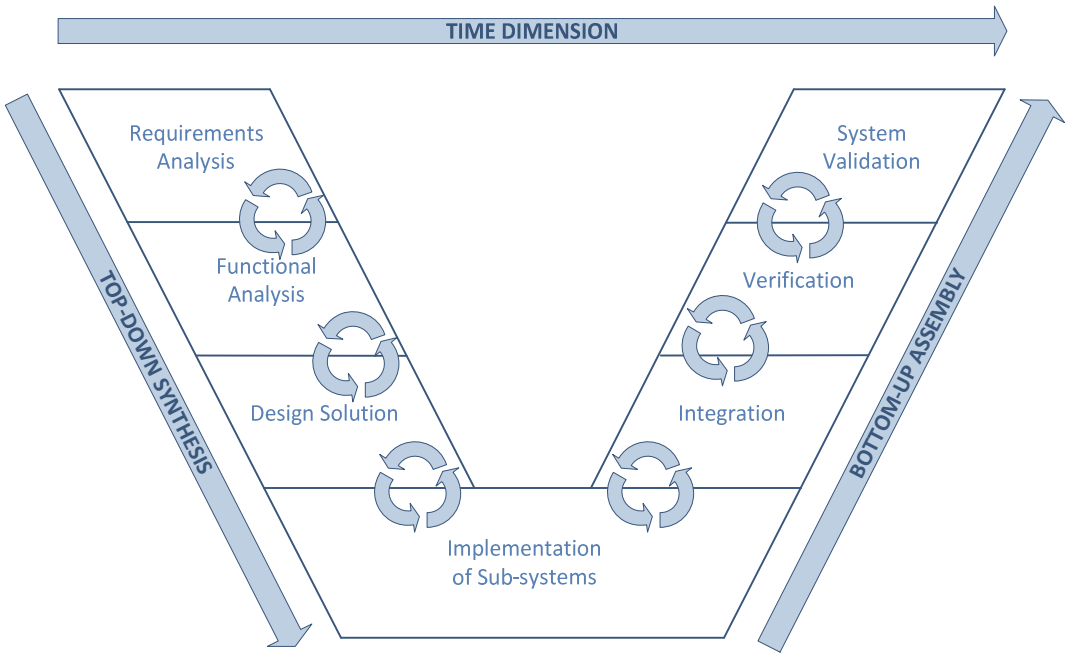

Figure 2-1: Vee Model

2.2 System Releases Concept

In order to develop the system and advance its technology readiness level up to TRL 7 the project follows an incremental approach with four consecutive system releases and development cycles each following the Vee model as can be seen over time in Figure 2-2. The releases are named A, B, C and the Final Release. A system release is achieved after the verification process of this system and it is used for the validation against the user requirements. The system validation of a previous release connects with the requirements analysis of the following Vee. With this approach, the different system releases can be validated and the overall system can be constantly improved to fulfil the stakeholder requirements and reach the expected TRL. At each release, new features will be added and features of previous releases will be incrementally improved over time. As can be seen, the time plan allocates additional time after the final demonstration to analyse the outcome of the final user evaluation and incorporate it to the dissemination activities and the business case analyses.

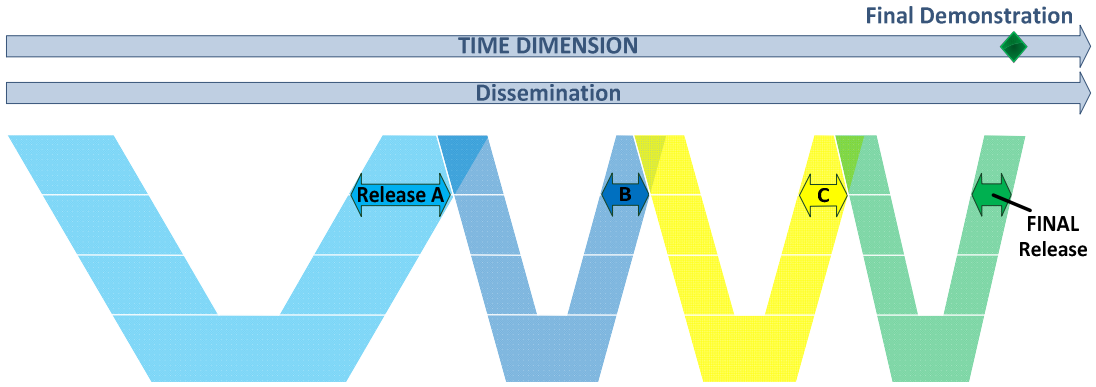

Figure 2-2: Development and system release concept

A close cooperation with the relevant stakeholders is established in the project: on the one hand, there are potential end users as partners of the consortium, on the other, the consortium is in contact with an advisory board (AB) consisting out of experts in the field. Both the consortium partners and the members of the AB validate the developments of the system releases in four demonstrations, three end user workshops (Demo 1 to Demo 3) and one final demonstration. Figure 2-3 depicts the interaction between the system engineering and the stakeholder management layers. The demonstrations go in line with the system releases and form the basis for the requirement collection process of the next release. The demonstrations will be performed in the frame of an AB workshop.

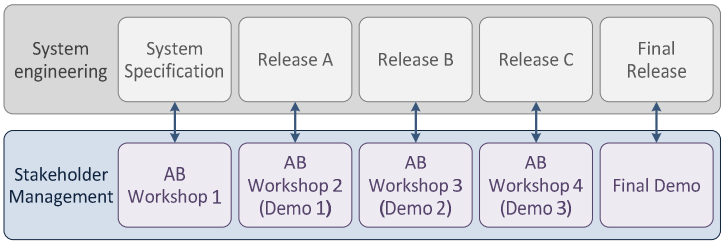

Figure 2-3: System engineering and stakeholder management relation

The outcome of the first workshop is used as starting point for developing the system specification based on the gathered user requirements. Furthermore, it must be mentioned that the final demonstration will be used to show the expected TRL, so the demonstration will be in operational environment.

2.2.1 **Internal Milestones**

In addition to the official milestones with the European Commission (EC) where specified deliverables must be submitted, the project consortium keeps also track of the status by the means of internal milestones (IMS). They are used to evaluate internally if the developments and requirements engineering processes are in line with the work planned for the period. The consortium has defined three IMS that are:

- IMS 1: the preliminary submodule specification.
- IMS 2: Demonstration 2: System Release B
- IMS 3: Demonstration 3: System Release C

The demo of Release A and the final demo are part of official milestones of the project. IMS 1 is the basis for the implementation and kicks off the corresponding work in the technical WPs according to the Vee model.

2.3 Calendar

In order to track the progress of the project in detail and keep an eye on the deliverables of the project, the important delivery dates and milestones have been combined into a single excel sheet that can be seen in the following pages (Figure 2-5 and Figure 2-6, reporting the schedule[1] for WPs 1-3). The consortium partners can access the sheet so they can check the state and deadlines at any point in time. Thereby, an arrow at the top is always indicating the current month so that partners have a quick way to check. The deliverables are color-coded as presented in Figure 2-4. The table is organized in WPs and months. For each deliverable due in a month there is also a line showing the responsible partner for the deliverable as well as the inputs required and the responsible partner(s) for that/these input(s). In this way, the partners who will provide the input they need can check it. On the very first line, MSs and IMSs are shown and highlighted.

Milestones	Deliverable Final Version	Demonstrator	
Internal MS	Deliverable Draft Version		

Figure 2-4: Colour Code Calendar

Tables of contents (ToC) and draft versions are also considered in the calendar according to the HEIDALL project handbook [3]. Reminders are distributed to the responsible partners if a deadline approaches. The phases of the Vee model can also be seen in the calendar in WP 2 line. For example, at M14 it is indicated that the submodules for Release A are needed which marks the transition to the integration phase. At M16 the modules needed, are already in a verified state. Therefore, in this case it is planned to have two months for integration and testing. Demo A will then be in M17 and is in line with MS 2 of the project. It must be mentioned, that the deadlines for the demonstrations in this plan are not hard deadlines. Since many partners are involved in it, a date is agreed among them to increase the number of participants. In this way, it can happen that a demo is close to the planned date but not exactly in the same month. It must be further mentioned that the technical developments differ from the initial planning: developments, milestones and demonstrations have been anticipated in this calendar. This is because the initial date for the final demonstration was planned for M39. This however, falls in the fire season of the firefighters in Catalonia, which play a major role in the validation of the final release. In order to enable the final demonstration it had to be anticipated by 3 months, and that affected the overall planning. Therefore demonstration C and releases A and B are anticipated by 2 and 1 months respectively.

[1] The schedule reported in these figures is limited to WPs 1-3 for lack of space. The same tool is obviously utilized also to track the progress of the other WPs (4-8) and to plan the preparation of deliverables and related milestones.

	Project KO (May 2017)		EUW1 + PM1			PM2			01.01.2018 MS 1 - Service Concept and Architecture definition		IMS 1 - Preliminary Sub-Module Specification		Current Month				MS 2 - Submodule Specf and Demo 1- Release A			
WP1	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20
Item due													D1.3							
Responsible partner													DLR-KN							
Required input			Quarterly Progress Report			Quarterly Progress Report			Quarterly Progress Report			Quarterly Progress Report			Quarterly Progress Report			Quarterly Progress Report		
Input responsible partner			All			All			All			All			All			All		
WP2	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20
Item due		D2.6 ToC	D2.11 ToC, D2.12 ToC	D2.6 Draft	D2.1 ToC	D2.6		D2.11 Draft, D2.12 Draft	D2.11 D2.12			D2.1 Draft	D2.14 ToC	D2.1				D2.2 Draft		D2.2 D2.7 Draft
Responsible partner		DLR-KN	DLR-KN	DLR-KN	DLR-KN	DLR-KN		DLR-KN	DLR-KN			DLR-KN	SPH	DLR-KN				DLR-KN		DLR-KN
Required input				User Requiremen ts					Service Concept and Architecure definition		Sub-module Specificatio n	IR + Interface document		Release A submodules		Release A verified		IR + Interface document User Requiremen ts		
Input responsible partner				PCF				WPL(4-6)				WPL(4-6)		WPL(4-6)		SPH		WPL(4-6) +PCF		
WP3	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20
Item due		Define strategy to compile requiremen ts	D3.1 ToC D3.8 ToC D3.11 ToC	D3.4 ToC User Requiremen ts	D3.4 Draft D3.8 Draft D3.11 Draft	D3.1 Draft	D3.4, D 3.8, D3.11	D3.1						D3.2 Draft D3.12 ToC		D3.2	D3.12 Draft	D3.5 Draft D3.9 Draft User Requiremen ts	D3.12	D3.5, D3.9
Responsible partner		PCF		PCF + EKUT		PCF + EKUT	PCF + EKUT							PCF + EKUT	PCF + EKUT	PCF	EKUT	PCF + EKUT	EKUT	PCF + EKUT
Required input				User requiremen ts		Case Studies + User Requiremen ts								Case Studies				User Requiremen ts + Demonstrat ion organisatio n documents		
Input responsible partner				DINT, IRC, FBBR, SFRS		DINT, IRC, FBBR, SFRS, PCF								DINT, IRC, FBBR, SFRS				PCF		

Figure 2-5: Calendar for WP1-3 in the first part of the project (M1-M20)

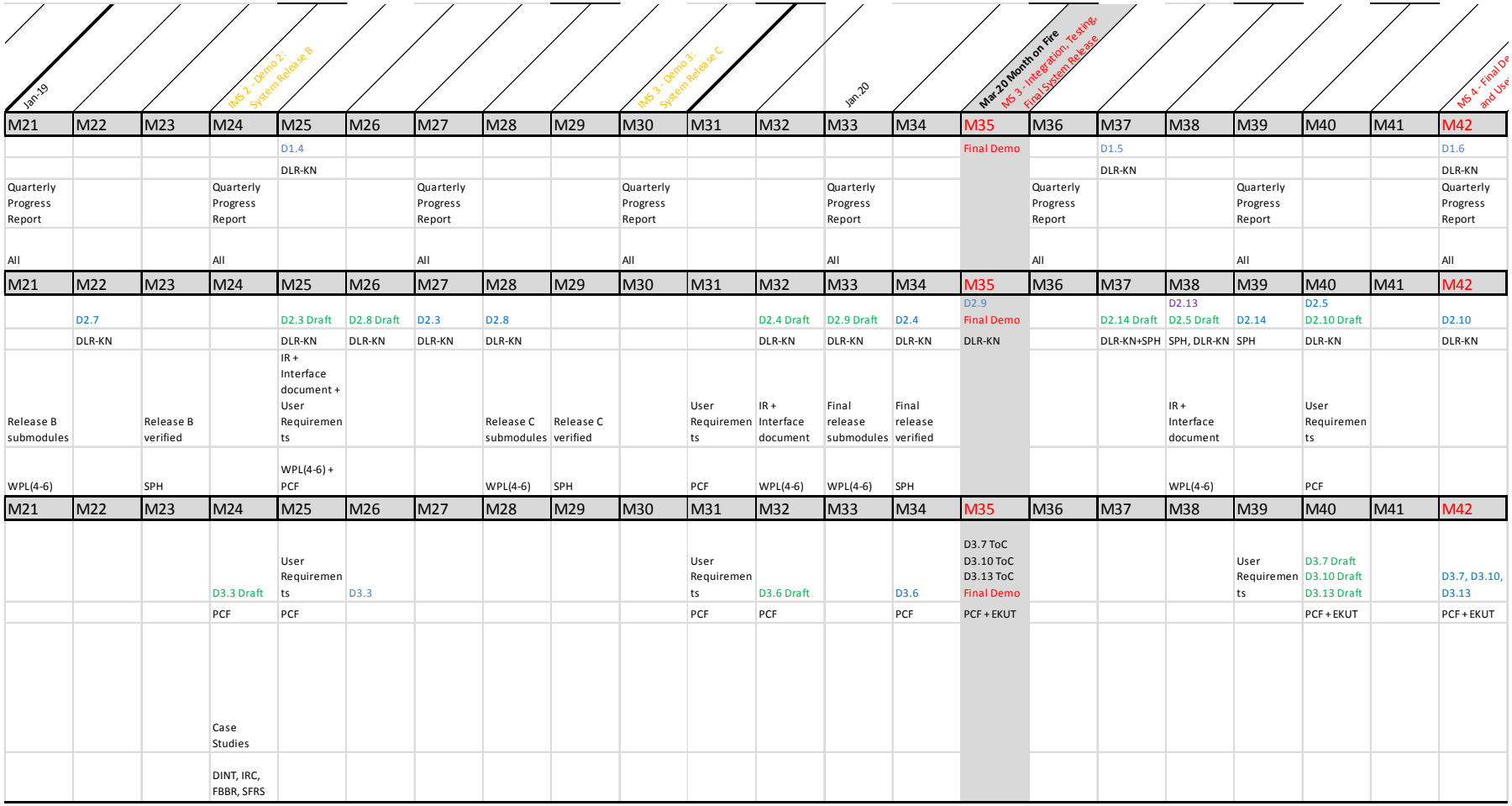

Figure 2-6: Calendar for WP1-3 in the second part of the project (M21-M42)

3 Releases

For each release, this section documents the features to be included linking them to the system design. The current issue presents the integration plan for Release A in section 3.1 and specifies the implementation plan and a preliminary version of all features and releases in section 3.2. The later one still can vary over the next releases whilst the requirements presented in section 3.3 are agreed to be implemented in Release A.

3.1 Integration Plan

Integrating a module in HEIMDALL means implementation of the necessary interfaces and connecting the module with the system, i.e. connect it with the service platform (SP) as middleware and integrate the features in the graphical user interface (GUI) so that the output to be visualised and the module controlled by the user. Thereby, it must be considered that HEIMDALL builds on previous research and innovation projects and integrates modules with different level of maturity. In particular, the concept of the HEIMDALL SP is a follow up of the PHAROS SP, drawing form the lessons learnt of that project. The HEIMDALL SP will have the same role as in PHAROS, acting as the glue that will bring all components and data sources together to deliver the expected outcomes. However, within HEIMDALL, the SP is based on a new design in order to accommodate new end-user requirements, a higher number of HEIMDALL modules and external data sources that each LU has to hold. Furthermore, the SP will facilitate the interaction with other HEIMDALL instances and be evaluated under multi-hazard scenarios.

The integration plan presented in Table 3-1 does this. It shows when the first version of a specific module is planned to be integrated in the overall system. The integration process covers the different releases. In this way, the main integrators, the GUI and SP, are unburdened and the system can evolve over time. It further allows these modules to achieve the maturity required for the integration first. The presented list does not include information about the features implemented at each module at each release (for this see following sections); it just shows the first integration.

Table 3-1: Integration Plan

Module	**Release A**	**Release B**	**Release C**
GUI	X		
User and role management	X		
Service platform	X		
Earth observation		X	
Aerial based data			X
Landslide monitors			X
Crowdsourced and first responders data	X		
External systems	X	X	X
Fire simulation	X		

Flood simulation		X	
Landslides		X	
Scenario management	X		
Risk and impact assessment products and workflows		X	
Impact summary		X	
Scenario matching			X
Decision support			X
Satellite communication			X
Information gateway	X		
Catalogue		X	
Interface to other local units		X	

3.2 Implementation Plan

The following tables present for each single module the features to be implemented and the release at which they would be implemented. They are sorted according to the products introduced in [4] and [5]. The second column shows the format of the provided product. In the next columns the ID of the technical requirement (TR) linked to the product is presented. TRs are features of the system that will be implemented and they are further specified in the corresponding deliverable of the module and the requirements report D2.7 [6]. For each requirement the planned release is shown in the fourth column, i.e. a first version of the feature will be implemented for this release.

This iterative approach of HEIMDALL, allows the definitions and implementations of the TRs to evolve during the project so a final version of each requirement will first be available for the final demonstration. The next column will be used in the next issue of this deliverable and shows the release the TR was actually implemented. This is a kind of checklist, making possible to track ongoing implementation work and helping to identify planning deficiencies. These tables form the basis of the implementation and requirement fulfilment tracking during the project evolution and will be used by both practitioners and technical partners. During the end-user workshops/demonstrations, the practitioners will provide their comments and feedback regarding the implementation of the various features (HEIMDALL products and services), whereas the end users will updated the technical requirements based on that feedback. From the system-engineering point of view, these tables lay the foundations for tracking the requirements coverage of the project.

Table 3-2: Release Schedule GUI

Module	**GUI**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**

Display of information in the GUI	The format of each corresponding product.	TR_UI_1	A		Also linked to another product
		TR_UI_3	A		
		TR_UI_4	A		
		TR_UI_5	A		
		TR_UI_6	A		
		TR_UI_8	A		Linked to another product
		TR_UI_9	A		Linked to another product
		TR_UI_10	B		Linked to another product
		TR_UI_11	A		Linked to another product
		TR_UI_12	B		Linked to another product
		TR_UI_13	B		Linked to another product
		TR_UI_14	C		Linked to another product
		TR_UI_16	C		Linked to another product
		TR_UI_17	B		Linked to another product
		TR_UI_18	C		
		TR_UI_20	B		Linked to another product
		TR_UI_21	B		Linked to another product
		TR_UI_22	C		Linked to another product
		TR_UI_23	B		Linked to another product
		TR_UI_24	B		
		TR_UI_25	B		
		TR_UI_26	B		Linked to another product

		TR_UI_27	C		
		TR_UI_28	C		
		TR_UI_29	C		
		TR_UI_30	C		
Provisioning of products and services to users	Product format	TR_UI_1	A		Linked to another product
		TR_UI_2	A		
		TR_UI_7	B		
		TR_UI_8	A		Linked to another product
		TR_UI_9	A		Linked to another product
		TR_UI_10	B		Linked to another product
		TR_UI_12	A		Linked to another product
		TR_UI_13	A		Linked to another product
		TR_UI_14	C		Linked to another product
		TR_UI_15	B		
		TR_UI_16	C		Linked to another product
		TR_UI_17	C		Linked to another product
		TR_UI_19	A		
		TR_UI_20	B		Linked to another product
		TR_UI_21	C		Linked to another product
		TR_UI_22	C		Linked to another product
		TR_UI_23	B		Linked to another product
		TR_UI_26	C		Linked to another product
		TR_UI_31	A		

		TR_UI_33	C		
		TR_DataFR_1	A		

Table 3-3: Release Schedule User and Role Management

Module	**User and Role Management**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Authentication	Comply with the HEIMDALL password policy Token format	TR_UeRM_02	A		
		TR_UeRM_03	A		Linked to another product
		TR_UeRM_11	A		Linked to another product
		TR_UeRM_12	B		Linked to another product
		TR_SP_12	A		
Access control	Web interface/UI	TR_UeRM_03	A		Linked to another product
		TR_UeRM_10	B		
		TR_UeRM_11	A		Linked to another product
		TR_UeRM_12	C		Linked to another product
		TR_SP_12	A		
Admin console	Web interface/UI	TR_UeRM_04	B		
		TR_UeRM_05	B		
		TR_UeRM_06	B		
		TR_UeRM_07	B		
		TR_UeRM_08	B		
Account management console	Web interface/UI	TR_UeRM_09	B		
		TR_UeRM_12	B		Linked to another product
User profile	JSON	TR_UeRM_01	B		

		TR_UeRM_12	B		Linked to another product

Table 3-4: Implementation Plan Service Platform

Module	**Service Platform**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Georeferenced data storage service	OGC WMS/WFS/WCS	TR_SP_01	A		
		TR_SP_02	B		
		TR_SP_04	B		Dep. crowdsourcing
GIS database	REST API/JSON	TR_SP_01	A		
		TR_SP_02	B		
“Plain” data storage service	REST/JSON	TR_SP_03	A		
“Plain” database	Document and/or NoSQL storage	TR_SP_03	A		
Historic data service	JSON (comply with scenario format)	TR_UI_10	B		Could be moved to Scenario Management
Workflow invocation service	REST/JSON	TR_SP_05	B		
		TR_SP_08	C		
		TR_SP_09	B		
		TR_SP_11	C		
SP Monitoring	REST/file/JSON	TR_SP_09	B		
		TR_SP_11	C		
Interfaces with various services	Acquired data (either raw or processed) not provided HEIMDALL modules	TR_SP_06	A		
		TR_SP_07	A		
		TR_SP_10	C		
		TR_SP_13	A		

		TR_SP_14	C		

Table 3-5: Implementation Plan Earth Observation

Module	**Earth Observation**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Flood extent (semi-automatic)	GeoTIFF and ESRI Shapefile	TR_DataEO_2	A		Example products
		TR_DataEO_3	A		Example products
Burn scar (semi-automatic)	GeoTIFF and ESRI Shapefile	TR_DataEO_1	A		Example products
		TR_DataEO_3	A		Example products
Fire hot spots (semi-automatic)	ESRI Shapefile	TR_DataEO_1	A		Example products
		TR_DataEO_3	A		
Landslide extent (semi-automatic)	GeoTIFF and ESRI Shapefile	TR_DataEO_4	A		Example products
		TR_DataEO_3	A		Example products
Information about landslides (semi-automatic)	ESRI Shapefile	TR_DataEO_4	A		Example products
		TR_DataEO_3	A		Example products
Flood extent (automatic)	GeoTIFF and ESRI Shapefile	TR_DataEO_2	C		
		TR_DataEO_3	C		
Burn scar (automatic)	GeoTIFF and ESRI Shapefile	TR_DataEO_1	C		
		TR_DataEO_3	C		
Fire hot spots (automatic)	ESRI Shapefile	TR_DataEO_1	C		
		TR_DataEO_3	C		

Landslide extent (automatic)	GeoTIFF and ESRI Shapefile	TR_DataEO_4	C		
		TR_DataEO_3	C		
Information about landslides (automatic)	ESRI Shapefile	TR_DataEO_4	C		
		TR_DataEO_3	C		

Table 3-6: Implementation Plan Aerial Based Data

Module	**Aerial Based Data**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Geo-referenced alert signal	JSON	TR_DATASitu_6	A		
		TR_DATASitu_7	A		
		TR_DATASitu_8	C		
		TR_DATASitu_9	C		
		TR_DATASitu_10	C		
Pictures	JPEG	TR_DATASitu_3	B		Linked to another product
		TR_DATASitu_9	C		
		TR_DATASitu_10	C		
Thermal Pictures	JPEG	TR_DATASitu_3	B		Linked to another product
		TR_DATASitu_9	C		
		TR_DATASitu_10	C		
On-demand video	MPEG	TR_DATASitu_3	B		Linked to another product

stream		TR_DATASitu_11	C		

Table 3-7: Implementation Plan Landslide monitors

Module	**Landslide monitors**				
Product-	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Terrestrial radar for landslide monitoring	Georeferenced shape files or 1D Plots (e.g. excel files)	TR_DATASituMon_1	B		Linked to another product
		TR_DATASituMon_2	B		Linked to another product
Geotechnical/hydrological sensors data for landslide monitoring	Database	TR_DATASituGeo_1	C		Linked to another product
		TR_DATASituGeo_2	C		Linked to another product
		TR_DATASituGeo_3	C		Linked to another product
Geodesic or topographic surveys	Raster/Vectorial files	TR_DATASituMon_1	B		Linked to another product
		TR_DATASituMon_2	B		Linked to another product
Near real-time terrain movement information	Report	TR_DATASituGeo_4	C		

Table 3-8: Implementation Plan Crowdsourced and First Responders Data

Module	**Crowdsourced and First Responders Data**				
Product	**Format**	**Linked Requirements**	**Release planned**	**Actual implemented**	**Comments (opt.)**

Authentication	Object represented by e.g. JSON	TR_DataFR_2	B		
Alerts receiver	CAP	TR_DataFR_3	A		
Hazard	Object represented by e.g. JSON	TR_DataFR_4	B		
Incident	Object represented by e.g. JSON	TR_DataFR_4	C		
First responders' location	Object represented by e.g. JSON	TR_DataFR_5	A		
Chat	XMPP	TR_DataFR_6	B		

Table 3-9: Implementation Plan External Systems

Module	**External Systems**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Service-specific interfaces as plug-ins	Service API	TR_SP_05	B		
		TR_SP_08	C		
		TR_SP_09	B		
		TR_SP_11	C		Dependent on the maturity of services
Enterprise Service Bus	XML, JSON, binary data (videos, photos, documents etc.)	TR_SP_06	A		
		TR_SP_07	A		
		TR_SP_10	C		
		TR_SP_13	A		
		TR_SP_14	C		
Copernicus EO services	Raster, vector and KMZ, NetCDF, GRIB, Web API services.	TR_DataEx_01	A		Get data from EFFIS where layers concerning hot spots and burnt area (24h, 7d and 90d) are

					available through WMS.
GDACS information	- API/Web services including WMS - KML	TR_DataEx_01	C		Integration of that source of data
Meteorological and hydrological information	REST/JSON or XML files	TR_DataEx_04	A		
		TR_DataEx_05	A		
		TR_DataEx_06	B		depending on the service availability
Cartographic data	Shapefiles, GeoTIFF	TR_DataEx_01	A		
		TR_DataEx_02	A		
		TR_DataEx_07	B		depending on the service availability
		TR_DataEx_08	B		depending on the service availability
Census data	WPS.REST services and/or shapefiles, GeoTIFF				Dependent on the availability of data sources.
Critical infrastructure information	Shapefiles, GeoTIFF				Dependent on the availability of data sources. Link to GOIs
Asset location	GeoJSON	TR_DataEx_09	B		
		TR_DataFR_05	B		
Information received from drones	Georeferenced sensor data (i.e., hotspot identification)	TR_DataEx_13	C		
Crowdsourcing information	Georeferenced data (images,	TR_DataEx_03	B		

from FRs	text, etc.) (GeoJSON object)	TR_DataEx_10	B		
		TR_DataEx_11	C		
		TR_DataEx_12	B		
		TR_DataEx_14	B		
Crowdsourcing information from the public	Georeferenced data (images, text, etc.) (GeoJSON object)	TR_DataEx_14	B		
		TR_DataEx_18	B		

Table 3-10: Implementation Plan Fire Simulation

Module	**Fire Simulation**				
Product	**Format**	**Linked Requirements**	**Actual implemented**		**Comments (opt.)**
Time of arrival	Raster in GeoTIFF format	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		
		TR_FFS_5	A		
		TR_FFS_7	A		
Fire perimeter	Vectorial output. In GML or GeoJSON	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		
		TR_FFS_5	A		
		TR_FFS_7	A		
Minimum Travel Time (MTT) fire paths	Vectorial output. In GML or GeoJSON	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		
		TR_FFS_5	A		

		TR_FFS_7	A		
Fire perimeter	Raster in GeoTIFF format.	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		
		TR_FFS_5	A		
		TR_FFS_7	A		
Flame length	Raster in GeoTIFF format.	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		
		TR_FFS_5	A		
		TR_FFS_7	A		
Fire intensity	Raster in GeoTIFF format.	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		
		TR_FFS_5	A		
		TR_FFS_7	A		
Rate of Spread (ROS)	Raster output of the ROS of the fire in m/s and in GeoTIFF format.	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		
		TR_FFS_5	A		
		TR_FFS_7	A		
Out of suppression capacity	Raster output in GeoTIFF	TR_FFS_1	A		
		TR_FFS_3	A		
		TR_FFS_4	A		

		TR_FFS_5	A		
		TR_FFS_7	A		
Adjusted forest fire simulations	Vectorial and raster outputs. Vectorial: In GML or GeoJSON Raster: GeoTIFF format	TR_FFS_2	B		To adjust simulations, firebreaks are a functionality of the simulator however it is not a product itself.
Effect of firebreaks	N/A	TR_FFS_8	C		To simulate taking into account the effects of firebreaks is a functionality of the simulator however it is not a product itself.
Mountain ridges	Raster or vectorial output	TR_FFS_6	B		
Consolidation lines	Raster or vectorial output	TR_FFS_6	B		
Valley nodes	Raster or vectorial output	TR_FFS_6	B		
Vertical walls	Raster or vectorial output	TR_FFS_6	B		
Impact oriented fire paths	Raster in GeoTIFF format.	TR_FFS_9	C		
Forest fire impact relevance assessment	Vector or raster map of qualitative classes	TR_FFS_9	C		

Table 3-11: Implementation Plan Flood Simulation

Module	**Flood Simulation**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Real-time flood extensions (Simplified model)	Raster of binary values (flooded/not-flooded) in GeoTIFF format	TR_FLOS_1	B		
		TR_FLOS_2	B		
		TR_FLOS_3	B		

		TR_FLOS_4	B		
Real-time water depth (Simplified model)	Raster of binary values (flooded/not-flooded) in GeoTIFF format	TR_FLOS_1	B		
		TR_FLOS_2	B		
		TR_FLOS_3	B		
		TR_FLOS_4	B		
Flood extensions (Complete model)	Raster of binary values (flooded/not-flooded) in GeoTIFF format	TR_FLOS_5	C		
		TR_FLOS_6	C		
		TR_FLOS_7	C		
		TR_FLOS_9	C		
Water depth (Complete model)	Raster of real values of water depth in GeoTIFF format	TR_FLOS_5	C		
		TR_FLOS_6	C		
		TR_FLOS_7	C		
Water velocity (Complete model)	Raster of real values of water velocity in GeoTIFF format	TR_FLOS_5	C		
		TR_FLOS_6	C		
		TR_FLOS_7	C		
Dynamic mapping tool (hydrological model and simplified hydraulic)	Raster of real values of water velocity in GeoTIFF format	TR_FLOS_8	C		

Table 3-12: Implementation Plan Landslide Modelling

Module	**Landslide Modelling**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**

Terrain Movement Susceptibility map	Raster or vectorial output	TR_LS_1	A		
		TR_LS_2	B		
		TR_LS_3	A		
		TR_LS_4	A		
Trends of triggering conditions that can trigger terrain movements	Report	TR_LS_5	B		Linked to another product
		TR_LS_6	B		Linked to another product
Scenarios of potential landslide warning areas based on triggering conditions evolution.	Report	TR_LS_5	C		Linked to another product
		TR_LS_6	C		Linked to another product

Table 3-13: Implementation Plan Scenario Management

Module	**Scenario Management**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Scenario	Descriptive format e.g. JSON	TR_Scen_1	A		
		TR_Scen_2	A		
		TR_Scen_3	A		
		TR_Scen_4	A		
		TR_Scen_5	A		
		TR_Scen_8	A		
		TR_Scen_12	A		
		TR_Scen_15	A		
		TR_Scen_7	B		
		TR_Scen_9	B		

		TR_Scen_11	B		
		TR_Scen_13	B		
		TR_Scen_14	B		
		TR_Scen_6	C		
		TR_Scen_10	C		
Decision	Descriptive object represented by e.g. JSON; drawing, georeferenced format for formalizing paths of decisions	TR_Scen_24	C		
Response Plan	Descriptive object represented by e.g. JSON	TR_Scen_18	A		
		TR_Scen_19	B		
Measure	Georeferenced object, e.g. GeoJSON	TR_Scen_25	C		
Lesson learnt	Descriptive object represented by e.g. JSON	TR_Scen_17	B		
		TR_Scen_20	C		

Table 3-14: Implementation Plan Risk and Impact Assessment Products and Workflows

Module	**Risk assessment**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Multi-hazard risk	Raster or vector map of qualitative classes (low – medium – high)	TR_Risk_17	B		
		TR_Risk_18	C		
		TR_Risk_19	C		
		TR_Risk_20	C		
		TR_Risk_23	C		
Human Impact	Raster or vector map of	TR_Risk_21	C		

Assessment	qualitative classes (low – medium – high)				
Human Exposure	Raster or vector density map	TR_Risk_05	B		
		TR_Risk_04	A		
		TR_Risk_03	B		
Physical Exposure	Vector map (e.g. building height, building function, etc.)	TR_Risk_01	A		Physical Exposure data set will be provided by DLR-DFD: Main feature for Review Meeting Implementation
		TR_Risk_02	B		
		TR_Risk_21	C		
Physical Impact Assessment	Vector map of percentage damage for e.g. building stock transportation networks and land use classes	TR_Risk_06	B		
		TR_Risk_07	B		
		TR_Risk_08	B		
		TR_Risk_09	B		
		TR_Risk_10	B		
		TR_Risk_11	B		
		TR_Risk_12	C		
		TR_Risk_13	C		
		TR_Risk_14	C		
		TR_Risk_22	C		
		TR_Risk_24	C		

Table 3-15: Implementation Plan Impact Summary

Module	**Impact Summary**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**

GOIs at risk	Descriptive format; georeferenced objects where applicable, e.g. in GeoJSON format	TR_SA_1	A		
		TR_SA_3	A		
		TR_SA_6	B		
		TR_SA_7	B		
People at risk	JSON Object	TR_SA_2	C		Classification based on availability of Human Impact Assessment
		TR_SA_4	C		
		TR_SA_12	C		
Potential cascading effects/ hazards	JSON Object	TR_SA_8	C		
		TR_SA_10	C		
		TR_SA_13	C		
Hazard evolution information	JSON Object	TR_SA_9	C		
		TR_SA_11	C		
		TR_SA_14	C		
Situation Report	In standardized, XML-based message format such as EDXL-CAP or EDXL-SitRep	TR_SA_5	B		Final version depending from availability of scenario snapshot (first version can operate on scenario) and decision support products

Table 3-16: Implementation Plan Scenario Matching

Module	**Scenario Matching**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
List of similar scenarios	JSON Object	TR_Scen_22	C		
		TR_Scen_23	C		

Table 3-17: Implementation Plan Decision Support

Module	**Decision Support**	

Product	Format	Linked Requirements	Planned for release	Actual implemented	Comments (opt.)
Information about safe, significant infrastructure	Descriptive and georeferenced objects where applicable, e.g. in GeoJSON format	TR_DS_1	B		
		TR_DS_2	B		
		TR_DS_5	C		
		TR_DS_6	C		
Information about safe response infrastructure	Descriptive and georeferenced objects where applicable, e.g. in GeoJSON format	TR_DS_3	C		
		TR_DS_4	C		
		TR_DS_5	C		
		TR_DS_6	C		

Table 3-18: Implementation Plan SatCom

Module	SatCom				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
SatCom	TBD	TBD	TBD		

Table 3-19: Implementation Plan IG

Module	Information Gateway				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
FR information service	SitRep, Scenario in the corresponding format (probably EDXL based)	TR_Com_4	B		
		TR_Com_5	B		
		TR_Com_6	C		
		TR_Com_7	C		
		TR_Com_8	C		
Alerting service	CAP message	TR_Com_1	A		
		TR_Com_2	A		
		TR_Com_3	A		

		TR_Com_11	A		
		TR_Com_12	A		

Table 3-20: Implementation Plan Catalogue

Module	**Catalogue**				
Product	**Format**	**Linked Requirements**	**Planned for release**	**Actual implemented**	**Comments (opt.)**
Information Discovery Translation and mapping service	Shared content and metadata	TR_DSC_1	B		
		TR_DSC_2	B		
		TR_DSC_3	B		
		TR_DSC_4	B		
		TR_DSC_5	B		Linked to another product
		TR_DSC_6	B		Linked to another product
		TR_DSC_7	B		
		TR_DSC_8	B		
		TR_DSC_9	B		
		TR_DSC_10	B		
		TR_DSC_12	C		
		TR_DSC_13	C		
		TR_DSC_19	B		
		TR_DSC_20	B		Linked to another product
		TR_DSC_21	B		Linked to another product
		TR_DSC_22	B		Linked to another product
Collaboration	Shared content and	TR_DSC_5	B		Linked to another

and messaging	metadata				product
		TR_DSC_14	C		
		TR_DSC_15	C		
		TR_DSC_16	C		
		TR_DSC_20	B		Linked to another product
		TR_DSC_21	B		Linked to another product
		TR_DSC_22	B		Linked to another product
Interface to other local units	Data input by the user	TR_DSC_6	B		Linked to another product
		TR_DSC_11	B		
		TR_DSC_20	B		Linked to another product

3.3 Release A

As implementation plan for Release A, Table 3-21 summarizes the features scheduled for integration at this release. It includes for each main module the planned technical requirements (TRs) of features to be implemented for this release. For the sake of clarity the TRs are briefly described in the table, for more detailed information see [6]. According to the system release concept followed in HEIMDALL, the features implemented are a first version to be validated in Release A. The features will evolve during the project duration, based on the gathered feedback after each end user workshop that follows each release. In the same way, Table 3-22 summarizes the features that will be implemented during the implementation phase but as standalone, i.e. to be integrated later release. In this way, it is possible to track also the progress of the features that are not integrated.

Table 3-21: Features implemented and integrated for Release A

Main Module	ID	TR brief description	Comments
GUI	TR_UI_1	User login	
	TR_UI_2	Customise settings	

	TR_UI_3	Show data	
	TR_UI_4	Filter information, map layers, settings	
	TR_UI_5	Show information in a map	
	TR_UI_8	Trigger Simulations, show results	
	TR_UI_9	Enable simulation settings	
	TR_UI_13	Include external services	
	TR_UI_20	Add information to scenario	
User and Role Management	TR_UeRM_02	Single sign on/off	
	TR_UeRM_03	Support of connection to existing LDAP, Active Directory, etc. servers	
	TR_UeRM_11	Support of standard protocols	
Service Platform	TR_SP_01	Database to store GIS data	
	TR_SP_03	Database to store sensor data	Dependent on availability of sensor data.
	TR_SP_04	Receive and store georeferenced information from first responders	Dependent on smartphone application
	TR_SP_06	Integrate multiple heterogeneous data sources using standard interfaces	
	TR_SP_07	Integrate multiple heterogeneous data sources using proprietary interfaces	Stepwise integration. If the data sources used do not require proprietary interfaces this will not be satisfied.
	TR_SP_12	Support multiple users operating simultaneously	
	TR_SP_13	Facilitate the exchange of information with existing operational tools	The parts for Release A and if needed.
Crowdsourced and First Responders Data (App)	TR_DataFR_3	App receives alert messages	
	TR_DataFR_5	Track and display the location of first responders	
	TR_DataFR_6	Chat	
External Systems	TR_DataEx_01	Present the information as map layers	

	TR_DataEx_02	Georeferenced base layer for the maps	
	TR_DataEx_04	Meteorological information from weather services	
	TR_DataEx_05	Hydrological information from available services	
Fire Simulation	TR_FFS_1	Run forest fire simulations	
	TR_FFS_3	Integrate the necessary weather parameters	
	TR_FFS_4	Simulations with multiple ignition points	
	TR_FFS_5	Multiple simulations at the same time	
	TR_FFS_7	Different simulation parameters defined by the user	
Scenario Management	TR_Scen_1	Creating a scenario from a potential or real hazard	
	TR_Scen_2	Accessing scenarios	
	TR_Scen_3	Modifying scenario parameters	
	TR_Scen_6	Defining scenario either as “real” or “simulated” scenario	
	TR_Scen_9	Accessing all information associated to a scenario	
	TR_Scen_10	Associate further information to a scenario	
Information Gateway	TR_Com_1	Provide information to public	
	TR_Com_2	Transmission of alert messages	
	TR_Com_3	Create alert messages	
	TR_Com_11	Connection to communication networks	
	TR_Com_12	Secure communication links	

Table 3-22: Features implemented in Release A implementation phase but to be integrated at a later phase

Main Module	ID	TR brief description	Comments
Earth Observation	TR_DataEO_1	Burn scars based on Sentinel-2 and hot spot detection based on MODIS data.	
	TR_DataEO_2	Flood layer	
	TR_DataEO_3	Download of EO products and	

		their metadata	
	TR_DataEO_4	Information about the landslide extent and landslide movement	
Aerial Based Data	TR_DATASitu_6	Define a region of interest that the can be monitored by the swarm	
	TR_DATASitu_7	Define points of interest within the region of interest	
Landslide Modelling	TR_LS_1	Landslide propagation simulation to assess landslide susceptibility	
	TR_LS_3	Run simulation with user defined parameters	
	TR_LS_4	Landslide propagation simulation with multiple areas	
Scenario Management	TR_Scen_13	Accessing EO data associated to a scenario.	
	TR_Scen_16	Add information from the public to a scenario	
	TR_Scen_17	Manipulate lessons learnt and assign them to scenarios	
	TR_Scen_18	Manipulate response plans and assign them to scenarios	
Risk and Impact Assessment Products and Workflows	TR_Risk_01	Extraction of built-up area from Earth Observation data.	
	TR_Risk_02	Identification of affected buildings and other infrastructure components based on hazard information	
Impact Summary	TR_SA_1	ISA information for GOIs at risk	
	TR_SA_2	ISA information which describes people at risk	

4 Progress and Status

At the moment of submitting this deliverable in M14, according to the calendar from system engineering perspective the following milestones have been completed:

- MS 1 – “Service Concept and Architecture definition” which includes the delivery of the following deliverables to the EC. The list only includes deliverables from relevant technical work.
    - D2.6
    - D2.11
    - D2.12
- IMS 1 – “Preliminary Sub-Module Specification”. This IMS is also the kick-off for the first implementation phase. Draft versions of the following deliverables should have been prepared by the partners. Draft versions should include the TRs to be implemented, a description of the functionalities of the module and the technical specification. The task was to have the deliverables in a state where a developer can use it to start the implementation.
    - D4.13
    - D5.4
    - D5.1
    - D6.1
    - D6.7
    - D6.10
    - D6.14
    - D4.1
    - D4.4
    - D5.9
    - D4.7
    - D4.11
    - D4.16
    - D5.7
    - D5.12
    - D6.4
- Submission of D6.14. The first deliverable of a technical WP was due M12 and was submitted in time.

For MS 1 the deliverables have been finalized and submitted to the EC. The deliverables describe the service concept, the system architecture and give the first set of requirements. Translated to the Vee module this MS marks the finalisation of the “requirements analysis”, the “functional analysis” and partially of the “design solution” phase. The overall system has been defined and was split into sub-modules. The specification of the submodules was part of the IMS1.

For IMS 1 the necessary drafts have been provided by the partners and have been reviewed by the technical coordinator of the project and feedback has been given. The design phase has been achieved and the implementation phase for Release A has been kicked off. At the moment of submitting this deliverable the implementation work is ongoing. The date of the first demonstration has been set on the first week of M18 so there are 3 months left for implementation, integration and verification. Planning of the integration has already been initiated.

The following sections give some more details about the ongoing work of each technical work package and the current state. In parallel, there is already preparation for demonstration A ongoing at management level.

4.1 Status of Implementation in WP4

In T4.1, SPH has released a first implementation of the SP providing the corresponding databases, the SP ESB and interfaces with other components and with external services. The HEIMDALL components interact with the Service Platform for two purposes – a) for sending and retrieving data and b) for triggering workflows. Data exchange is mainly performed over HTTP directly to the SP Data repository. Geospatial data can be published/retrieved via the OGC-compliant services (WFS, WCS) and can be retrieved also fully rasterised via the WMS service. In addition, a REST-based interface will be available. Sensor data is exchanged via the OGC SOS service, while generic data can be published and retrieved via a proprietary HTTP REST interface, whose API will be defined within the HEIMDALL project. Furthermore, D4.1 has been updated.

In T4.2, the draft architecture of the UeRM module has been designed and a first dockerised instance of the keycloak framework is operational in the SPH data centre. Currently, SPH investigates the ways to evaluate the issued tokens and updated the draft APIs of D4.4.

In T4.3, AVA has progressed with the design of the GUI, incorporating the feedback gathered during the previous months. An updated design of the GUI has been prepared and the implementation has started, updating at the same time D4.7. Furthermore, AVA and SPH have exchanged information regarding the interfaces between the GUI and the SP. AVA was granted access to the HEIMDALL VPN and tested the APIs provided by SPH.

In T4.4 a virtual machine is set up for the catalogue and currently preparations for connecting it to the HEIMDALL system are ongoing. The catalogue will be integrated for Release B hence implementation work is mainly focusing on T4.5. In T4.5, from the information gateway side there is effort ongoing in trying to establish firewall rules to be able to connect to the HEIMDALL network. A virtual machine has been set up. The code for the first version, i.e. the alerting chain, has been prepared but needs to be adapted to a newer operating system and framework.

4.2 Status of Implementation in WP5

In T5.1, The first implementation of the complete processing chains for automatic flood mapping based on Sentinel-1 and TerraSAR-X data is finalized. Currently, the processors are extensively tested with a focus on classification accuracy, transferability and processing effectivity. The implementation of the automatic MODIS-based hotspot service for wildfire detection is finalized.

With regard to the Sentinel-2 burn scar processing service, a first version of a prototypical burn scar processor is implemented. Currently the processor is extensively tested with a focus on classification accuracy, transferability and processing effectivity. Further, current work focuses on reducing uncertainties related to cloud shadows and the similarity between burn scars and harvested agricultural land.

After having defined two distinct automatic flood processing chain workflows for Sentinel-2 and VHR data, a first Sentinel-2 water extraction chain has been implemented and tested over several flood events across Europe and worldwide using Sentinel-2 data, in parallel to operational activities. The first version of the flood processing chain, called WATEX, is still in a testing and improvement phase, and will be ready before the Demo 1 – Release A. WATEX has also been tested with VHR data (Pléiades and SPOT6/7) on several flood events in order to define if a single tool could be implemented for all types of optical data, both HR and VHR. The results are quite promising but the processing times are longer. Even if the results automatically provided by this chain are generally satisfactory, a step of validation by photo-interpretation is still needed in order to optimize the flood layer, especially for VHR data and when clouds, shadows and highly changing water colours are present. A version 2 of WATEX will be developed after the Demo 1 in order to minimize the limits of the tool and completely integrate HR and VHR optical data.

An existing basic landslide mapping chain, developed for SPOT6/7, LANDSAT-8 and Sentinel-2 data, has been tested using Sentinel-2 images over several past landslide events. Further testing will be realised over the HEIMDALL landslides defined test sites over Italy and Spain; available Sentinel-2 and VHR archive images acquired over past events in these areas have been listed and are going to be ordered to the Copernicus Data Support Portal (CDS-SSO) and then processed. The first version of the landslide mapping chain will be ready before the Demo 1 – Release 1.

With regard to the processing chain for updating landslide activity based on interferometric data a set of Sentinel-1 Single Look Complex (SLC) images, acquired over Catalonia, have been downloaded and processed. Different processing tools have been tested over different sub-areas. Clusters of Persistent Scatterers (PS) have been identified in some areas and atmospheric correction has been analysed.

Semi-automatically derived example products related to all processors will be provided for Release A.

In T5.2, the work has been progressed in both the MAV and in-situ sensors parts. Concerning the MAVs, the work is about the development of a MAVs swarm for forest fire hotspot detection, in-situ monitoring and surveillance with thermal sensors. The system concept has been defined, whereas within T5.2 the partners have investigated, selected, and purchased the required hardware. This includes a tablet computer, a communication system, thermal and visual cameras, and an onboard computer for drones. Furthermore, DLR-KN has designed the system‘s architecture, and programmed a “light” version of the system. This version allows the deployment of drones as autonomous sensor-carrying platforms.

With respect to the sensors, GB SAR data, are transmitted via FTP (continuous) to CTTC, or directly entered through a storage media (discontinuous), are then processed at CTTC and sent to the Service Platform via HTTP. Data will be transmitted from the sensors (in-situ) to the Service Platform through the ICGC Server. The transmission of the GB SAR and in-situ sensor data to the SP is going to be implemented in the future as is planned for releases B and C respectively.

In T5.3, AVA has performed an initial design of the first responder application. The implementation has started prioritising the features needed for Release A.

In T5.4, an investigation of the external data and services that will provided added valued to the HEIMDALL platform has been performed. From the available sources prioritisation has been given to the integration of external weather services to be exploited by the fire simulation and scenario management components. Hence, the first implementation of the weather service component splits areas of interest into a uniform grid and periodically polls the selected weather service (Weather Underground - https://www.wunderground.com/weather/api/ - for the Release A) for each grid point. The retrieved data are stored to the geodata repository of the SP. At request; cached values from the closest point via WFS as GeoJSON are served.

In T5.5, the implementation of the landslide simulator has been through a first phase of concept design and choice of the algorithms to be used for analysis of susceptibility for each type of landslide (rock falls, debris flows and landslides). At the moment the implementation of the susceptibility simulator is under development, and a first version of stand-alone submodules will be ready for Release A. The weather trends simulator will has been designed, to be implemented during Release B.

With regard to the forest fire simulator, currently the functionalities foreseen to be demonstrated in Release A are being developed and implemented, namely the services related to the fire spread simulation mode, until now work has been done in the implementation of the forest fire simulation engine core as well as of the data repository.

For what concerns the flood simulator, the development phase of the simulation engine core is completed. The simplified flood model has been tested in its first version in stand-alone mode. The extension to the complete flood model is currently under development. A test-

case with required inputs and outputs (extent, depth, velocity) has been designed. At the moment the integration with possible punctual measures (i.e. raising or lowering levees) is under development.

4.3 Status of Implementation in WP6

In T6.1, work has focussed on the development of the overall risk analysis concept. The methodological concept that addresses the exposure methods, i.e. the relation between physical exposure and human exposure has been documented. Two different impact assessment components have been identified: a) a deterministic impact assessment approach that uses observation-based hazard information as an input and b) a probabilistic approach that uses simulation-based hazard information as an input. Two different approaches are needed, since the level of detail of hazard information determines which impact methods can be used.

In T6.2, the implementation of the physical exposure methods has been started with a focus on the generation of 3D building model, since the 3D building model serves as input during the human exposure generation. Therefore, building extraction from Airborne Laser Scanning point cloud data has been implemented, serving as an input for the 3D building model. In addition to the geospatial information extracted, a generic building function taxonomy for building stock classification has been developed in order to be able to consistently assign building functions regarding different national building functions taxonomies within their national datasets.

Various sources have been exploited for further inputs for the 3D building model such as OpenStreetMap and VHR images and tested with regard to their suitability to complement the 3D building model. Sources for the transportation network and critical infrastructures database generation have been exploited.

In T6.3, the first version of a data model for GOIs (Geographical Objects of Interest) at risk has been developed. As the Impact Summary Service (ISAS) uses T5.5, T6.1 and T6.2 products as major inputs for the generation of ISA information the GOI data model will be finalized once example products are available. In addition, expert criteria will be defined during the next project phase together with the end-user partners which will be integrated into the ISAS logic. The ISAS component has been created as a Django Framework application. A Git repository has been set up for collaborative work on the application. During the next time, the source code shall be published in a HEIMDALL project on the online repository platform GitHub.

Besides the ISAS, a first version of the Situation Report Generation (SITREP) component has been set up also as a Django application. SITREP is planned for Release C. However, the SITREP component helps to understand and test the interface of the Scenario Management Service (SMES) at this early stage of implementation.

In T6.4, implementation work has not started yet.

In T6.5, a first version of the Scenario Management Service (SMES) component has been implemented. That version contains a first relational scenario data model. The final version of the SMES including its RESTful API conforming to the specification in D6.14 is planned for being ready for integration by the end of June. During the next time, the source code shall be published in the same GitHub project as the ISAS for collaborative software development.

5 Conclusion

This deliverable shows the system engineering approach followed during the HEIMDALL project. A standard Vee approach is used in an iterative manner in order to achieve four consecutive system releases A-C and final that will be validated in four dedicated system demonstrations.

A calendar including all important delivery dates and milestones is shown which is used in the project to keep an overview of the ongoing activities and deadlines. An overall integration plan shows when a feature is planned to be implemented on a per module basis. Details about the features are presented in the dedicated technical deliverables of WP 4, WP 5 and WP 6. A summarized version of the implementation plan for Release A specifies the features that will be demonstrated in the first release.

An integration plan shows at which release each module is integrated in the overall system. This integration plan considers the maturity of the module as well as the plan for the demonstrations where each demonstration shall be dedicated to a specific hazard as shown in [7].

The progress in terms of achieved milestones as well as in terms of the Vee model is presented. In MS 1, the service concept definition, system architecture specification and the first set of requirements are finalized. Furthermore, in IMS 1, the preliminary submodule specification has been closed and implementation for Release A was kicked-off which is ongoing at the moment of submitting this deliverable.

6 References

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