



**An Enhanced Common Information Sharing Environment for Border  
Command, Control and Coordination Systems**

*Grant Agreement Number: 833881*

## **D.2.5 User Community Final Report**

<b>Deliverable Identifier:</b>	D.2.5
<b>Deliverable Due Date:</b>	2021/07/31
<b>Deliverable Submission Date:</b>	2021/07/31
<b>Deliverable Version:</b>	1.0
<b>Author (ed) and Organisation:</b>	Rauno Pirinen, LAUREA University of Applied Sciences
<b>Work Package:</b>	WP2 Operational Analysis, User Requirements and Technical Specifications
<b>Task:</b>	T.2.1 User Community Interactions
<b>Dissemination Level:</b>	PU: Public



## Document Control Page

Deliverable Number:	D.2.5	
Deliverable Title:	User Community Final Report	
Deliverable Version:	v.1.0	
Work Package Number:	WP2	
Work Package Title:	WP2 Operational Analysis, User Requirements and Technical Specifications	
Submission Date:	2021/07/31	
Dissemination Level:	<input checked="" type="checkbox"/> PU: Public <input type="checkbox"/> CO: Confidential, only for members of the Consortium (including the Commission Services) <input type="checkbox"/> RE: RESTREINT UE (Commission Decision 2015/444/EC)	
Status:	<input checked="" type="checkbox"/> Draft <input checked="" type="checkbox"/> Consortium reviewed <input checked="" type="checkbox"/> Peer reviewed <input checked="" type="checkbox"/> Management Support Team reviewed <input checked="" type="checkbox"/> Project Coordinator accepted	
Author (ed):	Rauno Pirinen	Laurea (editor)
Contributor(s):	Rauno Pirinen	Laurea
	Ilkka Tikanmäki	Laurea
	Jari Räsänen	Laurea
Peer Reviewer(s):	Dimitris Katsaros	EXUS
	Lazaros Karagiannidis	ICCS
Security Assessment:	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Rejected Comments:	
Funding Authority:	European Commission	
Funding Program:	Horizon 2020 Secure Societies Work Programme 2018 – 2020	
Topic:	SU-BES03-2018 Demonstration of applied solutions to enhance border and external security, Subtopic [2018]: Open	
Rights:	ANDROMEDA Consortium	

## Version History

Version	Date	Edited by	Description
v.0.1	2020/09/10	Rauno Pirinen, Jari Räsänen, Ilkka Tikanmäki, Laurea	Document Structure and LAYOUT; ANDROMEDA FORUM; User Community Meetings; Editing of Deliverable
v.0.1	2020/09/11	Jari Räsänen, Ilkka Tikanmäki, Laurea	Document Content Outline and Design of Structure
v.0.1	2020/09/11	Jari Räsänen, Ilkka Tikanmäki, Laurea	Design of Topic and data collection procedures for deliverable
v.0.1	2020/09/20	Rauno Pirinen, Jari Räsänen, Ilkka Tikanmäki, Laurea	Partner Profiles; Experience-Expertise descriptions; User Community Exploitation and Expansion
v.0.2	2020/09/22	Rauno Pirinen, Laurea	ANDROMEDA User Community Explanations and Descriptions
v.0.2	2020/09/25	Jari Räsänen, Ilkka Tikanmäki, Laurea	ANDROMEDA User Community Interactions
v.0.2	2020/09/26	Costas Rizogiannis, KEMEA	ANDROMEDA Operational and Design Drivers and additional review
v.0.3	2020/09/28	Jari Räsänen, Ilkka Tikanmäki, Laurea	ANDROMEDA User Community Interaction and Systems Interactions
v.0.3	2020/10/04	Jari Räsänen, Ilkka Tikanmäki, Laurea	ANDROMEDA Potential and Feasibility
v.0.3	2020/10/08	Jari Räsänen, Ilkka Tikanmäki, Laurea	ANDROMEDA User Community Forming and Methods
v.0.3	2020/11/25	Ilkka Tikanmäki, Jari Räsänen, Laurea	Analysis and assessment of ANDROMEDA Gaps in the perspective of User Community
v.0.3	2020/12/12	Rauno Pirinen, Laurea	Analysis of ANDROMEDA Continuums
v.0.3	2020/12/18	Luca Bertocchi, MARINA MILITARE	Pattern of Life in ANDROMEDA
v.0.4	2020/12/18	Ilkka Tikanmäki, Laurea	Analysis of User Community Gaps and Potentials
v.0.4	2021/06/24	Jari Räsänen, Ilkka Tikanmäki, Laurea	D2.1 update to D2.5 and finalisation of D2.5
v.0.5	2021/07/13	Luca Bertocchi, MARINA MILITARE	Internal review by WP Leader
v.0.6	2021/07/14	Dimitris Katsaros, EXUS	Internal review by Peer Reviewer
v.0.6	2021/07/15	Lazaros Karagiannidis, ICCS	Internal review by Peer Reviewer
v.0.7	2021/06/16	Tuomas Tammilehto, Laurea	Review by Ethics Manager
v.0.7	2021/07/21	Ilkka Tikanmäki, Jari Räsänen, Laurea	User Community Survey results
v.0.8	2021/07/25	The Security Advisory Board	Review by the Security Advisory Board
v.0.8	2021/07/27	Rauno Pirinen, Jari Räsänen, Laurea	Finalization of deliverable and including of amendments by reviews and feedback
v.0.9	2021/07/29	Athena Foka, MMAIP, Alkis Astyakopoulos, KEMEA	Approval review by the Project Coordinator and Appointed Reviewer from MST

<b>Version</b>	<b>Date</b>	<b>Edited by</b>	<b>Description</b>
v.1.0	2021/07/31	Athena Foka, MMAIP	Final version to be released for submission

## Executive Summary

ANDROMEDA User Community addresses the stakeholders information exchange needs of the operational maritime and land border surveillance. ANDROMEDA User Community focuses to its industrial and academic experts and end-users interactions for utilizing the achievements reached in previous EU funded projects for unlocking the full capabilities of CISE by extending the scope to Land Border Information Exchange. The ANDROMEDA operative domain will, through the enhanced CISE Model, streamline the integration with current and future operational systems in order to foster faster detection of new elements, better informed decision making and the achievement of a joint understanding of situation across borders.

ANDROMEDA project<sup>1</sup> can be considered as an integral part of the cross-border continuity started with the CoopP project and CISE network. The results laid down in ANDROMEDA deliverables<sup>2</sup> provide improved elements for interoperability and cooperation and allows Member State and EU Agencies to decide how, when and whether additional data sources are of relevance to its operations.

ANDROMEDA project forms a User Community that covers not only project partners, but also additional organizations, both end users and providers of data and services, not directly involved in the project. The community supports and advises project partners with experience and know-how by participating User Community sessions, project Trials, project's Work Shops and taking part in discussions in ANDROMEDA Forum throughout the project duration. A key element driving this community is the collaborative involvement not only of users but also of all stakeholders, bringing together their expertise in Command & Control (C2) systems, Data Fusion technologies and information sharing solutions, during and beyond the lifetime of ANDROMEDA project.

The design of ANDROMEDA therefore integrates the user community experience in design and development as well as needs, operational scenarios, existing gaps, acceptability issues and societal impacts. Collective mind of the ANDROMEDA User Community as a networked expertise community improves the establishment and management of relationships such as management of mutual causalities-nexus and impacts. Here, mutual causalities and impacts are addressed to cross-border interaction processes which faces increasing speed of cross-border technological development, needs for mutual and collective trust building, effects of new updates and needs of resilience for "expected and legacy" as well as "unexpected and emergent" local-global requirements, responses and collective interactions and operations. In addition, ANDROMEDA project offers its participants and stakeholders valuable insights into the development of the data fusion capabilities in the maritime and land border domains.

ANDROMEDA project makes a continuum from the CoopP (12/2012 - 03/2014) and EUCISE2020 as well as MARISA research-development-innovation activities and previously delivered capabilities by enhancing the CISE data model and by extending its scopes to the land surveillance information exchange. ANDROMEDA project addresses the relevant gaps and requirements providing a secure, effective common situational awareness and information exchange system integrated with CISE environment. According to the current analysis of past and ongoing initiatives in the sphere of border security operative environments: ANDROMEDA project addresses the development of solutions utilizing the results and co-operation from relevant projects formerly funded by the H2020 and Framework Program 7 (FP7). Moreover, ANDROMEDA consortium proposes an enhanced CISE (e-CISE) Data Model which is an essential driver and enabler to increasing of interoperability and operational cooperation. ANDROMEDA project takes place at the time where the benefits of data exchange is in the "last-mile research"<sup>3</sup> as proofing-off phase, especially on European Commission Policy Level, the definition of the extended CISE data model as well as the

---

<sup>1</sup> <https://www.andromeda-project.eu>

<sup>2</sup> <https://www.andromeda-project.eu/downloads/index.html>

<sup>3</sup> <https://www.tandfonline.com/doi/abs/10.1080/07421222.2015.1094961>

EUCISE2020 services and existing CISE and MARISA nodes. Current proof-of-concept and validation processes in the EUCISE2020 exploits adaptor services to integrate legacy systems and nodes as gateways of the CISE network that utilize the CISE Services and Data Models.

*Disclaimer*

The content of the publication herein is the sole responsibility of the publishers and it does not necessarily represent the views expressed by the European Commission or its services.

While the information contained in the documents is believed to be accurate, the authors(s) or any other participant in the ANDROMEDA consortium make no warranty of any kind with regard to this material including, but not limited to the implied warranties of merchantability and fitness for a particular purpose.

Neither the ANDROMEDA Consortium nor any of its members, their officers, employees or agents shall be responsible or liable in negligence or otherwise howsoever in respect of any inaccuracy or omission herein.

Without derogating from the generality of the foregoing neither the ANDROMEDA Consortium nor any of its members, their officers, employees or agents shall be liable for any direct or indirect or consequential loss or damage caused by or arising from any information advice or inaccuracy or omission herein.

*Copyright message*

©ANDROMEDA Consortium, 2019-2021. This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both. Reproduction is authorised provided the source is acknowledged.

## Table of Contents

<b>1. Introduction .....</b>	<b>12</b>
1.1 Purpose of Document .....	14
1.2 Reference Documents .....	14
1.3 Definitions and Descriptions .....	15
1.4 Structure of Document.....	17
1.5 List of Acronyms .....	17
<b>2. ANDROMEDA Authorities Cooperation.....</b>	<b>21</b>
2.1 Description of User Community.....	21
2.1.1 EU Bodies and Agencies .....	21
2.1.2 End-User Community.....	22
2.1.3 Industrial Community.....	27
2.1.4 Academic and Research & Technology Community .....	31
2.1.5 External End-Users Community.....	35
2.1.6 External Industrial Community .....	45
2.1.7 External Academic and Research & Technology Community.....	47
2.1.8 External EU funded projects.....	52
2.2 Continuum of Projects .....	54
2.3 Operational Drivers .....	59
2.4 User Community Interactions.....	61
2.4.1 User communities and their purposes.....	64
2.4.2 Interactions in Trials.....	65
2.4.2.1 Interactions in Trial 1 .....	65
2.4.2.2 Interaction in Trial 2.....	66
2.4.2.3 Interactions in Trial 3 .....	68
2.5 Implications .....	69
<b>3. Methodology.....</b>	<b>73</b>
3.1 Approach to Quality .....	73
3.2 Operative Process and Data Collection .....	74
3.3 Applied Design Science Research Methodology .....	75
3.4 Triangulation Fashion and Validation .....	77
<b>4. User Community Reflections and Recommendations.....</b>	<b>78</b>
4.1 Pattern of Life.....	78

4.2	Towards Resilience.....	78
4.3	Gap analysis.....	79
4.4	Learning by Andromeda.....	82
4.5	Potential of Andromeda.....	82
4.6	User Community Surveys.....	84
<b>5.</b>	<b>Conclusions .....</b>	<b>86</b>
<b>6.</b>	<b>Annex A: Reviews and Quality.....</b>	<b>88</b>
6.1	Reviewers .....	88
6.2	Overall Peer Review Result.....	88
6.3	Consolidated Comments of Quality Reviewers.....	88
6.4	Ethics Compliance Checks .....	89
6.5	Ethical self-evaluation .....	93
<b>7.</b>	<b>Annex B: User Community Survey.....</b>	<b>96</b>

## Table of Figures

Figure 1: The User Community forming methodology .....	62
Figure 2: ANDROMEDA User Community .....	63
Figure 3: ANDROMEDA Forum .....	63
Figure 4: The Iberian Maritime Border Trial .....	66
Figure 5: The Greece-Bulgarian Land Border – Maritime Trial .....	67
Figure 6: The Ionian-Adriatic Trial .....	68
Figure 7: Revised Design Science Research Methodology (DSRM) .....	75

## Table of Tables

Table 1: EU Bodies and Agencies.....	21
Table 2: End-User Community.....	22
Table 3: Industrial Community .....	27
Table 4: Academic and Research & Technology Organisations (RTO), .....	31
Table 5: External End-Users Community .....	35
Table 6: External Industrial Community .....	45
Table 7: External Academic and Research & Technology Community.....	48
Table 8: EU funded projects.....	52
Table 9: Continuum of Projects.....	54
Table 10: Operational Drivers .....	60
Table 11: Design Drivers.....	60
Table 12: User Communities and purposes .....	64
Table 13: The implications regarding the Command and Control .....	69
Table 14: The implications regarding the Economy.....	70
Table 15: Implications regarding the Co-Operation.....	71
Table 16: The Description of Quality Aspects in ANDROMEDA .....	73
Table 17: The Description of OODA Process .....	74
Table 18: Revised DSRM in ANDROMEDA.....	76
Table 19: Triangulation types.....	77
Table 20: Gap analysis of cross-border and cross-sector information sharing.....	79
Table 21: Gap analysis from the User Community perspective. ....	81
Table 22: The Potential of ANDROMEDA .....	82
Table 23: The main results of User Community Survey .....	84

## 1. Introduction

This D2.5 User Community Final Report is incrementally collected in ANDROMEDA (An EnhaNced Common InfoRmatiOn Sharing EnvironMent for BordEr CommanD, Control and CoordinAtion Systems) project: which has received funding from the European Union's Horizon 2020; related to the funding scheme of Innovation Action; and Grant Agreement which identification number is 833881. Funding reference: H2020-EU.3.7.3 (Strengthen security through border management) and H2020-EU.3.7.8 (Support the Union's external security policies including through conflict prevention and peace-building). Project topic: SU-BES03-2018-2019-2020 (Demonstration of applied solutions to enhance border and external security).

The ANDROMEDA project aims to unlock the full potential of CISE, by validating in a long period of time CISE-compatible command, control and coordination systems from several Coast and Border Agencies. At the same time it is envisaged to further enhance, validate and demonstrate CISE by extending its scope for land borders and adapting relevant C2 solutions and associated services. This was accomplished by extending the CISE data model based on the use cases and requirements and adapting state-of-the-art command & control systems for full compliancy with the enhanced model and CISE message exchange patterns.

As stated in the Grant Agreement, Deliverable D2.5 description, the report should include the final assessment of user community Gap analysis. In the area of information sharing, the Gaps could be categorised at least to Gaps in national procedures, political, legal, operational, technical and geographical areas. The ANDROMEDA User Community, were involved to the work for taking into account all aspects of the gaps in information sharing from the cross-border cross-sector and User Community perspective. Among several other Gaps the Gap analysis indicated that the enlargement of the User Community should focus on potential Land Border authorities.

The project architecture followed a hybrid scheme in order to allow the usage of the End User CISE Nodes or Gateways and at the same time to allow the testing and validation of the extended data model. The project leveraged on the developments, results and experience of the consortium from current and previous research projects (PERSEUS, CloseEye, MARISA, RANGER), from National Procurement projects of CISE Nodes and Adaptors and on the CISE infrastructure of the End Users (CORDIS<sup>4</sup>: The Community Research and Development Information Service is the European Commission's primary source of results from the projects funded by the EU's framework programmes for research and innovation).

ANDROMEDA operative environment includes border surveillance which is a complex mission related to the length of European borders and the variety of terrain configurations. This domains' complexity arises from the fact that 17 EU countries possess an external land border, including those which border Switzerland, and all countries except the Czech Republic possess an external border of some kind either land or maritime. Border security within the EU remains the responsibility of the independent member states as well as associated Schengen states, though there is an element of coherence of approach imposed as a consequence of multilateral agreements such as the Schengen agreement. The EU region has approximately 8000 km of land border to secure, in terrain varying from the arctic, to the mid-latitudes of southern Europe and North Africa. The maritime border situation varies again, with an extensive maritime border made complex by large numbers of islands, and relatively unconstrained leisure traffic around large portions of the EU. The long length of borders requiring protection, and the inevitably limited resources available demands a risk-based approach to be adopted, with resources concentrated in those areas where the probability of an incursion is highest. Large part of the external borders is Maritime and the Mediterranean being the south gate to enter Europe continuously faces common challenge security challenges and various types of pressures (ANDROMEDA, 833881, GA, Part B, p. 8-9).

---

<sup>4</sup> <https://cordis.europa.eu/about/en>

The ANDROMEDA User Community facilitates collective progress for unlocking the full capabilities of the CISE by enhancing the Maritime information sharing environment for land border operations and providing the CISE compliant C2, Data Fusion and Decision Support systems in order to enable the land border specific information sharing. Mutual and collective mind of the ANDROMEDA User Community as a “networked expertise community<sup>5</sup>” addresses to the establishment and management of casual relationships such as management of nexus and mutual impacts. The term “nexus<sup>6</sup>” used here, as mutual causalities and impacts are related to cross-border interaction processes those faces increasing speed of cross-border technological development, needs for mutual and collective trust building, effects of new updates and needs of adaptive-resilient systems-services for “expected and legacy” as well as “unexpected and emergent” local-global requirements, responses and collective interactions and operations.

In ANDROMEDA project, the term “innovation” addresses to the enhanced CISE data model in order to develop 100% CISE compatible Command and Control systems with advanced data fusion and decision support tools, products, processes, knowledge or services by using new or existing scientific or technological knowledge. These provide a degree of novelty either to: the developer, the industrial sector, the nation or the world or to succeed in the operative-tactic domain. Here, the term “innovation” takes place, for the most part, in an end users and stakeholders shared context as the desired result. The focus of research is on investigations for understanding and development of artifacts, innovative capabilities and functionalities, situation understanding, action and decision-making competence. In addition, often, the achieved results of participators innovation-learning transactions are as the stakeholder’s own or collective creations as trials, which in turn, may be disseminated to expanded domains or more general to internationally impacting high-value innovations.

ANDROMEDA Task 2.1, User Community Interaction corresponds to the Deliverables 2.1 (initial report) and 2.5 (final report) of ANDROMEDA Work Package 2 (WP2). ANDROMEDA WP2 includes topics of Operational Analysis, User Requirements and Technical Specifications. The specific objectives of WP2 Task 2.1 address to Basic Doctrines of ANDROMEDA User Community described in following Table.

List of Common Principles in ANDROMEDA User Community	
1	The role of ANDROMEDA User Community is focused on the goal of “innovation”, delivering the benefits of the Information Sharing Environment through the enhanced CISE models for Land and Maritime Border Surveillance and Monitoring (GA, Part A p. 15-16).
2	The e-CISE and functionalities of the C2s and the ways that they were implement the CISE service model were first and foremost driven by this user community. Fostering of pro-active involvement of stakeholders; following a user-centric approach in the design and validation; addressing user needs and relevant requirements; user experience animation; legacy systems connectivity; co-creativity; and collective trust building (GA, Part A p. 15-16).
3	The User Community mechanisms is created to foster interactions, leading to knowledge co-created through social interactions, competence sharing and collective service development. The interactions include the verification and validation during the operational trials (GA, p.15-16).
4	The User Community set-up involves users and partners as well as external end-users invited to join the initiative. Co-creation of relevant requirements of functionalities provided by the Land and Maritime Border Surveillance Systems (GA, p. 15-16).

<sup>5</sup> <http://www.helsinki.fi/science/networkedlearning/news/networkedexpertise.html>

<sup>6</sup> <https://en.wiktionary.org/wiki/nexus>

List of Common Principles in ANDROMEDA User Community	
5	The User Community aims to be as inclusive as possible, building also on the links of individual consortium partners of the ANDROMEDA consortium to past and on-going initiatives in the domain to speed up the process (GA, p. 15-16).
6	Incorporate ethic and legal aspects: an active involvement of the end user partners and associates to identify potential acceptability issues and societal impacts that the proposed solution may entail, and provide useful guidance to the technological partners of the consortium for the implementation of the technologies (GA, p. 15-16).

## 1.1 Purpose of Document

This D2.5 USER COMMUNITY FINAL REPORT is addressed to ANDROMEDA stakeholders and partners for current and further development as well as adoption of authority-based collective activities for achievements of high-value co-operation in border surveillance complex mission in order to enlarge and utilise the benefits from previous information sharing projects. The first purpose of D2.5 is to describe the willingness and continuum of the authorities and stakeholders co-operation for improving the situational awareness and information sharing in ANDROMEDA User Community. The ANDROMEDA User Community was formed on the goal of innovation, delivering the benefits of the Information Sharing Environment through the enhanced CISE models for Land and Maritime Border Surveillance and Monitoring. The approach for User Community extension was based on the Trials’ scenarios and goals. This document describes how the User Community was formed and the organised interactions for User Community in which they were able to support the project to achieve the ambitious goals. Additionally this USER COMMUNITY FINAL REPORT describes ANDROMEDA’s implication to command and control, economy and authorities future co-operation. The ANDROMEDA trials were available to the ANDROMEDA User Community for the purpose of validating and disseminating the project’s results in the three operational trials. The trials and the ANDROMEDA Workshops were used for collecting the information for the Gap analysis as well as for collecting the feedback of the potential of ANDROMEDA. This deliverable describes results from Gap analysis in information sharing categorised according to cross border – cross sectoral and User Community perspective. The potential factors the ANDROMEDA could provide in the field of border security and situational awareness are also covered in this document.

The one additional purpose of this USER COMMUNITY FINAL REPORT is in description of paths and outcomes towards availability of future ANDROMEDA services and suites: during ANDROMEDA project, the trials were available only to the ANDROMEDA end-users for the purpose of validating the new tools in the three operational trials. For each future User Community of Interest, such as generic, experts in CISE network and/or other similar EU networks, Data Fusion Expertise and Security-Safety Agencies, different representations of public ANDROMEDA deliverables are available based on access privileges as assigned in the ANDROMEDA Consortium Agreement.

## 1.2 Reference Documents

Reference Documents	
[1]	Grant Agreement No 833881 (ANDROMEDA GA) – Annex 1 Description of the action (DoA). The Grant Agreement is the contract document concluded between the EC, here representing the EU, and the beneficiaries under which the parties receive the rights and obligations, e.g., the right of the Union's financial contribution and the obligation to carry out the research and development work.

Reference Documents	
[2]	Consortium Agreement (CA) of ANDROMEDA PROJECT. The Consortium Agreement (CA) is the internal agreement signed between the members of the consortium establishing their rights and obligations with respect to the implementation of the activities in compliance with the Grant Agreement.
[3]	D.2.1 User Community Initial Report. Deliverable (D.2.1) USER COMMUNITY REPORT is addressed to ANDROMEDA stakeholders and partners for current and further development remarks as well as adaption of authority-based collective activities for achievements of high-value of data fusion services and impacts.
[4]	D2.2 User Requirements & Technical Specifications. The deliverable Describes the requirements and technical specifications. The requirements are combination of results from previous R&D and cooperative projects which have been elaborated and updated by the User Community.
[5]	D.2.5 User Community Report (final version) includes an amendments to the D.2.1 including ANDROMEDA User Community establishment, descriptions of stakeholders visions-anticipations and motivation for authorities over border cooperation, implications for experimentation and rationalization of authorities functions and organizational streamlining, and furthered descriptions of interactions and pipelines.

### 1.3 Definitions and Descriptions

List of Definitions and Descriptions	
ANDROMEDA System	In order to fostering faster detection of new events, better informed decision making and achievement of a joint understanding of a situation across borders, the ANDROMEDA system will be able to provide a suite of services to correlate and fuse various heterogeneous and homogeneous data and information from different sources.
Anomalies	Detection of an incident that falls outside the frame of normal operations. Typically detected within own sector work. May require action from other sectors. Services used may include sector- or domain-wide anomaly detection tools, risk analysis and planning tools. Typically, basic and additional information is shared on a regular basis.
Classification	Classification is the process in which the characteristics of an asset is used to associate it to a category, hence, two vessels or vehicles classified in the same way cannot not be easy to differentiated unless they are identified.
CONOPS	A concept of operations is describing the characteristics of a proposed system from the viewpoint of an individual who will use that system. A description of how a set of capabilities may be employed to achieve desired objectives or end state. It is used to communicate the quantitative and qualitative system characteristics to all stakeholders.
Correlation	The process which associates and combines data on a single entity or subject from independent observations, in order to improve the reliability or credibility of the information.
CISE	CISE is the Common Information Sharing Environment originally developed for Maritime Domain. It will integrate existing surveillance systems and networks and give to all the relevant authorities (EU and national authorities responsible for different aspects of surveillance) concerned access to the information they need for their missions. The CISE will make different systems interoperable so that data and other information can be exchanged easily through the use of modern technologies.
CLOSEYE	Collaborative evaluation of border surveillance technologies in maritime environment by pre-operational validation of innovative solutions (FP7 project).
Data Fusion	The process of integrating multiple data sources to produce more consistent, accurate, and useful information than that provided by any individual data source. Is analogous to

List of Definitions and Descriptions	
	the ongoing cognitive process used by humans to integrate data continually from their senses to make inferences about the external world.
Detection	The process in which the system becomes aware of a real-life object such as a vessel or vehicle, a buoy or a helicopter and creates its virtual counterpart in the Recognized Maritime or Land border Picture. Detection can be achieved using data coming from one sensor or from several sensors at the same time.
Extra ordinary	When major incidents or accidents occur there is a need to coordinate assets from several sectors and nations. Decision-making across sectors and borders is required. Information sharing outside normal patterns is required. Services should be designed to share information accordingly. Basic and additional information is to be shared as well as restricted as required.
European Interoperability Framework	A commonly agreed approach to the delivery of European public services in an interoperable manner. It defines basic interoperability guidelines in the form of common principles, models and recommendations.
Knowledge: embedded in system	A form of knowledge that is linked whit tools, practices and action environment. End users and operative actors are supported to overcome their decision-making challenges and cognitive processing limitations by facilitating knowledge which is in the system, environment and knowledge of nexus.
Knowledge: distributed	Knowledge that is unique to participator, member, flow of work package or working team and it is not uniform across all consortium members.
Knowledge: instructions & splinters	Instructions addresses to knowledge sharing activities for reduction of the amount of irrelevant cognitive load to a minimum through an increased awareness of individuals and operative factors that influence cognitive processing; an instruction which may advance our capacity to handle complexity in understanding and learning.
Knowledge: shared	Knowledge that is uniform and shared across all participators of a project or an activity related to the share development target. Type of knowledge which is represented in personal way by each member but in very end the type of achieved knowledge is rather kind of uniform when it is shared.
Legacy System	The existing Surveillance systems in the National/Regional Coordination Centres to which ANDROMEDA tools can establish some kind of communications. For example, the term “legacy” is used here in a conversion process, when moving data from the “legacy system” to a new system. However, if the “legacy system” is rebuild or improved, then it is understood as a new system.
Resilience	Addresses (here) to an ability to recover from adverse event. A decision-making ability related to absorption and adaption. Main factors: readiness, clean data, additivity of capabilities, clusters and parallel options, nexus management and adaptive-dynamic capabilities of artifacts. Combines: engineering, infrastructure, organizational, psychological, ethical and socio-ecological impacts in decision-making.
Saturation	Saturation has attained widespread acceptance as a methodological principle in qualitative analysis. It is commonly taken to indicate that, on the basis of the data that have been collected or analysed hitherto, further data collection and analysis are unnecessary.
Situational awareness picture	Sector, domain, regional, national or EU-wide services which are addressed to provide a recognized maritime picture. National or regional maritime situational awareness may be facilitated for maritime domain, cross-domain or cross-border purposes depending on national legislation and agreements. Information exchange and sharing are in line with this principle. The services used provides as much open information as possible, e.g., map services, weather services, tools for visualization, augmentations and compilation which improves quality of information in data fusion.

List of Definitions and Descriptions	
Surveillance	The set of activities aimed to understand and prevent wherever applicable and manage in a comprehensive way all the events and actions relative to the ANDROMEDA domain which could impact the areas of safety and security, law enforcement, defence, border control, protection of the environment, control, trade and economic interest of the EU.
Toolkit	In order to fostering faster detection of new events, better informed decision making and achievement of a joint understanding of a situation across borders, the ANDROMEDA toolkit it will be able to provide as a suite of services to correlate and fuse various heterogeneous and homogeneous data and information from different sources.
Triangulation	The term “triangulation” refers here to the validation of data through cross-verification from more than two sources. One focus of triangulation in ANDROMEDA would be that decision-maker can be more confident in an analysis for decision-making if different methods (algorithms and inquiries) lead to the same result.

## 1.4 Structure of Document

The document is structured as follows:

Chapter 1 – Introduction to the operational environment and a macro level outline of ANDROMEDA User Community. Common principles as the doctrines of ANDROMEDA User Community. Purpose of document. Definitions and descriptions of key terms. List of acronyms and reference documents.

Chapter 2 – Project’s cooperation and interactions. Description of ANDROMEDA User Community interests and motivation. Operational drivers and potential of cooperation. Reasoning and rationale of ANDROMEDA. Resonance of related projects and path-dependency of development continuums. Towards the development of the User Community and especially end-user needs based project.

Chapter 3 – Description of methodological approaches as actualized in ANDROMEDA. Replication logic and forms of analysis such as the triangulation fashion. Description of the quality approach and processes of investigating and interpreting quantitative and qualitative data in order to gain a deeper understanding and new knowledge for design-building-testing-validation activities.

Chapter 4 – The User Community discussion document collection in ANDROMEDA addresses to the open category that provides a forum for the communication of well-articulated position statements concerning emerging, paradoxical, or even controversial development and research issues for progress of current ANDROMEDA capability development.

Chapter 5 – Summary with the conclusions and final future remarks of the ANDROMEDA User Community with reflections.

## 1.5 List of Acronyms

List of Acronyms	
AI	Artificial Intelligence
AIS	Automatic Identification System
AMSPM	Administration for Maritime Safety and Port Management
ASC	Advanced Scientific Computing
BDI	Bulgarian Defence Institute
BMM	BlueMassMed (project)

List of Acronyms	
C2	Command and Control
C3I	Command, Control, Communications and Intelligence
C4I	Command, Control, Communications, Computers and Intelligence
CA	Consortium Agreement
CCTV	Closed Circuit Television
CDBP	Chief Directorate Border Police
CENELEC	European Committee for Electrotechnical Standardization
CINAV	The Portuguese Navy's Research Centre
CIRA	Centro Italiano di Ricerche Aerospaziali
CISE	Common Information Sharing Environment
CLOSEYE	Collaborative evaluation of border surveillance technologies in maritime environment by pre-operational validation of innovative solutions. FP7 project.
CMMI	Capability Maturity Model Integration
CO	Centre of Operations
CONOPS	Concept of Operations
CoopP	Cooperation Project Maritime Surveillance Project
COP	Common Operational Picture
CPV	Coastal patrol Vessel
CSP	Climate Simulation and Prediction
CSS	Coastal Surveillance System
DF	Data Fusion
DFE	Data Fusion Engine
DG MARE	Directorate-General for Maritime Affairs and Fisheries
DoA	Description of the Action including Annex 1 of the Grant Agreement
DPD	Data Protection Directive
DSRM	Design Science Research Methodology
DST	Decision Support Tool
E/O	Electro Optical
EAMA	The Executive Agency Maritime Administration
EBCGA	European Border and Coast Guard Agency
EC	European Commission
ECIP	Economic analysis of Climate Impacts and Policy
EDA	European Defence Agency
EEZ	Economic Exclusive Zone
ELSI	Ethical, Legal and Social Issues
EMSA	European Maritime Safety Agency
EMSN	European Maritime Surveillance Network
ENLETS	European Network of Law Enforcement Technology Services
EOS	European Organization for Security
ETSI	European Telecommunications Standards Institute
EUC	European University of Cyprus
EUCISE2020	European test bed for the maritime Common Information Sharing Environment in the 2020 perspective, FP7 project
EUROPOL	European Police Office System
EUROSUR	European Border Surveillance System
EWE	Early Warning Engine
FP7	Framework Program 7

**List of Acronyms**

FRONTEX	European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union
GDPR	General Data Protection Regulation
GIS	Geographical Information System
HCG	The Hellenic Coast Guard
HMOD	The Hellenic Ministry of Defence
HPL	The Hellenic Police
IA	Impact Assessment
IAFES	Impacts on Agriculture, Forests and Ecosystem Services
IAFES	Impacts on Agriculture, Forests and Ecosystem Services
ICT	Information and Communication Technology
IM	Innovation Manager
INGV	Istituto Nazionale di Geofisica e Vulcanologia
INP	The Israel National Police
INUS	Intelligent UxV Surveillance
IoT	Internet of Things
IPR	Intellectual Property Right
IRL	Integration Readiness Level
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
IT	Information Technology
ITN	Italian Navy
IUU	Illegal, Unreported and Unregulated
JDL	Joint Directors of Laboratories
JRC	Joint Research Centre
KPI	Key Performance Indicator
LEA	Law Enforcement Agency
LIDAR	Light Detection and Ranging
LRIT	Long Range Identification and Tracking
LSA	Land Situational Awareness
LSP	Local Situational Picture
MARISA	MARitime Surveillance Awareness Project
MCCIS	Maritime Command Control and Information System
MMAIP	The Ministry of Maritime Affairs and Insular Policy
MoD	Ministry of Defence
MoE	Measure of Effectiveness
MoP	Measure of Performance
MOPS	The Ministry of Public Security
MPA	Maritime Patrol Aircraft
MRCC	Maritime Rescue Coordination Centre
MS	Milestone / Member State
MSA	Maritime Situation Awareness
MSW	Maritime Single Window
NAF	NATO Architecture Framework
NATO	North Atlantic Treaty Organization
NCC	National Command Centre
NSP	National Situational Picture
OPA	Ocean Predictions and Applications
OSA	Ocean modelling and Data Assimilation
OSINT	Open-Source Intelligence

List of Acronyms	
PC	Project Coordinator
PERSEUS	Policy-oriented marine environmental research for the Southern European seas (FP7)
PM	Project Manager
PoL	Pattern of Life
PortNet	Port Traffic Declaration Service
POV	Pre-Operational Validation
PSO	Project Security Officer
R&D	Research & Development
R&I	Research & Innovation
RAAS	Risk Assessment and Adaptation Strategies
RCC	Regional Command Centre
RDI	Research, Development and Innovations
REHMI	Regional Models and geo-Hydrological Impacts
RFI	Request for Information
RPAS	Remotely Piloted Aircraft System
RTO	Research and Technology Organisation
SA	Situation Awareness
SafeSeaNet	Vessel traffic monitoring and information system
SAR	Search and Rescue
SAT-AIS	Satellite Automatic Identification System
SATIMAGE	Satellite Image
SEME	Sustainable Earth Modelling and Economics
SMILE	SMart mobILity at the European land borders
SOA	Service Oriented Architecture
SSAS	Ship Security Alert System
STM	Sea Traffic Management
TBD	To Be Decided / To Be Described
TC	Task Croup
TCP	Thematic Community of Practitioners
TM	Technical Manager
TRL	Technology Readiness Level
TTW	Territorial Water
UC	User Community
UCL	User Community Leader
UK	United Kingdom
UNDP	United Nations Development Programme
UoA	Unit of Analysis
VTMIS	Vessel Traffic Management Information System
VTS	Vessel Traffic Service
WP	Work Package

## 2. ANDROMEDA Authorities Cooperation

ANDROMEDA User Community has been continuously involved in expanded cooperation activities towards a coherent approach to create a basis for clean data based solutions, data refining tools and trust based information sharing with the expanded data fusion functionalities in order to support knowledge transfers from research and development and for collective and operative decision-making on implementation of new confidence-based maritime concepts of operations. This continuum of collective maritime work has led to the development of the partners and end-user needs based ANDROMEDA project, partners and end-user-centred adoption model and improvements of continuum focused methodology for design research in distributed information systems (cf. DSRM). In ANDROMEDA project, the User Community as a steering forum first and foremost drove the extension of CISE model to the Land Surveillance Information Exchange.

### 2.1 Description of User Community

The ANDROMEDA User Community consists of a wide range of leading European organizations such as industrial organisations, research & technology organisations, academies and of course end-users. Nineteen partners representing expertise in the fields of command and control, border surveillance, ICT systems, data fusion, artificial intelligence, GIS systems, electronics, surveillance sensors, industrial integration, design, business and financial models definition signed the consortium agreement. The User Community has been open to new external partners through the project duration. The External partners from EU-funded projects related to border surveillance, maritime and land surveillance, security and information & communication technology were invited to support and advise the project with their knowledge and expertise. The projects in focus were ARCSAR, ARESIBO, CAMEIOT, CIVILnEXt, EFFECTOR, EUCISE2020, EWISA, MARISA, MEDEA, OCEAN2020, ROBORDER, COMPASS2020 and TRESSPASS.

#### 2.1.1 EU Bodies and Agencies

The European Union has a wide variety of bodies and agencies. The most important for ANDROMEDA are European Maritime Safety Association (EMSA), Joint Research Centre (JRC) and European Border and Coast Guard Agency (Frontex). EMSA leads CISE transition phase preparing CISE to the operational phase. JRC supports EU projects with scientific and technical expertise. Frontex monitors the situation on the borders and contributes border authorities to share information with Member States. The JRC has replied in the affirmative to participate in the ANDROMEDA project.

Table 1: EU Bodies and Agencies

EU Bodies and Agencies	
	<p>JRC - Joint Research Centre  <a href="https://ec.europa.eu/info/departments/joint-research-centre">https://ec.europa.eu/info/departments/joint-research-centre</a></p>
<p>The Joint Research Centre (JRC) is the Commission's science and knowledge service. JRC employs scientists to carry out research in order to provide independent scientific advice and support to EU policy. JRC creates, manages and makes sense of knowledge and develop innovative tools and make them available to policy makers. JRC i.e. supports EU industry through scientific research leading to new standards, investigates the impact of new digital technologies, manages early warning systems and response mechanisms for natural disasters, health emergencies, humanitarian crises and conflicts and supports EU satellite projects with scientific and technical expertise.</p>	

	<p>EMSA – European Maritime Safety Agency  <a href="http://europa.eu">Home - EMSA - European Maritime Safety Agency (europa.eu)</a></p>
<p>EMSA’s mission is to serve EU maritime interests for a safe, secure, green and competitive maritime sector and act as a reliable and respected point of reference in the maritime sector in Europe and worldwide.</p> <p>EMSA capitalises on its unique know-how to position itself as an essential player in the maritime cluster in Europe and beyond.</p> <p>EMSA works on maritime safety, security, climate, environment and single market issues and tasks, first as a service provider to Member States and the Commission, but also as an innovative and reliable partner and knowledge hub for the European maritime cluster and potentially beyond as a reference internationally.</p>	
	<p>FRONTEX – European Border and Coast Guard Agency  <a href="http://europa.eu">Frontex   European Union Agency (europa.eu)</a></p>
<p>Frontex, the European Border and Coast Guard Agency, is an essential part of Europe’s efforts to safeguard the area of freedom, security and justice. Frontex’s support at the external borders helps guarantee free movement without internal borders checks that many of us take for granted.</p>	

### 2.1.2 End-User Community

ANDROMEDA End-User community consists of ANDROMEDA consortium partners who are involved in e.g. national security, border surveillance and control, illegal immigration, illegal trafficking, fisheries control. All end users bring their expertise on CISE and other similar information sharing networks, Command & Control systems, Data Fusion (DF) technologies and Situation Awareness (SA) information solutions, during and beyond the project’s lifetime.

Table 2: End-User Community

End-Users Community	
	<p>MMAIP - The Ministry of Maritime Affairs and Insular Policy,  GREECE <a href="https://www.ynanp.gr/en">https://www.ynanp.gr/en</a></p>
<p>The Ministry of Maritime Affairs and Insular Policy, as a governmental body of the Hellenic Republic, is tasked to apply and enhance the country’s general policy on such matters. The Executive Structure of National Strategic Reference Framework of the Ministry of Maritime Affairs and Insular Policy is a specially structured agency, assigned among others with the finding of potential collaborations on research programs for the Ministry, especially Horizon 2020, where it can also participate as a partner. At the same time, under the Ministry’s organization chart, among the general secretariats, lies also Hellenic Coast Guard (HCG), the competent authority for the implementation of the law in its area of jurisdiction, which, among others, include: the protection of the life in danger at sea, the general police duties at the sea and at the port facilities, the protection of the marine environment, border surveillance and fishery control.</p> <p><b>Key role in project</b></p>	

End-Users Community	
<p>MMAIP is the coordinator of the project and will be the contact point with the EU. MMAIP will contribute also to: Gap analysis and end user requirements, System Requirements and Functional specifications, Definition and development of use case/ pilot scenarios, Simulations and Training, Pilot Testing and Demonstrations, Validation of use cases, System Evaluation and Assessment and Communication and Dissemination.</p>	
	<p>ITN - Italian Navy, ITALY  <a href="http://www.marina.difesa.it/EN/Conosciamoci/Pagine/default.aspx">http://www.marina.difesa.it/EN/Conosciamoci/Pagine/default.aspx</a></p>
<p>The Marina Militare Italiana (Italian Navy, ITN) is one of the four services depending from the Italian Defence General Staff / Ministry of Defence, which is called upon to operate with adequate personnel and assets necessary to guarantee the Italian maritime security.</p> <p>In addition to its defence and military duties and tasks, ITN also performs some customary tasks (which are underpinned by national laws and regulations) such as fishing surveillance, the fight against illegal immigration and illegal trafficking, the protection of the environment, which are carried out not only in pursue of national interests but also, due to its pivotal position in the Mediterranean basin, of those of the European Union, surveying its external borders. To perform the assigned tasks, ITN avails itself also of a robust and experienced capability in maritime surveillance and monitoring. This capability is achieved throughout a complex of maritime presence and patrolling activities performed, in the areas of national interest, using air and naval assets and also a series of remote sensors including its coastal radar network. At the Command in Chief of the Italian Navy (CINCNAV) is located the ITN Operational Centre, that accommodates the operational staff and enables the acquisition of all collected maritime surveillance-related data acquired by ITN own assets/equipment n sensors and those obtained within alliances and initiatives Italy is member of. All pieces of maritime surveillance-related information, made available by different agencies operating at sea are merged in a single hub.</p> <p><b>Key role in project</b></p> <p>The Italian Navy participated in the implementation of the project and leads Work Package 2 (Operational Analysis, User Requirements and Technical Specifications). ITN will participate in the ANDROMEDA project trials (in particular the Adriatic-Ionian and also the Iberian) and to the related-validation of value added software based on neural networks.</p> <p><b>Assets for ANDROMEDA</b></p> <p>Italian CISE node linked to IT NAVY system (SMART). Further assets/data flow TBD.</p>	
	<p>MARINHA - Ministério da Defesa Nacional, PORTUGAL  <a href="https://www.marinha.pt/pt">https://www.marinha.pt/pt</a></p>
	<p>CINAV - Centro de Investigação Naval (CINAV), PORTUGAL  <a href="https://escolanaval.marinha.pt/pt/investigacao">https://escolanaval.marinha.pt/pt/investigacao</a></p>
<p>CINAV is the Portuguese Navy's Research Centre. It was created in 2010 to coordinate the various research projects in which the Navy participates, and to support the research conducted by the faculty of the Naval Academy, where CINAV has its offices. It currently has 7 research lines, in the following areas: Signal Processing, Decision Support Systems, Mobile Robotics, Maintenance Engineering and Management, Maritime History, Maritime Strategy, and Naval Health. It has 24 permanent members that hold PhDs</p>	

### End-Users Community

(mainly faculty from the Naval Academy), and 142 associate members (mainly naval officers involved in research projects).

Its research projects cover a wide range of areas and go from theoretical research funded by the Portuguese Science Foundation, to more applied research funded by various national and European agencies, to very applied research (demonstration and testing) funded by the Navy itself or by the Portuguese MoD.

Being a Navy Research Centre, CINAV benefits from a very close proximity to the operational experience and expertise of the Navy in all operational fields and, in particular, in the fields of surveillance, security and border integrity.

#### Key role in project

CINAV's main role is related to maritime surveillance and Sea Lines Of Communications monitoring Territorial Waters, the Economic Exclusive Zone (EEZ) Waters and Sea Lines Of Communication in order to prevent accidents, support seafarers, prevent illegal activities at sea, conduct SAR operations and environmental protection (including fishery control).

PT Navy/CINAV is very interested to identify new smart tools created to support the decision-making process and speed up the data collection in order to give to the operators a better COP. CINAV will participate in several work packages, with various degrees of involvement. In addition, the Portuguese Navy CIS Directorate will have a major involvement in the project being responsible for the link of the ANDROMEDA products within the Portuguese Navy Maritime data Network, where all the Maritime surveillance data and maritime information systems services run.

Portugal is also involved in the CISE program and the envisaged compatibility with extended functionalities, provided by ANDROMEDA, will be used in the Portuguese Maritime Operations Centre.

#### Assets for ANDROMEDA

The main asset that CINAV will provide is the expertise of a vast number of operators and supervisors that, taking into account their experience with the existing legacy system, will allow to test and improve the ANDROEMDA developments and the toolkit to be used, which will run inside the Navy network with a Navy hardware infrastructure, for a better user experience.

Besides, CINAV is able to provide to ANDROMEDA some unmanned vehicles (air, surface, and underwater), Networked Navigation simulator, access to naval assets, access to Maritime Operations Centre and Maritime Rescue Coordination Centre, Infrastructures for meetings, seminars, conferences and Infrastructures for tests and demonstrations at sea.



INP – Israel National Police, ISRAEL  
[https://www.gov.il/en/Departments/israel\\_police](https://www.gov.il/en/Departments/israel_police)

The Israel National Police (INP) is under the authority of the Ministry of Public Security (MOPS). The INP is comprised of some 30,000 sworn officers and reinforced by 50,000 volunteers. It is the only Law Enforcement Agency in Israel responsible of policing activities.

The responsibilities of INP cover all aspects of policing from the local through the national levels.

The main areas on which the Israel Police focuses are public security, maintaining Law and Order, fighting crime through Investigating and Intelligence, traffic enforcement and border security.

#### Key role in project

INP will be involved in collection and analysis of relevant user requirements, contribution to the development process where necessary and perform review of the results where necessary.

#### Assets for ANDROMEDA

End-Users Community	
<p>Contributors of knowledge as End-users with comprehensive view of operational requirements along with applicable technological abilities. Vast experience in conducting Early-stage operational field trials accompanied by thorough Performance analysis in view of realistic scenarios and operational deployment.</p>	
	<p>EAMA – Executive Agency Maritime Administration, BULGARIA <a href="https://www.marad.bg/en">https://www.marad.bg/en</a></p>
<p>The Executive Agency Maritime Administration (EAMA) is a legal entity to the Minister of Transport, Information Technology and Communications. The statute of the Agency is regulated in the Merchant Shipping Code. The activities, the structure and the work organization are laid down in the Statutory Regulation, adopted by the Council of Ministers. The Agency’s territorial jurisdiction extends to the internal seaways, the territorial sea, the Bulgarian section of the Danube River and the relevant coastline, the territory of the ports except the military ones, the Bulgarian search and rescue sea region and the shipping rivers that flow into the Black Sea.</p> <p><b>Key role in project</b></p> <p>Among its other activities, Executive Agency “Maritime Administration” is responsible for the coordination and organization of search and rescue activities, emergency response and maritime pollution prevention on national level. Within the ANDROMEDA project, EAMA will contribute to the achievement of full compatibility and integration of the enhanced EUCISE models to the Command, Control and Coordination systems, by providing the civil maritime authority point of view within the areas of its responsibilities.</p> <p><b>Assets for ANDROMEDA</b></p> <p>EAMA has established EUCISE 2020 Node C and has integrated access to EMSA Portal – CleanSeaNet, SafeSeaNet, LRIT, ImDate; Ship Security Alert System (SSAS); Hydro meteorological data; Vessel Traffic Management Information System data; Search and Rescue assets; Search Planning Software (SAR PC).</p>	
	<p>HMOD – Ministry of National Defence, GREECE <a href="http://www.mod.mil.gr">www.mod.mil.gr</a></p>
<p>Hellenic Ministry of Defence (HMOD) is a public authority that applies the Government’s National Defence Policy. HMOD dispose capabilities and manage resources for the benefit of the society, by implementing interventions focusing on serving every day’s and unpredictable matters. In other more pressing issues like crisis management for man-made or physical disasters, humanitarian aid, search and rescue (SAR) missions and environmental research, consistently plays key role. Among others, the most significant contribution is considered the land, air and maritime border surveillance, since Greece is situated in a sensitive area/crossroad. Therefore, HMOD today incarnates a very important social role in everyday life of Greek, EU citizens and other people.</p> <p><b>Key role in project</b></p> <p>The areas in which HMOD will be involved in the project as participant in work packages and tasks, include the following:</p> <ul style="list-style-type: none"> <li>• Gap analysis and end user requirements</li> <li>• System Requirements and Functional specifications</li> <li>• Definition and development of use case/ pilot scenarios</li> </ul>	

End-Users Community	
<ul style="list-style-type: none"> <li>Pilot Testing and Demonstrations</li> <li>Validation of use cases, System Evaluation and Assessment</li> </ul> <p><b>Assets for ANDROMEDA</b></p> <ul style="list-style-type: none"> <li>EUCISE2020 Gateway Type A</li> </ul>	
	<p>HPL – Hellenic Police, GREECE  <a href="http://www.hellenicpolice.gr">http://www.hellenicpolice.gr</a></p>
<p>The Hellenic Police is subordinated to the Ministry of Public Order and Citizen Protection. The Hellenic Police assumed its present structure in 1984 when the Gendarmerie (Chorofylaki) and the Urban Police Forces (Astynomia Poleon) were merged (Law 1481/1-10-1984, Government Gazette 152 A). Hellenic Police (Elliniki Astynomia) is a Law Enforcement Agency according to the Law nr. 4249/2014 and its mission is to:</p> <ul style="list-style-type: none"> <li>ensure peace and order as well as citizens` unhindered social development, a mission that includes general policing duties and traffic safety</li> <li>prevent and interdict crime as well as to protect the State and the democratic form of government within the framework of constitutional order, a mission that also includes the implementation of public and state security policy</li> <li>Prevent illegal border crossing as well as to enforce the legal framework in which immigrants are allowed to live and work in the country.</li> </ul> <p>Hellenic Police is comprised of both central and regional Services. Hellenic Police`s headquarters is the supreme authority over these Services. Its efforts centre on the fulfilment of the Force`s mission, within the framework of the Ministry of Citizen Protection. For this reason, it schedules, directs, oversees and monitors the activities of its Services, and it ensures the necessary conditions for the exercise of its authority.</p> <p>In its continuous mission to serve and protect citizens, Hellenic Police has responded to our times` demands and challenges by improving training, adopting a modern crime prevention policy, better utilizing science and technology and by exploiting international law enforcement cooperation.</p> <p><b>Key role in project</b></p> <p>The areas in which HPL will be involved in the project as participant in work packages and tasks, include the following:</p> <ul style="list-style-type: none"> <li>Gap analysis and end user requirements</li> <li>System Requirements and Functional specifications</li> <li>Definition and development of use case/ pilotscenarios</li> <li>Pilot Testing and Demonstrations</li> <li>Validation of use cases, System Evaluation and Assessment</li> </ul>	
	<p>AMSPM - Administration for Maritime Safety and Port Management,  MONTENEGRO  <a href="https://ups.gov.me/en">https://ups.gov.me/en</a></p>
<p>The basic activity of the Administration for Maritime Safety and Port Management is to ensure conditions for, and actual performance of, tasks stemming from the international obligations that the State has agreed</p>	

End-Users Community
<p>to by signing conventions, agreements and protocols, related to the safety and security of navigation in the area of responsibility of the Contracting Government. AMSPM performs i.e. following activities: Border Surveillance, Crisis &amp; Disaster Management, Emergency Management and Safety &amp; SAR Management.</p> <p><b>Key role in project</b></p> <p>The areas in which AMSPM will be involved in the project as participant in work packages and tasks, include the following:</p> <ul style="list-style-type: none"> <li>• Gap analysis and end user requirements</li> <li>• System Requirements and Functional specifications</li> <li>• Definition and development of use case/ pilot scenarios</li> <li>• Pilot Testing and Demonstrations</li> <li>• Validation of use cases, System Evaluation and Assessment</li> </ul> <p><b>Assets for ANDROMEDA</b></p> <p>According to National plan for SAR at sea, and National Contingency Plan for oil spill prevention at sea, AMSPM could involve other national institution from Montenegro (Army, Police) and their equipment to participate in SAR action or exercises.</p> <p>AMSPM infrastructure system could be used for the project purposes: VTMISS (Vessel Traffic Management Information System) system, Coastal radio station BARRADIO, MRCC (Maritime Rescue Coordination Centre) and two SAR boats.</p>

### 2.1.3 Industrial Community

The industrial community provides its expertise and knowledge for ANDROMEDA by creating, developing and deploying the ANDROMEDA product according the projects and End-User requirements. The Industrial partners are highly experienced in numerous projects with maritime and land surveillance, information exchange, security, defence systems, ICT, data fusion and are leading actors on the markets in Europe. They also own wide experience of aerial surveillance, information sharing, early warning e.g. systems, methods and software.

*Table 3: Industrial Community*

Industrial Community	
	<p>GMV - GMV Innovation Solutions, SPAIN  <a href="https://www.gmv.com/en">https://www.gmv.com/en</a></p>
<p>GMV is a privately-owned technology business group founded in 1984 and trading on a worldwide scale in the following sectors: Aerospace, Defence and Security, Transport, Telecommunications and IT for public administration and large corporations. In 2019 it chalked up a revenue of more than 240 million Euros and more than 2,100 employees. The company’s growth strategy is based on continual innovation; 10% of its turnover is returned back into R&amp;D. GMV has achieved the level 5 of the CMMI (Capability Maturity Model Integration), the world’s most prestigious business-process improvement model and holds several international patents. GMV is currently the world’s top supplier of ground control systems (GCS) for commercial telecommunications operators; as a firm it boasts Europe’s third biggest participation by volume in Galileo; it is the main supplier of C3I command and control systems to the Spanish army and the nation’s top supplier of telematic systems for public transport. In the area border Surveillance, GMV is the main contractor for development, evolution and maintenance of the EUROSUR Network. EUROSUR network is operational with more than 20 countries.</p>	

### Industrial Community

Border Surveillance is one of the cornerstone activity areas of the company. Exploiting synergies coming from our projects in space and defence, GMV has consolidated its position becoming a reference in this domain. Border and external surveillance technologies constitute an essential part of our R&D strategic mid and long term agenda as we have learned that the key for success is to create and nurture mutually beneficial partnerships with our clients.

#### **Key role in project**

GMV'S Technical contributions are focused on Maritime border C2 design Advanced Data Fusion. Regarding Maritime border design, the products provided will be based on the Socrates suite tools that are currently part of the Advanced Services deployed in EUCISE, with the innovative purpose of providing total integration with CISE data model, allowing users to consume all the information provided by the CISE network and to provide information to it.

Regarding Advanced Data Fusion, the products provided will be based on JDL level 1 components, with the innovative purpose of supporting additional data sources as input to the services and increasing the performance of the services.

#### **Assets for ANDROMEDA**

GMV provides for the project the Socrates CO (Center of Operations) which has been developed with the experience gained in development of C4I systems for Spanish MoD, C2 systems for Crisis Management and in particular the development of EUROSUR Pilot Project for FRONTEX. Socrates is especially suited to support the operations of National, Regional and Local Coordination Centres, as it provides all the tools and subsystems for the production and exchange of maritime situational picture in a Unified Graphical Interface. GMV also provides a Data Fusion level 1 component, Socrates DF, with the capability of fusing tracks in the maritime and land domain.



SATWAYS - Satways Ltd., GREECE  
<http://www.satways.net>

The company is dedicated to develop integrated Geospatial command and control solutions for Security and Public Safety applications for police, coast guard, emergency medical service, civil protection and fire & rescue operations, critical public infrastructure protection, transportation security and border monitoring. With core technology built on open standards, Satways offers a range of mission critical enterprise solutions empowering governments and businesses around the world to make better and faster operational decisions. Its product line includes C2 and C3I enterprise software packages namely the Atlantis, AutoTrack, ENGAGE, that respond to different operational requirements of Public Safety Agencies such as Distributed Geospatial Data management, Operational Resources Tracking, Incident Management and dispatch, Physical Security Information Management and Natural & Technological Hazards Crisis Management respectively. The common goal though, is to provide effective decision support, to simplify operations, to provide a Common Operational Picture (COP) and collaboration tools across organizations, to collect and disseminate data in the field and to coordinate response units and system users.

#### **Key role in project**

STWS is the Technical Coordinator of ANDROMEDA, responsible for coordinating the implementation of all project- wide technical matters, ensuring technical decisions are in line with ANDROMEDA objectives. STWS is responsible for the definition of the enhanced CISE Model, the adaptation of the ENGAGE C2 and TRITON and the integration of the ANDROMEDA DF, SA and DST services. STWS is also the main responsible to organize the Greece-Bulgaria Land/Maritime Border trial T 6.3. STWS leads the Work Packet 5 and tasks T 3.1 Enhanced CISE (e-CISE) Data Model for Border Monitoring & Control, T 3.4 Maritime Borders C2 Design, T4.1 Development of Land C2 Systems Adaptations, T5.4 Factory Integration and Testing of Trial Configurations and T7.1 Dissemination and Communication.

#### **Assets for ANDROMEDA**

Industrial Community	
<p>STWS provides for the project the ENGAGE Border Monitoring Edition which is C3I system, especially suited to support the operations of National, Regional and Local Coordination Centres, as it provides all the tools and subsystems for the production and exchange of maritime situational picture in a Unified Graphical Interface.</p>	
	<p>EXUS - Exus Ltd., UNITED KINGDOM  <a href="https://www.exus.co.uk/en">https://www.exus.co.uk/en</a></p>
<p>EXUS is an enterprise software company specializing in credit risk management, digital transformation services and innovation management. EXUS designs, creates and markets software solutions and services in several business areas such as finance, e-health, e- learning, and security. EXUS is certified with ISO: 9001 and ISO: 27001. The company aims at leveraging its successful track record in view of delivering cutting edge innovation to its customers. Its flagship product ‘EXUS Financial Suite’ was ranked “Best in Class in the world” from the CEB Tower group in 2016. Both products and bespoke solutions built by EXUS, serve demanding and critical business applications and domains. Finally, the company operates its internal Innovation department which manages the strategic research and development portfolio of the company. EXUS AI Labs manages a portfolio of initiatives that aim to pave the way for the introduction and take up of emerging technologies. Leveraging the results of strategic research activities allows us to harness untapped niches in our market sectors of interest.</p> <p><b>Key role in project</b></p> <p>EXUS in Andromeda project is going to lead the Situational Awareness System and the data fusion mechanism, Tasks 3.5 and 4.4. Especially for the data fusion EXUS is going to offer the DF Gateway and for the situational awareness a JDL 3 solution. In addition, is going to participate actively in all the activities regarding User Requirements and the creation of the User community, Technical Specifications, Overall Design, Architecture, Integration, Demonstrations and dissemination/exploitation.</p> <p><b>Assets for ANDROMEDA</b></p> <p>EXUS has informed to be able to provide wide range of infrastructure for the development, technical testing and integration of the project. EXUS is going also to provide the Data Fusion gateway and Data fusion service (EWE).</p>	
	<p>INW – Inovaworks Command &amp; Control, PORTUGAL  <a href="http://www.inovaworks.com">http://www.inovaworks.com</a></p>
<p>Inovaworks Command and Control (IW C&amp;C) is a Portuguese software solutions provider specializing in distributed operations management solutions for military and civilian markets – in short, Command and Control software. The company designs, develops and licenses a product suite named GeoC2 that can be used for distributed visualization, analytics, operations management and collaboration in complex multi-party scenarios both for Defence and Security applications. The company provides complete technology-centric and market-centric solutions for operations visualization, sensor integration and fusion, situational awareness, consolidated sense-making, real-time analysis, mission planning, mission execution and monitoring, mission logistics, and deployments dispatch in a modular but well-integrated software solution.</p> <p><b>Key role in project</b></p> <p>In ANDROMEDA, Inovaworks will be focusing on the technology components of the project (Operational Analysis, User Requirements and Technical Specifications, Overall Design, Architecture &amp; Interoperability Framework, and Interoperable Command &amp; Control Systems Developments) as well as supporting the Portuguese End User and the Bulgarian End User for Pilot Demonstrations, Validation &amp; Evaluation. The company will be the leader of Work Package 5, System Integration and Testing and lead the Tasks 3.2</p>	

Industrial Community	
<p>Physical and Logical System Architecture, Task 4.3 Development of enhanced CISE Adaptors, Task 5.3 Definition of System Configurations for Each Trial, Task 6.2 Iberian Maritime Border Trial.</p> <p>Inovaworks' main value add in ANDROMEDA is the expertise in the CISE and C2 matters and integration technologies, as well as its solid, open and field-proven Command and Control Solution GeoC2.</p> <p><b>Assets for ANDROMEDA</b></p> <p>Inovaworks provides infrastructure and technical equipment for the ANDROMEDA project.</p>	
	<p>CDN – CODIN SpA, Direzione Ricerca e Sviluppo, ITALY</p> <p><a href="http://www.codin.it">http://www.codin.it</a></p>
<p>CODIN is a provider of innovative software solutions on the ICT market since 1986. CODIN supports its customers during change and evolution of their information systems and solutions through design, planning and implementation of innovative solutions dedicated to Safety, Security and Process Automation areas. CODIN has developed an integration software platform dedicated to security and safety process management. The platform, ESSG® (Enterprise Security ServiceGrid) is a software framework dedicated to Real Time User and Entity Behaviour Analytics and enables the implementation of integrated security solutions for several domains such as Homeland Security, Cyber Defence, Critical Infrastructure Protection and Territory Protection and Exploitation.</p> <p><b>Key role in project</b></p> <p>CODIN provides its expertise and the developed computation engines to enhance the capabilities of the Andromeda solution. The computation engine performs ship behaviour modelling, detection, identification and supervision. The engine derives the behaviour from the track position information received from AIS, RADAR, VTS systems etc. In addition CODIN will lead the Task 6.4, Ionian-Adriatic Maritime border.</p> <p><b>Assets for ANDROMEDA</b></p> <p>CODIN provides to the ANDROMEDA project infrastructure and technical equipment such as Research and Development department in headquarter with 6 people and Taranto branch office for delocalized field trial activities.</p>	
	<p>STM – Stemo Ltd, BULGARY</p> <p><a href="https://stemo.bg/en">https://stemo.bg/en</a></p>
<p>STEMO LTD is a recognized leader in the field of information and communication technology with offices in all major cities in Bulgaria. STEMO offers a wide portfolio of IT products, solutions and services that help clients to build and increase effectiveness, productivity, security and reliability of the IT infrastructure. Company is direct business partner of leading world manufacturers among which: Hewlett Packard Enterprise Platinum partner, HP Inc. Gold partner and service provider, Cisco gold partner and service provider, SAP gold partner, Microsoft gold partner, NetApp gold partner, VMware enterprise solution provider etc.</p> <p><b>Key role in project</b></p> <p>As a technology partner STEMO will undertake all activities requiring the knowledge, expertise and resources for development of innovative solutions related to validating operational environment of civilian missions according to specifications set by the practitioners and tailored to effectively meet their needs within civilian missions. STEMO's information technology experts will support institutions in variety innovation and research activities including validation and demonstration of CISE capabilities, extending its scope for land borders and introduce models for relevant C2 solutions and services.</p>	

Industrial Community	
<p><b>Assets for ANDROMEDA</b></p> <p>STEMO provides a wide range of infrastructure and Technical Equipment.</p>	
	<p>ENG – Engineering Ingeneria Informatica Spa, ITALY  <a href="https://www.eng.it/en">https://www.eng.it/en</a></p>
<p>Engineering is the leading Italian software and services group, which has a consolidated presence on all vertical markets and operates through its 4 business units - Public Administration &amp; Healthcare, Telco &amp; Utilities, Industry &amp; Services, Finance - supported by cross business unit centres of competence and by the Research and Innovation Department which, with its 250 resources, has the dual role of promoting research on software at an international level and transferring innovation to the production cycle of the business structures. The Group operates in the outsourcing and cloud computing market via an integrated network of 4 data centres, equipped with infrastructure aligned to the best technological, quality and security standards.</p> <p><b>Key role in project</b></p> <p>Engineering has both a management and technical role into ANDROMEDA. The company will support the project coordination, dissemination and exploitation activities. Under the technical point of view, Engineering will collaborate with the other members of the consortium to form the ANDROMEDA community and build the user requirements specification. ENG will contribute to the overall design, architecture and interoperability framework, particularly giving his own contribution for Situation Awareness and Decision Support Services. The company will also participate to the testing and trial activities for the ADROMEDA system validation. ENG is a Task Leader in T2.4 Operational Scenarios &amp; Trials Definition.</p> <p><b>Assets for ANDROMEDA</b></p> <p>ENGINEERING provide the ANDROMEDA Project with the e-CISE to CISE Adaptor that connects ANDROMEDA Network and the CISE Network.  The e-CISE to CISE Adaptor converts ANDROMEDA messages into CISE format and dispatch them to the connected CISE node. The e-CISE to CISE Adaptor will internally store the mapping between Message and Participant in order to perform the reverse substitution upon reception of the Acknowledgment message from CISE Network.</p>	

### 2.1.4 Academic and Research & Technology Community

In the ANDROMEDA project, an investigation of higher education functions and EU research systems addresses the collective contribution of knowledge, competence, capability, operative performance, action proficiency, adaptive capability, ethics and resilience. ANDROMEDA Academic and Research & Technology Community provides its knowledge for above mentioned subjects and consist of four research and technology organisations: LAUREA, ICCS, CMCC and KEMEA.

*Table 4: Academic and Research & Technology Organisations (RTO),*

Academic & RTO Community	
	<p>ICCS – Institute of Communication and Computer Systems, GREECE  <a href="https://www.iccs.gr/en">https://www.iccs.gr/en</a></p>

### Academic & RTO Community

The Institute of Communication and Computer Systems (ICCS) is a non-profit academic research body established in 1989 by the Greek Ministry of Education to carry out research and development activities in the area of telecommunications, systems and techniques, computer systems and their applications in transceivers, radar, electromagnetic sensors, satellite and wireless communications, electromagnetic phenomena modelling, neural networks, systems, software and hardware engineering, telematics and multimedia applications, transport applications, control systems, biomedical engineering and electric power.

#### Key role in project

ICCS is a Task Leader in T5.1 Test Architecture, ICCS being very active in the broad fields of Emergency Communications, Distributed Architecture for Real-Time Systems and Protocols, Positioning systems, Sensor Networks and Virtual reality all applicable to emergency environments, will mainly undertake research and developments activities associated with the Test Architecture, Sensor and Data Integration Sensor and Data Integration. ICCS is a WP Leader in WP7 Impact Creation, Exploitation and Standardization Activities, Communication Expert incorporating a specialised Communication Office. ICCS is a Task Leader in T7.5 Standardisation, ICCS has large experience and has been very active in standardisation participating in various TCs and working in standardisation of research items it implements.

#### Assets for ANDROMEDA

Within ICCS, the I-SENSE Research Group is very active in areas with border surveillance technologies, crisis and disaster management communications and platforms, cloud/edge computing, Virtual and Augmented Reality technology and applications, cyber security and privacy by design, embedded systems and sensor networks (remote sensing, ground based and aerial platforms), communication architecture, networking and telecom infrastructures, data analytics and AI, communication middleware/platforms and IoT, Intelligent Transportation Systems and logistics. In ANDROMEDA ICCS will exploit an Intelligent UxV Surveillance (INUS) Platform composed of UAV and ground surveillance assets for object detection and tracking in focused land border surveillance missions.



CMCC – Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici, ITALY  
<https://www.cmcc.it>

The Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (Fondazione CMCC) is a non-profit research institution. CMCC's mission is to investigate and model our climate system and its interactions with society to provide reliable, rigorous, and timely scientific results, which will in turn stimulate sustainable growth, protect the environment, and develop science driven adaptation and mitigation policies in a changing climate.

CMCC collaborates with experienced scientists, economists, and technicians, which work together in order to provide full analyses of climate impacts on various systems such as agriculture, ecosystems, coasts, water resources, health, and economics. CMCC also supports policymakers in setting and assessing costs, mitigation, and adaptation policies.

CMCC benefits from the extensive applied research experience of its members and institutional partners: Istituto Nazionale di Geofisica e Vulcanologia (INGV); Università del Salento; Centro Italiano di Ricerche Aerospaziali (CIRA S.c.p.a.); Università Ca' Foscari Venezia; Università di Sassari; Università della Tuscia; Politecnico di Milano; Resources for the Future; Università di Bologna.

CMCC research activities are distributed among nine research divisions that share different knowledge and skills in the field of climate science: Advanced Scientific Computing (ASC) Division; Climate Simulation and Prediction (CSP) Division; Economic analysis of Climate Impacts and Policy (ECIP) Division; Impacts on Agriculture, Forests and Ecosystem Services (IAFES) Division; Ocean modeling and Data Assimilation (ODA) Division; Ocean Predictions and Applications (OPA) Division; Risk Assessment and Adaptation Strategies (RAAS) Division; Regional Models and geo-Hydrological Impacts (REHMI) Division; Sustainable Earth Modeling and Economics (SEME) Division.

### Academic & RTO Community

#### Key role in project

CMCC will lead the activities related to the development and provision of meteo-ocean products in the project. CMCC will integrate new services in the CISE by producing and delivering Decision Support System for Oil Spill, Ship routing and Search and rescue. CMCC will develop relevant adaptor for the integration of the above-mentioned services. CMCC will contribute to the development of the algorithm for the use of meteorological-oceanographic products in the detection of anomalous vessels behaviour also using and adapting the ship routing system

#### Assets for ANDROMEDA

CMCC is a key expert on innovation, data gathering and management, observation, modelling and forecasting, web and mobile applications, decision support tools in the oceanographic field. CMCC is leading the Copernicus Mediterranean Ocean Forecasting Service, and participates to the Black Sea one. CMCC is in charge of the Global Ocean forecasting system and has developed very high-resolution forecasting products for coastal and offshore sites. CMCC is specialized in the provision of ocean products to maritime authorities, shipping, oil and gas production facilities. CMCC has developed oil spill forecasting, ship routing, search and rescue tools and services for supporting maritime safety activities.



LAUREA – Laurea University of Applied Sciences, FINLAND  
<https://www.laurea.fi/en>

Laurea is a distinguished and multi-faculty university educating future professionals for security management, business management, information and communications technology, service innovation and design, and nursing. Laurea operates in the Helsinki metropolitan area in seven regional campuses. Laurea's Research, Development and Innovations (RDI) bring together several aspects – from academic research to practitioners' knowhow, and from tech-savviness to traditional security and safety studies. It offers viable business opportunities, design of new services and enhancement of existing ones, with emphasis on the end-user experience. Laurea RDI activities concentrate on four focus areas, of which the most relevant to this project is Security, Safety and Social Responsibility. This focus area can be described through the human security paradigm which refers to a multidisciplinary approach towards understanding the concept of security, including international relations, strategic and development studies, and human rights. In this context, security is seen as an enabler, outcome, and integral part of other subject fields. Laurea's research activities promote solutions that are, above all, ethically and socially sustainable e.g. respecting fundamental human rights.

#### Key role in project

Laurea brings contribution and expertise to ANDROMEDA in the areas of Legal Aspect, Policy, Social and Ethical Management (T1.4) and their Context Analysis (T2.3). Laurea can bring high level research expertise on CISE due to its' profound knowledge on the creation of CISE. Laurea is professional in H2020 funded project dissemination and communication activities and strong contribution to ANDROMEDA is delivered. Laurea has strong track record on testing and exercise evaluations and input to these issues is in the core of Laurea's expertise. Laurea is Task Leader for T.1.4, T2.1 and T.2.3 and active contributor to other WPs. For the ANDROMEDA organisation Laurea provides the User Community Leader and the Ethical manager.

#### Assets for ANDROMEDA

Laurea utilizes its expertise in service science via interaction methods with end-users. Combining user-centric approach with expertise in education, security, sustainable development, system resilience, innovative business models and digitalization, for example defining user requirements, ethical design, sustainable stakeholder engagement and R&I dissemination.

Academic & RTO Community	
	<p>KEMEA – Kentro Meleton Asfleias, GREECE  <a href="http://www.kemea.gr/en">http://www.kemea.gr/en</a></p>
<p>The Center for Security Studies (KEMEA) is a think tank on homeland security policies and an established research center since 2005 (L. 3387/2005) within the Hellenic Ministry of Citizen Protection (former Ministry of Public Order and Citizen Protection), aiming to support security policy implementations in Greece, at a strategic level.</p> <p>KEMEA is a member of a number of European associations and organizations and it represented the Greek Government as a member of the “European Security Research and Innovation Forum (ESRIF)”. Amongst other associations and organizations, KEMEA is a member of the “Public Safety Communication Europe Forum (PSCE)”, the “European Association of Research and Technology Organizations” and has established links to the ENLETS community (European Network of Law Enforcement Technology Services). Furthermore, KEMEA is appointed as the Greek “National Contact Point” for the implementation of Directive 2008/114/EC, regarding the protection of European Critical Infrastructures and is member to the Board of Directors of the European Organization for Security (EOS).</p> <p>More specifically, the activities KEMEA is involved in include: a) research and development in the context of National and European projects in close cooperation with LEAs, working under the auspices of the Ministry of Citizen Protection, b) training of practitioners in new systems and technologies and c) the certification of practitioners in private security professions at the national level.</p> <p>A main objective of KEMEA is to bring together all national Law Enforcement Agencies (Police, Fire Service, Coast Guard, Civil Protection agency, etc.) and to enable them to collaborate, interconnecting them with corresponding agencies, research institutions and the industry from around Europe. This dedicated approach to exploring synergies, establishing communication links and working together to produce end-user driven research on all fronts of the Security Sector during the last decade, has earned KEMEA its participation in numerous National and EC R&amp;D projects.</p> <p><b>Key role in project</b></p> <p>KEMEA is WP6 Leader for the Pilot Demonstrations, Validation &amp; Evaluation and Task Leader in T1.2 Project Management, Quality Control and Risk Management, T2.2 User Requirements and Technical Specifications, T6.1 Operational Trials Context and T7.3 IPR Review and Patenting Process.</p> <p>Overall, the areas in which KEMEA is involved in the project include the following:</p> <ul style="list-style-type: none"> <li>• Project Management</li> <li>• Gap analysis and end user requirements</li> <li>• System Requirements and Functional specifications</li> <li>• Definition and development of use case/ pilot scenarios</li> <li>• Simulations and Training</li> <li>• Pilot Testing and Demonstrations</li> <li>• Validation of use cases, System Evaluation and Assessment</li> <li>• Legal and Ethical Issues (ELSI)</li> <li>• Communication, Dissemination and Exploitation</li> </ul> <p><b>Assets for ANDROMEDA</b></p> <p>KEMEA defines end-user requirements, transforming the requirements into functional specifications, system requirements and actions, mapping the actions into project’s objectives and prepare the appropriate action plans for the pilot tests. KEMEA designs the main use cases and the sub-scenarios for each use case</p>	

### Academic & RTO Community

that will take place at each pilot site. Last, KEMEA offers a set of equipment purchased in the context of the project (e.g. Radars, E/O sensors and cameras) for the execution of the trials and the validation of ANDROMEDA technologies with the participating End-Users.

### 2.1.5 External End-Users Community

ANDROMEDA External End-User community consists of partners who are not members of the consortium. Instead, they have indicated their interests to participate in the project by bringing their expertise in e.g. border surveillance and border control, national security, illegal immigration, illegal trafficking and fisheries control. External End-users provide, among other things, their expertise and knowledge in situational awareness, surveillance systems and methods to the project. The strategy and method for User Community enlargement with external partners is described in chapter 2.4.

Table 5: External End-Users Community

External End-Users Community	
	<p>Bulgarian Navy, BULGARIA  <a href="https://www.mod.bg/en/ba.html">https://www.mod.bg/en/ba.html</a></p>
<p>Navy protects the sovereignty and the territory of the Republic of Bulgaria in her maritime spaces. Organizationally, the Navy consists of Navy Training and Preparation Headquarters; two military naval bases – Varna and Bourgas, and units for combat support and combat provision. Functionally, the Navy is divided into Deployment Forces and Territorial Forces:</p> <ul style="list-style-type: none"> <li>• Deployment forces - formations with a high and low degree of readiness, capable of conducting the whole spectrum of NATO missions on the territory of the Alliance or outside it in the sense of Article 5 of the Washington Treaty, or in response to crises of a military or non-military nature. The Deployment Forces of the Navy are fully manned and equipped with the necessary arms and equipment.</li> <li>• Territorial Forces – formations with a high and low degree of readiness capable of fulfilling operations related to the protection of the territorial integrity (independently and/or in the system of collective security and defence), the maritime sovereignty of the country with integrated systems in NATO’s shared system that guarantee contribution to the national security in peacetime and counteraction against potential asymmetric threats.</li> </ul> <p><b>Key role in project</b>  Bulgarian Navy is able to provide experienced experts concerning Maritime Situational Awareness.</p> <p><b>Assets for ANDROMEDA</b>  Bulgarian Navy Command with its expertise.</p>	
	<p>BDI - Bulgarian Defence Institute, BULGARIA  <a href="https://di.mod.bg/">https://di.mod.bg/</a></p>

**External End-Users Community**

The Bulgarian Defence Institute (BDI) "Professor Tsvetan Lazarov" was established by a decree of the Council of Ministers of the Republic of Bulgaria #140 of 04.06.20009 as the main scientific-research, testing-design and expert-technical structure at the Bulgarian Ministry of Defence. The main areas of activates of BDI are:

- Scientific and applied research, development and experimental design activities in the sphere of Armaments, C4I Systems, Military Technologies, Logistics, Equipment and Materials;
- Human Factors in Defence Organisations
- Support to the Analysis of the situation of the Armaments, C4I Systems, and Military Technologies, Logistic Equipment and materials and working out of perspectives of their development;
- Support to the Integrated Project Teams through taking part in the preparation, scientific monitoring and complete implementation of the defence programs and projects;
- Recruitment of scientific personnel through education in doctoral programs, their development and creation of scientific-technical for needs of the Defence System
- Support of the activities of the Armaments Council and the Defence Capabilities Council of the Bulgarian MoD
- Cooperation in the sphere of research, development, testing and certification of the defence products in the frameworks of NATO, the European Union, as well as on bilateral basis and in national aspect;
- Working out technical specifications and expertise, programs and methods for testing, as well as standardization and other documents, related with the acquisition of defence products; Preparation and performance of laboratory, functional, acquisition, field and other testing of armaments, C4I systems, Military techniques, Logistics equipment and materials; Treasure, acquisition and development of the departmental standards;
- Certification of Quality Management Systems in accordance with NATO Standards, guaranteeing of the quality and assessment of the compliance during the acquisition of defence products; Ensuring of air safety and flying suitability of the military aerial vehicles, as well as of the aerial vehicles of the Ministry of the Interior;
- Coordination of the national contribution to NATO Science and Technology Organization and the European Defence Agency.

**Key role in project**

- Define and assess user requirements
- Participation to demonstrations
- Assessment and evaluation of results
- Provide virtual platform for testing and experimentations

**Assets for ANDROMEDA**

IT infrastructure for tests and experiments



Bulgarian Border Police, BULGARIA  
<https://www.mvr.bg/en/home>

Chief Directorate Border Police (CDBP) is one of the chief directorates within the Ministry of Interior. It is a national specialized structure with protective, preventive and investigative functions. Its main purpose is to perform border control and protection of the state borders of the Republic of Bulgaria.

The total length of Bulgaria's borders is 2 368 km. Out of them, EU external borders are 1 225 km, with 412 km sea border and 813 km land border.

The Bulgarian Border Police is a centralized unit with well-defined organizational structure and three levels of governance:

### External End-Users Community

- The first level is the Chief Directorate Border Police HQ, responsible for the overall management and coordination of the Border Police national, regional and local units.
- The second level consists of 7 /seven/ Regional Directorates Border Police, each responsible for a specific border (land borders with Serbia, North Macedonia, Greece, Turkey and Romania, the Black Sea border and international airports).
- The third level includes 37 /thirty-seven/ local Border Police Units with 35 /thirty-five/ Border Crossing Points (BCPs) and 2 /two/ Border Police Vessels Bases located respectively on the Danube river and at the Black sea (near the city of Burgas).

In line with Schengen best practices, CDBP has set up a specialized Air Surveillance Unit.

The Bulgarian Border Police plays a crucial role in safeguarding EU's external borders. Its efforts are focused on enhancing the effectiveness of border control and prevention of irregular migration, as an indispensable part of the integrated border management.

The human and technical resources dedicated to border control are conditioned by the intensity and profile of travellers' flow, assessment of threats and risk analysis. The Bulgarian Border Police deploys adequate infrastructure, equipment and modern technical devices in its efforts to combat irregular migration, trafficking in human beings and cross-border crime. CDBP personnel participating in/hosting the FRONTEX missions as well.

However CDBP has to remain committed and react in due time if new trends occur or if there is a shifting of the route.



Montenegro Border Police, MONTENEGRO  
<http://www.mup.gov.me/upravapolicije>

National Coordination Center – NCC Podgorica, performs activities of electronic surveillance of state border along whole administrative border of Montenegro, including all border crossings. More specifically, these activities are mostly related to:

- Multisensory surveillance of land and maritime border,
- Sensor detection, identification and classification of safety issues related to suspicious events and objects both on land and maritime borders,
- Deployment of unmanned crafts, radars, thermal and CCTV cameras, SMARTDEC and other mobile sets for situation monitoring and border surveillance purposes,
- Protection of life and property of civilians,
- Detection and prevention of illegal migrations and other types of unlawful border crossing,
- Prevention of all kinds criminal activities in border crossing and transport,
- Reporting on accidental situations related to border safety and data sharing for the purposes of cooperation with EUROSUR, FRONTEX, and other safety and security agencies.
- Detecting and preventing the commission of criminal offenses and misdemeanors and finding, arresting and imprisoning their perpetrators;
- Detecting and preventing illegal immigrations
- Preventing illegal traffic of goods across the state border and all forms of cross-border crime;
- Detecting and preventing criminal offenses, misdemeanors and finding and apprehending their perpetrators on the land, coastal and territorial waters of Montenegro; detecting and preventing the introduction of armed groups and individuals across the state border;

### External End-Users Community

- Gathering and reporting information about situation on boarder, boarder cross and in the depth of the territory;
- Cooperation and exchange of information relevant to combating and preventing all forms of cross-border crime;
- Eliminating and preventing other activities and actions that endanger public security;
- Joint work and implementation of activities with other organizational units of the Sector of Boarder Police and the Police Directorate;
- Planning of the use of technical means for the observation, surveillance and control of crossing the state;
- Initiating and participating in the implementation of the planning, and development of the Green and Blue Border Electronic Monitoring System and the Border Crossing;
- Keeping prescribed records and performing other tasks within the scope of work of the Unit;
- Multi-sensory observation of land borders, Border Crossing zones and zone of the waters;
- Classifications of security events and facilities
- Identification of security-interesting events and facilities;
- Issuing the necessary orders;
- Sensor detection of the security events and objects of interest;
- Monitoring, directing and controlling the work of the security authorities in the waters and territory and Boarder Crossing;
- Cooperation and exchange of information with all relevant entities - security system bodies Border Crossing
- Planning and control of the use of observation and technical means for monitoring and controlling the crossing of the state border;
- Monitoring and coordinating the work of Joint Police Cooperation Centers in Trebinje and Plav;
- Monitoring and coordination of the work of Regional Communication Centers - RCC North, RCC Center and RCC South;
- Operational cooperation at national level with EUROSUR and FRONTEX and all NCC centers in EU MS.
- Access to EU classified information;
- Drafting and updating the National Situation Image;
- Receiving reports from RCC North, RCC Center and RCC South;
- Preparation of reports on all incidents in the field of border security and the delivery of the same to EUROSUR system, FRONTEX and other security agencies;
- Coordinating work and providing the necessary support for regional joint actions -JOA;
- Making risk analysis;
- Preparation of analytical reports;
- Proposing the improvement of Operational Procedures and the Border Security System, implementation of all other activities in accordance with EU regulations in the field of EUROSUR, FRONTEX and Schengen Agreement.

#### Key role in project

Montenegro Border Police can actively participate in workshops, demonstrations and joint trials to exchange experience, and provide, guidelines recommendations, professional expertise for ANDROMEDA system to achieve project goals and other welfare for Security and Safety on Adriatic sea.

External End-Users Community	
<p><b>Assets for ANDROMEDA</b></p> <ul style="list-style-type: none"> <li>• National Coordination Centre Podgorica;</li> <li>• Electronic surveillance system;</li> <li>• Patrol watercrafts, and</li> <li>• Training for searching and checking stolen boats (provided by certificated trainers).</li> </ul>	
	<p>Polish Naval Academy of the Heroes of Westerplatte in Gdynia, POLAND  <a href="https://www.amw.gdynia.pl/index.php/en">https://www.amw.gdynia.pl/index.php/en</a></p>
<p>The Polish Naval Academy is a research and development centre for the Polish Navy and other organizations linked to the defence and national security. The research problems are selected so as to shape scientific specialties of the Academy in connection with plans for development of the Polish Navy as well as with the process of technical modernization of ships, weapons systems and equipment.</p> <p>The Academy has, unique in the country, research and development teams whose area of activity covers mostly the maritime environment. A wide range of scientific investigations causes the results obtained to be of universal character, which leads to implementing them in the maritime economy, the industry and environment protection.</p> <p><b>Key role in project</b></p> <p>Specialists from the Polish Naval Academy can take part in:</p> <ul style="list-style-type: none"> <li>• defining project's user requirements</li> <li>• project's trials, demonstrations, workshops and providing advices and recommendations</li> <li>• providing comments on the activities concerning maritime security, education and training programmes</li> <li>• cooperation with different industrial sectors to discuss relevant challenges proposed to be addressed by the Polish Navy, the Polish Border Guard Maritime Branch and to facilitate potential innovation to strengthen the maritime security</li> <li>• dissemination the project results</li> </ul>	
	<p>Home Office: Border Force Maritime Command (UKBF),            UNITED KINGDOM  <a href="http://www.gov.uk/government/organisations/border-force">www.gov.uk/government/organisations/border-force</a></p>

**External End-Users Community**

Border Force was formed on 1 March 2012 as a law enforcement command within the Home Office. Border Force secures the border and promotes national prosperity by facilitating the legitimate movement of individuals and goods, whilst preventing those that would cause harm from entering the UK. This is achieved through the immigration and customs checks carried out by our staff at ports and airports.

Border Force is responsible for:

- checking the immigration status of people arriving in and departing the UK
- searching baggage, vehicles and cargo for illicit goods or illegal immigrants
- patrolling the UK coastline and searching vessels
- gathering intelligence
- alerting the police and security services to people of interest

This is some of the most important and challenging work in Government as it both protects and enhances both the UK economy and national security.

**Key role in project**

Border Force Maritime Command’s mission is to enhance UK maritime border security through intelligence-led and proactive maritime operations to deliver the right effect in the right place at the right time to in order to:

- Detect and prevent the smuggling of people and prohibited and restricted goods into the UK;
- Deter those who use commercial and general maritime to pose a threat to the UK;
- Prevent and interdict in criminal activity and preserve and secure evidence to support prosecutions where appropriate;
- Reassure the public and wider maritime community whilst minimising interference into the lawful passage of people and goods within UK TTW’s.

ANDROMEDA offers the opportunity to enhance the intelligence which drives our deployments, and we would wish to play an active role in the planning around that.

**Assets for ANDROMEDA**

Border Force has five cutters (offshore patrol vessels) and six Coastal Patrol Vessels (CPV’s). One Border Force Cutter is deployed to the Aegean for humanitarian purposes to assist in the rescue of migrants. Four cutters and six CPVs operate in UK waters. One or more of these vessels could be used to trail Andromeda technology, dependent upon operational demands.



The Spanish Navy (Armada Española), SPAIN  
<https://armada.defensa.gob.es>

The Spanish Navy (Armada Española) is the maritime branch of the Spanish Armed Forces and one of the oldest active naval forces in the world. The Spanish Navy Headquarters, located in Madrid, comprises a series of departments with the necessary personnel and material to advise the Chief of Naval Staff in the execution of his duties.

The Fleet is the main naval power of the Spanish Navy, the core element of the Naval Force to conduct military operations anywhere as part of the joint action of the Armed Forces and capable of leading multinational operations. The soul of the Fleet is made up by surface combatant ships, submarines, mine countermeasures vessels, aircraft, special naval warfare units, command groups, logistic support and other Marine Corps elements that give the naval force an expeditionary character. To carry out its mission, the

External End-Users Community	
<p>Fleet has its own command and control systems as well as centres, departments and support facilities which develop training and assessment tasks, analysis of operations and exercises and generation of tactical doctrine.</p> <p>The Personnel Admiral is the authority responsible for the management, administration and control of the human resources of the Spanish Navy. Through this structure the Personnel Head Office conducts its activities related to the planning, management, integration of human resources, administration, assistance to personnel, teaching, doctrine, medical support and implementation of social policies.</p>	
	<p>MAOC-N – Maritime Analysis and Operations Centre - Narcotics  <a href="https://maoc.eu">https://maoc.eu</a></p>
<p>The Maritime Analysis and Operations Centre - Narcotics (MAOC (N)), based in Lisbon, is an initiative by 7 EU Member Countries: France, Ireland, Italy, Spain, Netherlands, Portugal and the UK and is co-funded by the Internal Security Fund of the European Union. The Centre provides a forum for multi-lateral cooperation to suppress illicit drug trafficking by sea and air. The headquarters is staffed by Country Liaison Officers (CLOs) representing the police, customs, military and maritime authorities of the participating European nations.</p> <p>In addition to the intelligence provided, MAOC (N)'s success can be attributed to other factors, such as the working model (Liaison Officers working together with full transparency and equality), as well as the civil-military connection and cooperation with West African countries. The MAOC (N) model, working practices and operations are conducted in a format, which aims to minimise bureaucracy, whilst maximising operational activity. From 2007 to July 2018, MAOC (N) supported the coordination and seizure of over 146 tons of cocaine, over 407 tons of cannabis and over 1 ton of heroin.</p> <p><b>Key role in project</b></p> <p>MAOC (N) wishes to participate in the Project as an End-User.</p> <p><b>Assets for ANDROMEDA</b></p> <p>MAOC (N) will contribute to ANDROMEDA by participating through experienced staff (analysts and/or Country Liaison Officers), upon availability to project's trials, demonstrations, workshops and provide advices, recommendations.</p>	
	<p>GUCI – Guardia Civil, SPAIN  <a href="http://www.guardiacivil.es">www.guardiacivil.es</a></p>
<p>The Guardia Civil is the oldest Law Enforcement Agency covering the whole of Spain. It has military nature and nationwide competences, it was founded during the reign of Queen Elizabeth II of Spain, and its origin dates back to 1844. The Guardia Civil is an institution whose main purpose the protection of citizens, their property and assets, and its core mission consists in ensuring the full exercise of rights and freedoms. As a national police force, the Guardia Civil is comparable today to the French National Gendarmerie, the Italian Carabinieri, the Portuguese National Republican Guard and the Dutch Royal Marechaussee as it is part of the European Gendarmerie Force.</p> <p>Currently, the Guardia Civil is the largest police force in Spain, in terms of area covered (carrying out public security tasks in 84% of the Spanish territory and the entire Spanish territorial waters) and</p>	

**External End-Users Community**

personnel (with around 80,000 agents).

The Guardia Civil is accountable to two ministries: the Ministry of the Interior, for all concerning public security affairs, and the Ministry of Defence, regarding military missions. At the same time, the Guardia Civil also serves the needs of the Ministries of Justice, Finance, and Environment, as well as Regional and Local Administrations in accordance with their respective competences.

Apart from the constant adaptation and modernisation, the Guardia Civil has progressively assumed new responsibilities, performing nowadays the widest spectrum of police duties (road traffic control, criminal investigation, protection of coasts, borders, territorial waters, seaports and airports, environmental protection, public order and safety, control over weapons and explosives, mountain rescue or counter- terrorism, inter alia).

In order to carry out all these functions, the Guardia Civil is present in the territory through Regional Headquarters (the highest command unit, corresponding to Autonomous Regions), Provincial Headquarters (they cover the whole territory of a province and are divided into Companies and Stations). As a complement to this operational structure, the Guardia Civil relies on different specialised Units such as Road Traffic Unit, Nature & Environment Protection Service, Air Service, K-9 Service, EOD & CBRN Service, Maritime Service, Underwater Search Unit, Mountain Rescue Service, Intelligence Command, Judicial Police Command, Fiscal and Border Control Command, Weapons & Explosives Inspectorate, and Special Units.

The specialised Unit of the Guardia Civil that will mainly contribute to the project is the Fiscal and Border Command. Its units are the first line of defence against drug and illicit goods trafficking, smuggling and international networks for trafficking in human beings and illegal substances. Port and Airport units complement the deployment.

Depends on Fiscal and Border Command the:

- Project Office: its specific mission is to manage projects in the field of borders with other organizations, in the area of the functions carried out by the Fiscal and Border Command.
- Fiscal Service: its specific mission is the fiscal protection of the State, exercising the functions and actions at preventing and prosecuting smuggling, drug trafficking, fraud and other infractions, within the framework legally assigned to the Guardia Civil. As well as the realization of the liaison, cooperation and operational collaboration in these matters with others related services, both national and international.
- Maritime Service: its specific mission is to exercise the functions that correspond to the Guardia Civil in Spanish maritime waters and inland waters. It also includes activities in the underwater environment, and in particular maritime surveillance, the fight against smuggling and the control of irregular immigration in this scope.
- Coast and Border Service: its specific mission is to guard and monitor airports, ports, coasts and borders, as well as control irregular immigration in this scope.

**Key role in project**

The Civil Guard's role in this project would be to keep informed of all the innovations and new technologies applied in the field of the Command and Control Center, as well as in the interconnection and new definition of the extended CISE Data Model.

**Assets for ANDROMEDA**

As an asset, we could provide information through the EUCISE network for trials, for example the one to be held in Portugal.

	General Maritime Directorate, ALBANIA <a href="http://www.dpdetare.gov.al">www.dpdetare.gov.al</a>
--	---

External End-Users Community	
	
<p>General Maritime Directorate of Albania was founded in April 02 2009, Pursuant to the Law No. IO109 and has the following obligations and rights:</p> <ul style="list-style-type: none"> <li>• Directs and coordinates the activity of the constituent structures of the maritime administration;</li> <li>• Performs control over the performance of the work and performance of duties on all the constituent structures of the maritime administration;</li> <li>• Control the application of the general, national and international rules of maritime law by all private and state entities registered , exercising their activity in the field of seamanship and are legally permitted by the ministry;</li> <li>• Provides technical assistance in drafting and approximation of national maritime legislation with international legislation. It completes the national legal framework for the implementation of international agreements relating to the law of the sea and the maritime transport in which the Republic of Albania is a party;</li> <li>• Represents the Republic of Albania on Maritime Affairs in the United Nations, the International Maritime Organization (IMC), the International Labour Organization ,ILO) and other organizations where the Republic of Albania is a party;</li> <li>• Cooperate with all other relevant institutions related to the operation of the maritime sector, such as the Coast Guard, Border Police structures, customs agencies, environmental agencies, the Hydrographic Service and associations of private operators;</li> <li>• Exchanges the necessary data for the discipline of maritime traffic, the increase of the security conditions of the navigation and the standards of the port security;</li> <li>• Establish expert groups for conducting investigations into marine incidents and accidents, ship fights, ship fires, land piracy, piracy, resolution of all marine issues provided for in the Maritime Code of the Republic of Albania, and takes the necessary measures to prevent and avoid them;</li> <li>• Provides technical assistance in drafting sub-legal acts and taking appropriate measures for the removal of solid, liquid and marine relics through the constituent structures of the maritime administration;</li> <li>• Directs, organizes and controls training s for the qualification of officers and seafarers of the Republic of Albania, of pilots, agents, port operators operating in the maritime field for issuing the necessary relevant certificates in accordance with national legislation and international conventions, where the Republic of Albania is a party;</li> <li>• Pursues and carries out the activities of the maritime transport, based on the government program, the National Transport Plan, master plans and the strategy of development of the maritime sector;</li> <li>• Monitors the development of marine ports, based on studies, master plans, projects, in accordance with the National Transport Plan.</li> </ul> <p><b>Key role in project</b></p> <p>General maritime Directorate performs department functions concerning. the safety of navigation in the coastal seas of Albania, in relation to regulation and maintenance of sea waterways, establishment of facilities for safety of navigation on waterways and ensuring their proper functioning, performance of radio service activities on sea waterways for the needs of maritime transport, establishment of seaworthiness of ships and other navigational and floating vessels, as follows: performing technical supervision, issuance of ship certificates, performing technical expertise in case of distress, protection of</p>	

**External End-Users Community**

sea against pollution from navigational and floating vessels; cooperation with international organizations and authorized bodies of other countries within the Department's scope of work. Taking administrative measures and administrative actions in relation to subjects of inspection; monitoring and execution of laws and other regulations; execution of offence and administrative procedure in accordance with the law; monitoring and studying the implementation of regulations and other measures and activities in relation to safety and security of navigation; preparing opinions about the implementation of regulations; analysis and proposal of adequate measures; providing professional assistance for the implementation of laws and other regulations in the field of maritime affairs; making required reports, information, programs, Etc.

**Assets for ANDROMEDA**

As per above mentioned, participation of our organization in this project will be a very useful experience and will give us the opportunity to provide our expertise for the project and come in contact with new technologies and with organisations, companies, and End Users working in Border Security domain.



GIBP - General Inspectorate of Border Police Ministry of Internal Affairs of the Republic of Moldova, MOLDOVA  
<https://www.border.gov.md>

General Inspectorate of the Border Police (GIBP) , under the Ministry of Internal Affairs. The Border Police is responsible for border surveillance and border controls , combatting irregular migration and cross-border crime, as well as implementing the State's policy on IBM and the management of border information/data systems. The Border Police cover Moldova's 1,906 km-long border, with the exception of the 453 km of the Transnistrian segment, and is responsible for 51 border crossing points (BCPs) (43 with Ukraine , 7 with Romania, 1 at Chisinau Airport) . The Border Police is split into four regional directorates and 41 border sectors, whilst Headquarters functions are contained within 16 directorates.

**Key role in project**

GIBP is interested to participate and contribute to achieving of the project objective: Extending the scope of the CISE Model in order to support Land Border Operational Information Exchange.

**Assets for ANDROMEDA**

To share and exchange experiences in the field of border surveillance and border controls, integrated state border management, information systems and transmissions , as well as strategies, regulations and operational standards.



Slovenian Maritime Administration, SLOVENIA  
<https://www.gov.si/en/state-authorities/bodies-within-ministries/slovenian-maritime-administration/o-upravi/>

The Slovenian Maritime Administration performs administrative and expert tasks related to maritime transport and port infrastructure and maintains order in ports and in the rest of Slovenian territorial and internal sea waters. Moreover, it ensures safety of navigation, controls maritime transport operations and the maintenance of navigation safety facilities and waterways, and supervises the implementation of regulations governing maritime transport and port infrastructure and regulations governing inland waterway transport.

**Key role in project**

### External End-Users Community

Participation in end-user questionnaire completion, collection of relevant user requirements, operational needs, experiences in maritime data exchange, other expertize related to EU maritime initiatives in the area of maritime administration, safety, governance, etc.

#### Assets for ANDROMEDA

Provision of relevant data and inputs in the end-user questionnaire for making the analysis of operational and technical requirements.

### 2.1.6 External Industrial Community

ANDROMEDA External Industrial community consists of industrial organizations who are not members of the consortium, instead they have indicated their interests to participate the project by bringing their expertise in e.g. border surveillance and border control, national security, illegal immigration, illegal trafficking and fisheries control. External Industrial partners provide, knowledge, expertise and best practises in the fields of situational awareness, surveillance systems and methods to the project. At the time of this deliverable publication, Marine Traffic, Székely Family and Company Ltd., Naval Group, and ELMAN S.r.l have joined to the projects external User Community. The strategy and method for User Community enlargement with external partners is described in chapter 2.4.

Table 6: External Industrial Community

External Industrial Community	
	<p>MarineTraffic Operations S.A, GREECE  <a href="http://www.marinetraffic.com">www.marinetraffic.com</a></p>
<p>MarineTraffic is the world’s leading platform for offering vessel tracking services and actionable maritime intelligence. MarineTraffic.com is an end-to-end service that tracks vessel positions, based mainly on the Automatic Identification System (AIS), and displays them on a map in real-time. The AIS data is collected from MarineTraffic’s own receivers’ network, comprising of over 2,000 coastal AIS stations around the globe, the world’s largest proprietary AIS network. At any given time, MarineTraffic is tracking over 150,000 vessels at real-time with 180,000 vessels reporting daily. With its Big Data infrastructure, MarineTraffic receives hundreds of millions of vessel positions daily and archives billions of records. MT research seeks to define the future of maritime shipping. MarineTraffic engineers are focused on discovering novel and innovative ways of making shipping safer, greener and more efficient through smarter technologies. As a data processing specialist, MT sees Big data as a natural development of its core business. MarineTraffic Research is an example of an industrial research lab where research outcomes affect millions of users in no time. The overarching goal is to build systems and algorithms which can exploit uncertainty and partial truth to achieve robustness and high performance in real world conditions. Research groups are engaged in several diverse projects and their expertise are within the areas of artificial intelligence, distributed and parallel computing, decision support systems, soft computing, evolutionary computing, Human-Computer Interaction and Visualization, data management.</p> <p>With its Big Data infrastructure, MarineTraffic receives hundreds of millions of vessel positions daily and archives billions of records. This data has positioned MT in a competitive position giving it the unique potential to make use of these enormous datasets to innovate and provide new knowledge from combined data sources and patterns in large data volumes.</p>	
	<p>Székely Family and Company Ltd., HUNGARY  <a href="https://szekely.family">https://szekely.family</a></p>

Recognizing the gap between end-users (the market) and research and innovation actions, founded by a family with a vision to provide a safe, secure and sustainable future for our children via responsible research, innovation and development actions, the Székely Family & Company Ltd. based in Budapest, Hungary supports its partners through joint projects or provides external, complementing services. The core team has sound expertise in the EU Framework Programmes (FP7 and H2020) as well as other research, innovation and development programs in the international (and national) community, such as European Space Agency 's Business Applications and Space Solutions (technology transfer and business incubation) program or UNDP supporting projects.

The main service is supporting dialogue between end-users, research and industrial partners, thus supporting creation of sound, tangible project results with real impact. For example, the team has expertise in organizing large-scale (1000 + participants) drills or simulations as well as thorough and realistic tabletops to validate results or solutions. In addition, it possesses strong educational and training skills, ranging from lecturing at higher education to basic training for law enforcement officers, also including high-level capabilities of teaching English for foreign speakers, supporting next generation learning strategies of the youth by AR, VR, gamification and blended learning solutions. The team is experienced in acting as Data Protection Officers or as external data protection experts, this can help overcome difficulties most security research actions certainly meet during the validation.

### **Key role in project**

Székely Family & Company Ltd. will contribute with providing experience in the definition of project's user requirements as well as with providing comments on the definition and implementation of the roadmap for the different demonstrators, facilitating alignment between private and public priorities. Due to its innovation community, it can effectively disseminate project results and related news to global and Hungarian peers.

### **Assets for ANDROMEDA**

- Peer review of ANDROMEDA deliverables upon pre-arranged request.
- Participation on ANDROMEDA external end-user Telcos upon request.
- News published in English and Hungarian over website, Facebook and LinkedIn (see example: <https://szekely.family/2020/03/12/szekely-family-and-co-joins-h2020-aqua3s-security-advisory-board/>)
- Support technology gaps with space technology if needed through its Space Impulse partnership (<https://szekely.family/2020/03/23/space-impulse-szekely-family-and-co-partner-to-grow-newspace-industry-platform/>)
- Szekely Family & Company Ltd. is a start-up and therefore it was not yet involved in any project as a consortium member. However, the predecessors of the company and the members of the team were involved in the following projects:
  - H2020 Smart mobility at the European land borders
  - H2020 Autonomous swarms of heterogeneous robots for border surveillance
  - H2020 Intelligent Portable Control System
  - H2020 Smart Resilience for Smart Critical Infrastructure
  - ESA TTD Satellite information for border security (SUPERB)
  - ESA TTD Drone Detection and Ranging Technology (DDRT)
  - ICMPD Eastern Partnership Cooperation in the Fight against Irregular Migration - Supporting the Implementation of the Prague Process Action Plan (Ea -SIPPAP)
  - DESTRIERO FP7
  - Implementation of integrated Border Management for Turkey (EU Twinning)

<ul style="list-style-type: none"> <li>PCC SEE Project on Joint Investigation Teams (Developing webinars for PCC SEE) JLS/2009/JPEN/OG/0729</li> </ul>	
	Naval Group, FRANCE <a href="http://www.naval-group.com">www.naval-group.com</a>
<p>Naval Group is an international high-tech company and one of the few global leaders in defence naval systems whose skills cover the whole of the production chain for complex programmes. Naval Group uses its extraordinary know-how and unique industrial resources to meet its customers' requirements.</p> <p>Naval Group offer solutions and products from Offshore Patrol Vessels to first rank Frigates and submarines, and command systems for Combat Fleet and large scale Maritime Surveillance.</p>	
	ELMAN S.r.l, ITALY <a href="http://www.elmansrl.com">www.elmansrl.com</a>
<p>Established in 1975, ELMAN operates in the design, manufacture, maintenance, and installation of telecommunications systems, taking care of the maintenance required to ensure the best possible operation in the long term.</p> <p>The Company, along with Italian Authorities and following the evolution of international regulations, has defined a strategy which enabled the development of an innovative program, leading to maximum satisfaction of both national and international customers. This has been made possible by the high degree of flexibility that characterizes ELMAN, in addition to the constant adoption of the most advanced technologies available.</p> <p>In this context, the capabilities of radio equipment have followed the advancements of technology, evolving from analog audio to digital communications for both audio and data with enhanced performance both in terms of service quality and reliability.</p> <p><b>Key role in project</b></p> <p>Support in the definition of Tactical platform.</p> <p><b>Assets for ANDROMEDA</b></p> <p>ELMAN has gained valuable experience in the design and manufacturing of:</p> <ul style="list-style-type: none"> <li>VTS systems</li> <li>GMDSS systems</li> <li>AIS networks and equipment</li> <li>VoIP-based communication networks and systems</li> <li>Fixed and portable synthesized transceivers in the VHF and UHF band</li> <li>Analog and digital radio links the VHF and UHF band</li> <li>GPS-based receivers and positioning systems</li> <li>Linear and switching stabilized power supplies</li> </ul>	

### 2.1.7 External Academic and Research & Technology Community

ANDROMEDA External Academic and Research & Technology community consists of partners who are not members of the consortium. Instead, they have indicated their interests to participate the project by bringing their expertise in border surveillance and border control, national security, illegal immigration, illegal

trafficking and fisheries control. The External Academic and Research & Technology partners provide, among other things, their expertise and knowledge in situational awareness, surveillance systems and methods to the project. The External Academic and Research & Technology partners currently are European University Cyprus / CERIDES; Nord University Business School; Faculty of Maritime Studies in Kotor / University of Montenegro; Faculty of Professional Studies, Aleksandër Moisiu University of Durrës (UAMD); Department of Shipping, Trade and Transport /University of the Aegean, and University of Montenegro / Faculty of Electrical Engineering. The strategy and method for User Community enlargement with external partners is described in chapter 2.4.

Table 7: External Academic and Research & Technology Community

External Academic and Research & Technology Community	
 <b>European University</b> Cyprus	<p>European University Cyprus, CYPRUS  <a href="https://euc.ac.cy/en">https://euc.ac.cy/en</a></p>
	<p><a href="https://cerides.euc.ac.cy/">https://cerides.euc.ac.cy/</a></p>
<p>The European University of Cyprus consists of the School of Business Administration, the School of Humanities and Social Sciences, the School of Sciences, the Medical School, and the School of Law with the mission to educate students for successful careers and life achievement, to understand and serve the needs of society, and to create knowledge through research and innovation. EUC is the only university in Cyprus and Greece to be rated by QS TOP UNIVERSITIES (QS Stars), which ranks many of the most prestigious universities in the United States, Canada and Europe. The University has been assessed with the highest distinction of 5-Stars in Teaching, Facilities, Inclusiveness, Social Responsibility and Internationalization. Its 4-Star distinction in the field of Employability is also considered a remarkable success, a result of the close association of its academic programs to the job market.</p> <p>The Centre of Excellence for Risk and Decision Sciences (CERIDES) is the research organisation of EUC. CERIDES provides a holistic offer to the academic and business world and operates under the auspices of European University Cyprus. It is the first cross-disciplinary, cross-School Center of Excellence of European University Cyprus.</p> <p>CERIDES focus areas revolve around two basic pillars; risk management and decision science with an application to a number of horizontal areas such as: Security, Safety, Telecommunications, Critical Infrastructure Protection and Industrial Processes.</p> <p>EXPERTISE: Project Management, Risk Perception, Risk Assessment, Safety, Ethical and Legal Issues in Security, Education and Training in Risk, Sendai Framework, Fires (Wildland and Urban), Risks from Climate Change.</p> <p><b>Assets for ANDROMEDA</b></p> <p>CERIDES has already participated in a large number of EU Funded projects (H2020, MCSA, DG ECHO, FP7, DG HOME, DG JUSTICE) and has amassed significant experience. CERIDES has provided training and consulting for the Government of the Republic of Cyprus, the World Bank and private organizations.</p>	
 <b>NORD</b> University	<p>Nord University Business School, NORWAY  <a href="https://www.nord.no/en">https://www.nord.no/en</a></p>

**External Academic and Research & Technology Community**

Nord University, Bodo, Norway provides Internationally-oriented teaching and research with a special focus on developing safe and secure societies and a prosperous community. The Nord University preparedness management laboratory (NORDLAB) is a part of the Nord university Business School. NORDLAB provides an arena for situational awareness and risk assessments, as well as education, research, exercises and tests related to sea, land and air-based emergency response. NORDLAB provides computer-based simulation capacities integrated with crisis management decision-support tools and command and control support systems. In cooperation with world-leading suppliers of emergency preparedness software, modelling and simulation systems as well as decision making support solutions we offer an advanced training and test arena within emergency management for students and professionals.

**Key role in project**

- Input user perspectives
- Testing systems in simulators
- Research
- Teaching
- Other efforts for dissemination to industry and government

**Assets for ANDROMEDA**

- Faculty within safety, security and emergency management
- International network towards academic institutions
- Broad cooperation with emergency response agencies, military organizations and government at all levels
- Advanced simulator and test centre within safety, security and emergency response



University of Montenegro, Faculty of Maritime Studies in Kotor,  
MONTENEGRO

<http://www.pfkotor.ucg.ac.me/en>

Faculty of Maritime Studies in Kotor is higher education institution being a part of the University of Montenegro. It was established in 1959 as a Maritime College and afterwards, complying with the growing trends of maritime infrastructure of Montenegro, this educational institution, recognized in former Yugoslavia, was turned into Maritime Faculty in 1981.

Today, in accordance with the Bologna declaration, Faculty of Maritime Studies in Kotor provides academic and applied studies lasting from three years (six semesters). Academic studies comprehend Maritime Sciences (Basic; Postgraduate Specialist and Master Studies; PhD studies), and Management in Shipping (Basic; Postgraduate Specialist and Master Studies). Applied Studies consist of Nautical Studies, Marine Engineering and Marine Electrotechnics (third year is a differential year).

Today, Maritime Faculty in Kotor is a modern educational institution for personnel in shipping. Maritime experts are being educated and professionally trained in line with international standards, conventions and regulations. Education of maritime experts is carried out within regular classes and special programmes for professional training and competence. The Institution is equipped with modern equipment for organization of teaching process as well as equipment for practical training. Quality of knowledge and skills of large spectrum of application enable that personnel who gain education at Maritime Faculty in Kotor easily get a job on shipping companies worldwide.

**Key role in project**

### External Academic and Research & Technology Community

Faculty of Maritime Studies Kotor as an academic, scientific and research institution express great interest to participate actively in the implementation of the ANDROMEDA project. There are numerous areas where the staff members from the Faculty can provide full support, professional expertise and academic opinion regarding to the safety and security domains in maritime industry. Based on the previous participation in several international projects staff from the Faculty of Maritime Studies Kotor will be interested and ready to widen collaboration network, share gained knowledge and skills, disseminate project idea to target groups and stakeholders, support sustainability of the project results and outputs and initiate some new projects based on the results of the ANDROMEDA.

#### Assets for ANDROMEDA

Faculty of Maritime Studies Kotor have large human and technical resources necessary for the effective implementation of anticipated activities. There are highly qualified experts in different academic and professional fields in maritime sector who are prepared to fully support all the activities of the ANDROMEDA project including organization of workshops, round tables, creation and development of studies, performing research and analysis etc. Technical capacities includes modern maritime simulators (nautical, engine room, DP, offshore, PIESCES II, etc.), laboratories, other sophisticated equipment and fully equipped computer rooms ready to be used in the implementation of the ANDROMEDA project.



Aleksandër Moisiu University of Durrës (UAMD), Faculty of Professional Studies, ALBANIA  
[www.uamd.edu.al/index.php/en](http://www.uamd.edu.al/index.php/en)

Aleksandër Moisiu University of Durrës (Albanian: Universiteti "Aleksandër Moisiu" Durrës; short: UAMD) is the newest public academic institution of the Republic of Albania. The University is located in the ancient city of Durrës and has a branch in Peshkopi. It was inaugurated in 2006 and is using the American system of education, unlike the rest of the public universities in the country. More than 1,300 students started classes as of October 2, 2006.

University of Durrës took its name from Austrian actor Aleksandër Moisiu, who was of Albanian descent. The rector is Prof. Dr. Mit'hat Mema. The university offers degree programs in each of its six main divisions: Faculty of Business, Faculty of Applied Integrated Studies, Faculty of Political and Legal Studies, Faculty of Education, Faculty of Professional Studies, Faculty of Information and Technology.

The Faculty of Business offers program studies at three levels (bachelor's, master's and doctoral) in various disciplines such as economics, marketing, tourism management, finance and banking. The Faculty of Applied Integrated Studies also offers a focus in economics, but unlike the other divisions, it operates according to the German model of *berufsakademie*, whereby students work simultaneously in the sectors that correspond with their program studies. The Faculty of Applied Integrated Studies is focused on banking and finance, tourism management, and small to-medium enterprise management.



University of the Aegean (Chios), Department of Shipping, Trade and Transport, GREECE  
[www.stt.aegean.gr](http://www.stt.aegean.gr)

The Department of Shipping Trade and Transport excels in research and teaching. Our work draws on management, shipping and port economics, transportation science, logistics, finance, computing and innovation studies. We aspire to make an impact on the sustainability and prosperity of maritime transport organizations. Our research is led by people who care authentically about shipping, trade and transport and whose analysis and insight change society.

**External Academic and Research & Technology Community**

We constantly work on securing and enhancing centre-stage positioning in key research areas, research that has high impact identified through its use and public recognition, an increase in research income, and increase in the number of our doctoral researchers.

The Department of Shipping Trade and Transport has numerous knowledge and research services to advance the strategies of maritime organizations.



University of Montenegro, Faculty of Electrical Engineering, MONTENEGRO  
<https://www.ucg.ac.me/etf>

Faculty of Electrical Engineering, as educational-and-scientific unit, has its mission to educate young and high quality experts in the area of technical sciences (electrical and computer engineering), capable to contribute to development of the country and region through creative work, in line with European trends, and all these through implementation of modern education techniques and research process. Mission of Faculty of Electrical Engineering is completely in line with the mission of University of Montenegro.

The Faculty performs educational and scientific research activities:

- educates personnel in disciplines of its competence, with graduate and postgraduate education levels, providing BSc, Spec. Sci and MSc degrees in electrical engineering and computer engineering, and/or PhD degree
- teaches disciplines of its competence in other university units
- organizes and performs scientific research and professional work
- improves scientific thought and prepares personnel for independent scientific work
- develops scientific work as the integral part of its activities and basis for teaching
- through scientific work provides development of science in the area of its competence

**Key role in project**

Faculty of Electrical Engineering is part of the Academic User community, which can provide expertise and advices in different aspects of data collection and data analysis processes.

**Assets for ANDROMEDA**

Being research and educational institutions, Faculty of Electrical Engineering has as its disposal computational and storage equipment, which can be used for analysis of the collected data, then, telecommunication laboratories which can be used for the testing of communication solutions implemented in ANDROMEDA project. Finally, Faculty of Electrical Engineering has expertise in these areas.



Institute for Corporative Security Studies, SLOVENIA  
<https://www.ics-institut.si>

Institute for Corporative Security Studies, ICS-Ljubljana is organized as non-government research institution. The vision of the ICS Ljubljana is to create top-level knowledge, technologies and processes in the area of corporative security while managing the entire scope of security risks. With a responsible and professional provision of comprehensive services in the area of corporative security, we create safer and richer future for the users of our services and knowledge.

Main activities of ICS are divided in to following area: education, research, business counselling, standardization and evaluation, security geopolitics and publishing.

Institute for Corporate Security Studies is research institute special focus in:

**External Academic and Research & Technology Community**

- Risk identification, evaluation and assessment;
- Scenario analysis,
- RiskAssessment Methodology Development,
- Comprehensive approach related natural human, technical, cyber and hybrid threat evaluation,
- Awareness based analysis and educational programs,
- Using an attack trees method,
- Comprehensive solutions to mitigate physical, human and cyber threats,
- Penetration testing of information systems in cyber security area,
- Security standardization,
- Exploitation and dissemination activities

**Assets for ANDROMEDA**

For project ANDROMEDA we could provide knowledge and experience from our previous EU project, provide experience in the definition of project’s user requirements, networking through Slovenian security environment.

**2.1.8 External EU funded projects**

ANDROMEDA External EU funded projects consist of projects which have collaborated in the context of ANDROMEDA and have contributed on their own way to ANDROMEDA research. The contribution includes for instance shared user requirements applicable to ANDROMEDA objectives cooperation in different events and sharing their expertise and knowledge in situational awareness, surveillance systems and methods.

*Table 8: EU funded projects*

<b>EU funded projects</b>	
	<p>D4FLY – Detecting Document Fraud and Identity on the Fly  <a href="https://d4fly.eu">https://d4fly.eu</a></p>
<p>D4FLY is a research and innovation action funded by the EU Horizon 2020 program “Secure societies – Protecting freedom and security of Europe and its citizens”. The project consortium is formed by 19 partners from 11 European countries including universities, SMEs, research institutes and border control authorities.</p> <p>D4FLY focuses on enhancing the quality and efficiency of identity verification at border crossings in all modalities: land, air and sea by providing faster and more secure border control solutions.</p>	
	<p>MARISA - Maritime Integrated Surveillance Awareness  <a href="https://www.marisaproject.eu">https://www.marisaproject.eu</a></p>
<p>MARISA project aims to provide the security communities operating at sea with a data fusion toolkit, which makes available a suite of methods, techniques and modules to correlate and fuse various heterogeneous and homogeneous data and information from different sources, including Internet and social networks, with the aim to improve information exchange, situational awareness, decision-making and reaction capabilities. The proposed solution will provide mechanisms to get insights from any big data source, perform analysis of a variety of data based on geographical and spatial representation, use techniques to search for typical and new patterns that identify possible connections between events, explore predictive analysis models to represent the effect of relationships of observed object at sea. Enterprise and ad-hoc reporting and services,</p>	

EU funded projects	
<p>within the CISE context, will be provided to support users and operational systems in their daily activities, as well as presentation tools for navigating and visualizing results of data fusion processing. The involvement of 5 practitioners as full partners will allow on the one hand to align innovation to user needs, on the other hand to validate the toolkit through a number of trials addressing cross country/cross domain applications.</p>	
	<p>MEDEA – The Mediterranean &amp; Black Sea Security Practitioners’ Network  <a href="https://www.medeia-project.eu">https://www.medeia-project.eu</a></p>
<p>MEDEA is an EU funded Coordination and Support Action project the scope of which is to establish and further develop a regional Network of practitioners and other security related actors in the Mediterranean and the Black Sea region. MEDEA project groups the practitioners into 4 thematic communities (TCPs – Thematic Communities of Practitioners):</p> <ul style="list-style-type: none"> <li>• TCP1: Managing of migration flows and asylum seekers</li> <li>• TCP2: Border management and surveillance</li> <li>• TCP3: Fight against cross-border crime and terrorism</li> <li>• TCP4: Manage natural hazards and technological accidents</li> </ul> <p>The aim of MEDEA is to engage a critical mass of security practitioners and actors including first aid responders, border guards, national police, civil protection teams, humanitarian workers, defence entities and other interested stakeholders in efficient cooperation with cross-discipline entities from other countries. The expected result would be the effective response to all security threats common to the Mediterranean and Black Sea region. The requirements from all four communities will be featured as inputs (regional operational needs) in the Mediterranean and Black Sea Security Research and Innovation Agenda (MSRIA).</p>	
	<p style="text-align: center;"><b>RANGER</b>  RADars for loNG distance maritime surveillancE and SaR operAtions  <a href="https://ranger-project.eu">https://ranger-project.eu</a></p>
<p>RANGER aims at re-enforcing EU by combining innovative Radar technologies with novel technological solutions for early warning, in view of delivering a surveillance platform offering detection, recognition, identification and tracking of suspicious vessels, capabilities exceeding current radar systems. It will be a platform, consisting of 2 radar technologies, a novel Over-The-Horizon Radar combined with a Multiple Input Multiple Output one implemented exploiting the latest photonics advancements, and an Early Warning System exploiting deep and adaptable machine learning schemes able to Automatically detect radar Targets. It safeguards seamless fitting and interoperability with CISE (enhanced maritime surveillance and cross border SaR operations), through the development of a CISE translation Gateway, exporting on-demand CISE services directly to end-users, by strengthening the information exchange between national authorities and the European Agency. The user requirements defined in RANGER project were shared with ANDROMEDA Consortium.</p>	
	<p style="text-align: center;"><b>SMILE</b> - SMart mobilLity at the European land borders  <a href="https://smile-h2020.eu/smile">https://smile-h2020.eu/smile</a></p>
<p>SMILE Action proposes a novel concept of mobility that addresses the challenges at the European land borders, by designing, implementing, and evaluating in a relevant environment (TRL6) a prototype management architecture for accurate verification, automated control, monitoring and optimization of people flows. It will take advantage of the capabilities of smart mobile devices in border control for secure and reliable authentication and processes their exploitation as a part of a biometric multimodal verification process that augments/complements existing approaches. The idea of SMILE mobility is based on private cloud infrastructure technologies that will communicate with remote handhelds through a secure gateway. The SMILE Action will target the land borders, so the proposed</p>	

EU funded projects
<p>technological and operational framework will be tested through demonstrations at two Border Crossing Points.</p> <p><b>Assets for ANDROMEDA</b></p> <p>SMILE Action, now at its third year, can contribute based on its experience and lessons learned in various areas such as user requirements, pilots' execution, training activities of end-users, recommendations for legal and ethical challenges stemming from the introduction of new technologies at the land borders, as well as the planning of dissemination and communication activities. Moreover, SMILE can also share its publicly available deliverables which many of them can be a valuable guide for running projects in the security domain.</p>

## 2.2 Continuum of Projects

ANDROMEDA focuses to demonstrate the full capabilities of CISE by enhancing the Maritime CISE Model and by extending its scope to the Land Surveillance Sector. To achieve the best results with reasonable efforts it is beneficial to know history and understand the work already done. The continuum of high-value impacts of other projects for ANDROMEDA could be described: “what we can do in our own way is related to where we are and then where we have been”. Almost all authorities are participating or has participated EU funded projects related to Land or Maritime surveillance and monitoring. ANDROMEDA consortium brings also experience from European and National Activities related to the Border and external Security and thus it will build on the results of these projects.

The past and current projects have also been used for making the ANDROMEDA User Community completed. New partners to external Organisational, Academic, Industrial and End-User Communities has been invited to provide their knowledge and expertise in supporting and advising the ANDROMEDA project. The following table provides a more detailed description of past and current projects relevant to ANDROMEDA.

*Table 9: Continuum of Projects*

Continuum of Projects	
EUROSUR 2007 - 2013	The European Border Surveillance system is a multipurpose system for cooperation between the EU Member States and Frontex in order to improve situational awareness and increase reaction capability at external borders. The purpose is to prevent cross-border crime and irregular migration and contribute to protecting migrants’ lives in all Schengen area countries and Bulgaria, Romania and Croatia. The EUROSUR network is operated by FRONTEX. All Frontex partners has connect their NCC’s to EUROSUR information sharing network. For ANDROMEDA Frontex (EUROSUR) could provide real life experience and expertise in border surveillance and incidents in border areas as well as for validation of ANDROMEDA.
SeaBILLA 2010 - 2014	Sea Border Surveillance Project, which aims to: define the architecture for cost-effective European Sea Border Surveillance systems, integrating space, land, sea and air assets including legacy systems, apply advanced technological solutions to increase performances of surveillance functions and demonstrate significant improvements in detection, tracking, identification and automated behaviour analysis of all vessels. To this end, work included the development of a novel algorithm for change detection and ship detection from space borne sensors, comparison of manned and unmanned aerial means, and assessment of remotely piloted aircraft system performance in selected scenarios. In terms of sensors, activities involved networking between radar and sensors to track small boats close to coastlines and a behaviour analysis algorithm to help relevant stakeholders detect suspicious boats. From the ANDROMEDA point of view SeaBILLA project is one of the key steps in progressing towards European

Continuum of Projects	
	Maritime surveillance implementation by improving the interoperability and reducing the information gap arising from heterogeneous surveillance systems, legislations, mandates and modes of operation.
BLUEMASSMED 2011 - 2012	The first European maritime surveillance pilot project launched by DG MARE, whose objective was to foster cooperation in maritime information sharing between 37 State partners from 6 Member States bordering the Mediterranean Sea and Atlantic approaches: operational users, data model, connectivity and capabilities. From the ANDROMEDA point of view, BMM project enhanced the political understanding of cross-border and cross-sectoral information sharing, change the philosophy from “Need to Know” to “Responsibility to Share” principal, enhanced technical readiness for information exchange by developing core and common services for information sharing.
MARSUNO 2011 - 2012	Maritime Surveillance in the Northern Sea Basins project addressed to support of CISE by identifying practical solutions to overcome legal, technical and administrative hurdles to cross-sectorial and cross-border information sharing between maritime authorities: the data-sharing across borders and across sectors like maritime transport, environmental protection, customs, border guarding, fishery inspection, law enforcement and defence is possible and improves reaction capacity. The project in particular made progress in reviewing the legal situation and made suggestions for a possible governance structure for information sharing in Maritime domain.
PERSEUS 2011 - 2015	Policy-oriented marine Environmental Research for the Southern European Seas (PERSEUS). Protection of European Borders and Seas through the Intelligent Use of Surveillance: project represented a program and research consortium that furthered large-scale integration, operational validation, demonstration of novel systems, collaboration of European research, a federative frame to joint research and collective steering forum as driver in areas of significant European interest. PERSEUS produced a Policy Brief, which highlights the major scientific findings of the project and sets out evidence-based recommendations for policy and decision makers in the Southern European Seas (SES) based on work carried out in several areas of the Mediterranean and the Black Sea. An atlas of riverine inputs to the Mediterranean was produced during the project. For ANDROMEDA the PERSUS demonstrated, through live exercises that legacy systems can interoperate through flexible data exchanges and that Member States authorities are able to co-operate seamlessly.
CoopP 2012 - 2014	Test project on cooperation in execution of various maritime functionalities at sub-regional or sea-basin level in the field of integrated maritime surveillance: identification of the Common Information Sharing Environment, definition of common data formats, semantics and data model, connection between information sharing and the operational aspect and description of the most important use cases. The CoopP project defined the use cases for CISE, which were used to define the information services, access rights and data model for CISE. The project produced a cost-benefit analysis of the CISE information exchange. The results of the project determined the further development of CISE in several projects e.g. MARISA, EUCISE2020 and now ANDROMEDA.
CLOSEYE 2013 - 2016	The goal of the CLOSEYE project was validate future solutions by means of the experimentation with innovative proposals in a real operational environment. Aim of the project was to provide an operational and technical framework that increases situational awareness and improves the reaction capability of authorities surveying the external borders of the EU. CLOSEYE paved the way towards the definition of future integrated surveillance solutions.

Continuum of Projects	
EUCISE2020 2014 - 2019	European test bed for the maritime Common Information Sharing Environment in the 2020 perspective. EUCISE2020 is a Security Research project of the European Seventh Framework Program; it aims at achieving the pre-operational Information Sharing between the maritime authorities of the European States. EUCISE2020 data model is based on the CISE data model that was defined in the CoopP project and modified in partnership with Joint Research Centre (JRC). The EUCISE2020 developed among other things the service model and message format for information sharing in maritime domain. ANDROMEDA aims to unlock the full capabilities of the CISE by enhancing the Maritime CISE Model, extending its scope to the Land Surveillance Information Exchange.
SUNNY 2014 - 2017	SUNNY was focused in on UAV platforms collaboration, two-tier intelligent heterogeneous UAV sensor network developments in order to provide both large field and focused surveillance capabilities, remote sensing, situational awareness and data communication capabilities, on-board processing generation, algorithms development to analyse the data collected by the sensors for robust and accurate target identification and event detection.
EWISA 2014 - 2019	EWISA is a POV on Intelligent Surveillance and Land Border Security that aims to promote further cooperation between public authorities on developing new solutions to improve the quality and efficiency of public services. EWISA will provide an innovative system for warning on possible threats, enhancement of effectiveness and efficiency of all security relevant systems, equipment, tools and processes for the surveillance in the selected areas. EWISA was mainly concentrated on land border surveillance and control and therefore EWISA consortium partners could provide valuable experience for ANDROMEDA.
RANGER 2016 - 2019	RANGER aims at re-enforcing EU by combining innovative Radar technologies with novel technological solutions for early warning, in view of delivering a surveillance platform offering detection, recognition, identification and tracking of suspicious vessels, capabilities exceeding current radar systems. It will be a platform, consisting of 2 radar technologies, a novel Over-The-Horizon Radar combined with a Multiple Input Multiple Output one implemented exploiting the latest photonics advancements, and an Early Warning System exploiting deep and adaptable machine learning schemes able to Automatically detect radar Targets. RANGER is compatible with CISE providing a scalable set of CISE-ready RANGER services through CISE Gateway to the end-users.
FOLDOUT 2018 - 2022	FOLDOUT focus is on through foliage detection in the inner and outermost regions of the EU. Foliage penetration is an unsolved important part of border surveillance. By solving the problem of unreliable detections in such harsh environments border guards' workloads are reduced, costs are reduced and, last but not least, lives can be saved. Fusing several sensor signals increases the effectiveness of detection. Further, sensors will be influenced (i.e. detection parameters adapted) by events detected by other sensors in the vicinity. By integrating data, such as vehicle traffic, from outside the immediate border area pre-events can be detected and learned. The events will be analysed with machine learning tools to continuously increase the systems detection and tracking capability.
MEDEA 2018 - 2023	The aim of MEDEA is to engage a critical mass of security practitioners and actors including first aid responders, border guards, national police, civil protection teams, humanitarian workers, defence entities and other interested stakeholders in efficient cooperation with cross-discipline entities from other countries. The expected result would be the effective response to all security threats common to the Mediterranean and Black Sea region. The co-operation between ANDROMEDA and MEDEA could be

Continuum of Projects	
	beneficial for both projects. Especially the MEDEA TCP 2 Border management and surveillance community could be seen as end users of ANDROMEDA while reviewing modern surveillance technologies for land and sea borders linked to common information-sharing environment (CISE).
MARISA 2017 - 2020	The MARISA project aim was to provide the security communities operating at sea with a data fusion toolkit, which makes available a suite of methods, techniques and modules to correlate and fuse various heterogeneous and homogeneous data and information from different sources, including Internet and social networks, with the aim to improve information exchange, situational awareness, decision-making and reaction capabilities. The proposed solution will provide mechanisms to get insights from any big data source, perform analysis of a variety of data based on geographical and spatial representation, use techniques to search for typical and new patterns that identify possible connections between events, explore predictive analysis models to represent the effect of relationships of observed object at sea.
NEREIDS 2011 - 2014	NEREIDS was conceived to provide an integrated vision of maritime policy and surveillance so that the different elements of the service become useful to the different domains (immigration, fisheries control...). In this context, the project aimed to enhance automatic and unsupervised ship monitoring capabilities for Maritime Situational Awareness (MSA) and, to support advanced and efficient decision making tools.
ACRITAS 2012 - 2017	The ACRITAS project aspires to develop an integrated and common border management system, applied to land and sea border control. It will provide rapid deployment to harsh and isolated environments providing multifunctional surveillance capabilities, intelligent data products and innovative services to regional and national authorities. ACRITAS could function as a stand-alone fully functional regional command and control (RCC) centre and/or in cooperation with the National coordination centre (NCC).
ARCSAR 2018 - 2023	The ARCSAR project will establish international best practice and propose innovation platforms for the professional security and emergency response institutions in the Arctic and the North-Atlantic. The focus is on increased interaction in targeted networks between the professional institutions, academia and the innovators in the preparedness service and equipment industry. The ARCSAR project will monitor research and innovation projects and recommend the uptake and the industrialization of results, express common requirements as regards innovations that could fill in capability and other gaps and improve their performance in the future, and indicate priorities as regards common capabilities, or interfaces among capabilities, requiring more standardization.
ARESIBO 2019 - 2022	ARESIBO aims at improving the efficiency of the border surveillance systems by providing the operational teams and the tactical command and control level with an accurate and comprehensive information. The pillars of research in ARESIBO are three-fold: 1. Set-up a complete configuration at tactical and execution level to optimise the collaboration between human and sensors (fixed and mobile), 2. Improve situation awareness by enhancing the understanding of the situation through adapted processing of sensor data, correlation between heterogeneous data and information and creation of knowledge through deep learning techniques and 3. Create a situation awareness capability at C2 level that will combine reports on previous missions, real time situation understanding and threat analysis for future actions. ARESIBO integrates research activities in the domain of 1. surveillance platforms (air, ground, surface, underwater) to optimise the collaborative capabilities of the platforms and their positioning (between themselves and with the teams), 2. Sensor processing to interpret, fuse and correlate all the data to produce information

Continuum of Projects	
	and knowledge and 3. Augmented reality techniques to elaborate and provide to the operators a situation awareness picture which is fit for their missions (minimum information for maximal understanding) both as team level and tactical C2 level.
COMPASS2020 2019 - 2020	The EU-funded COMPASS2020 project aims to demonstrate that the coordinated use of manned and unmanned technologies and tools, both of aerial and underwater coverage, leads to better achievements regarding the range of operation, the collection of information and the quick reaction to maritime surveillance necessities. The project will offer cost-effective and reliable operational solutions to coast guards and maritime authorities for better situational awareness. The major goal of COMPASS2020 is to demonstrate an operational solution to ensure long range and persistent surveillance, increasing the situational awareness of coast guards and maritime authorities, and, thus, increasing the cost-effectiveness, availability and reliability of the operations.
OCEAN2020	OCEAN2020 (Open Cooperation for European mARitime awareNess), funded by the European Union's Preparatory Action on Defence Research and implemented by the European Defence Agency, represents the ambition and vision of a European maritime initiative, highlighting the strategic approach shared and undertaken by all partners. The project has the main objective to demonstrate enhanced situational awareness in a maritime environment through the integration of legacy and new technologies for unmanned systems, ISTAR payloads and effectors, by pulling together the technical specialists in the maritime domain covering the "observing, orienting, deciding and acting" operational tasks. In particular, the OCEAN2020 Consortium will address the problems of integrating EU systems and individual organisations into a coherent framework.
EL BG SUR	Enhance of the migration flow management at the southeast external border of the EU, through the creation of regional networks, for the exchange of the precise situational picture between Bulgaria and Greece in the context of EUROSUR. Creation of an electronic communication channel between the NCCs of Greece and Bulgaria, for exchanging information, regarding pre-frontier migration cases at the land borders.
SafeShore 2016 - 2018	The objective of SafeShore is to demonstrate the detection of RPAS, boats and humans on the sea shore beyond capabilities of conventional coastal radars. SafeShore will scan the horizon and create above the protected area a virtual dome shield. The SafeShore core solution is based on 3D LIDAR, all-new device that will be developed and integrated with passive acoustic and radio sensors and video analytics to achieve highly accurate detection of mini-RPAS.
Hellenic CISE 2016 - 2017	The project aims to develop the Hellenic information sharing environment towards an integrated national maritime surveillance environment. To reach its objective, the "Hellenic CISE" seeks to enhance cross-sector and cross border information exchange capabilities by delivering notably a Situational Picture Manager (SPM) and a Hellenic Coast Guard CISE adaptor.
CY CISE 2017 - 2018	CY CISE aims to develop the Cypriot information sharing environment towards an integrated national maritime surveillance awareness, complying with the overall European CISE vision. It builds on the knowhow developed within the Hellenic CISE project.
SEAGATE	Initiating the international operational cooperation of all entities in security systems of the Adriatic Sea, with the aim to establish unified control, joint exchange of operational data and information, joint undertaking repressive and preventive measures according to product of joint risk analysis and decisions, in order to effectively fight against all forms of cross border crime, strengthen border security, export controls and non-proliferation efforts and increase the level of security and safety on Adriatic sea.

Continuum of Projects	
InBulMarS 2017 - 2018	Integrated Bulgarian Maritime Surveillance aim to deliver national surveillance system as a set of currently built up Maritime surveillance systems of several national authorities and agencies.
ROBORDER 2017 - 2021	ROBORDER aims at developing and demonstrating a fully functional autonomous border surveillance system with unmanned mobile robots including aerial, water surface, underwater and ground vehicles which will incorporate multimodal sensors as part of an interoperable network. The projects intention is to implement a heterogeneous robot system and enhance it with detection capabilities for early identification of criminal activities at border and coastal areas along with marine pollution events.
CAMELOT 2017 - 2021	CAMELOT proposes to develop and demonstrate different advanced command and control service modules for multiple platform domains, based on a SOA architecture that specifies internal and external interfaces, allowing the development of a modular and scalable command and control station, customisable to the user needs. This architecture can be based on results of previous studies and work or open architectures that may prove more suitable and the interfaces can take advantage of the standardisation work that has been done already.
CREST 2019 - 2022	CREST aims to equip LEAs with an advanced prediction, prevention, operation, and investigation platform by leveraging the IoT ecosystem, autonomous systems, and targeted technologies and building upon the concept of multidimensional integration and correlation of heterogeneous multimodal data streams (ranging from online content to IoT-enabled sensors) for a) threat detection and assessment, b) dynamic mission planning and adaptive navigation for improved surveillance based on autonomous systems, c) distributed command and control of law enforcement missions, d) sharing of information and exchange of digital evidence based on blockchain, and e) delivery of pertinent information to different stakeholders in an interactive manner tailored to their needs.
VTMIS I 2011 - 2015	VTMIS (Vessel Traffic Monitoring and Information System) in Montenegro is consisted of procurement and installation of the high performance equipment for maritime surveillance and monitoring of ship traffic, such as: solid state X-band radars, VHF and AIS transceivers, radio-communication devices, VTMIS software, meteo stations, radio-goniometers, etc. VTMIS aims to enhance safety of navigation, as well as environmental protection. VTMIS equipment is installed on several strategic sensor locations and the data transfer is enabled from particular geopositions to MRCC (Maritime Rescue and Coordination Centre) and VTS (Vessel Traffic Service) centre of Montenegro. Data from VTMIS system are shared with European institutions such as EMSA, what enables Montenegro to be a part of European and regional data sharing systems (SafeSeaNet, CleanSeaNet, EU LRIT Data Centre, MARES, THETIS.)
VTMIS II 2018 - 2023	Second phase of VTMIS project is related to continuation of the plans for further development of VTMIS system in Montenegrin sea responsibility area. Aim of second phase is to install additional sensors (CCTV) in new sites (short range radars and AIS) and to achieve compatibility with systems like CISE, STM (Sea Traffic Management), SafeSeaNet, European Maritime Single Window environment and others.

## 2.3 Operational Drivers

"Operational drivers" refer to the reasons why, from the operational perspective, the User Community should come together and be collective and cooperate both at sea and land surveillance domains. These drivers stem from the ANDROMEDA project objectives as well as from the User Requirements presented in deliverable D2.2 and include: increase of available information sources, cost-effective operations, improved services, and

advanced operational effectiveness. A set of Operational drivers in the context of the ANDROMEDA project is described in the following Table.

Table 10: Operational Drivers

Operational Drivers	
1	Access to new information sources, advanced services and improved capabilities, and real time information. Increase the validity and accuracy of available information and the quality of the extracted intelligence. Increase the operational effectiveness.
2	Defining of Maritime CISE Model Enhancements and extending it to support Land Border Operations.
3	Utilise resources towards the same goal, leading to cost efficient usage of existing resources. Achieve cost effective solutions, and reduce operational costs.
4	Provide novel services utilizing advanced algorithms to collect and properly process large amount of heterogeneous dataset for early warning, forensic purposes and illegal act prosecution. Improved data fusion and analytics services capabilities regarding the observation of elements in the environment, the comprehension of the current situation, and projection of future states.
5	Collection and analysis of the available information in time allowing the authorities to react properly to these threats and facilitate decision making.
6	Collection and exchange of maritime and land surveillance information between border and coast guard authorities to handle complex illegal actions taking place between land and sea.
7	The ANDROMEDA e-CISE Data and Service Model will enable the sharing of mission operations to partner organizations.
8	ANDROMEDA shall offer sharing of live selected mission data (general location, description, goals) with partner organizations.
9	ANDROMEDA C2s shall exchange requests of information.
10	The ANDROMEDA C2 will display information received from other ANDROMEDA C2s in a different visual manner for the operator to distinguish local or external created or received information.

Design Drivers refer to basic principles and goals followed in the design of the ANDROMEDA C2 systems. These principles have been specified by the User Community (authorities in charge of land or maritime border surveillance and coast guard functions) through the Questionnaire completion, the in-person discussions, and workshop organization conducted in the context of deliverable D2.2. Some basic Design drivers, derived from the ANDROMEDA objectives, and the User Requirements (mainly the General User Requirements and Operational Needs, and the Non-functional User requirements) presented in D2.2, are listed below.

Table 11: Design Drivers

Design Drivers	
1	The ANDROMEDA System design will incorporate Service Oriented Architecture (SOA) design principles by offering services which are modular and scalable. Design will be based on usability, operability, accessibility, and security principles.
2	ANDROMEDA System shall offer secure communications for data exchange defining the classification level of the information.
3	ANDROMEDA System architecture design shall be based on best practices (e.g. privacy-by-design and security-by-design) and open standards and shall be designed in such a way that its components can be upgraded, replaced, or easily extended with additional services.
4	The ANDROMEDA System design shall be based on the CISE data model classes, entities and attributes. The system architecture will be standardised and follow a modular approach along with a common data model (e-CISE).

Design Drivers	
5	ANDROMEDA System shall provide secure desktop-based applications enabling users to request and show information managed by the system. ANDROMEDA C2s as part of the ANDROMEDA System are accessible through various means (browsers, desktop apps, mobile terminals).
6	ANDROMEDA System shall provide means for the storage, archiving and backup of data and shall guarantee data integrity of any stored data.
7	ANDROMEDA Data distribution services shall guarantee the security, integrity and availability of exchanged data.
8	ANDROMEDA System shall provide role-based authentication system.
9	ANDROMEDA System shall provide means for protection of personal data (e.g. controlled access to personal data) according to EU GDPR and DPD data protection rules.

## 2.4 User Community Interactions

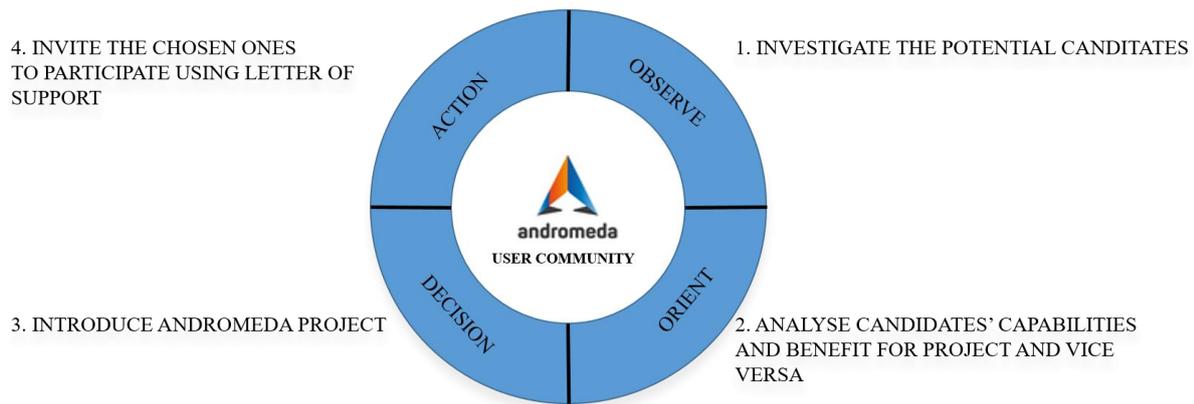
ANDROMEDA User Community is described in chapter 2.1 and it covers not only project partners, but also additional organisations, both users and providers of data and services, who has been invited into the project as external partners to support and advise project partners with their experience and expertise.

The user community interactions described in this chapter are divided into two categories, actualized interaction organized by WP2 and Task 2.1 and the interaction validated in ANDROMEDA Trials. In D2.1 the foreseen interactions were described in organisational and system level interaction. While the WP 6 is in responsible for technical part of the trials and describes the received technical achievements in D6.2 this deliverable concentrates in authorities interaction in trials.

According to Grant Agreement Task 2.1 “will form the ANDROMEDA community of practitioners focused on the goal of “innovation”, delivering the benefits of the Information Sharing Environment through the enhanced CISE models for Land and Maritime Border Surveillance and Monitoring. The functionalities of the C2s and the ways that they will implement the CISE service model will first and foremost be driven by this user community. Community mechanisms will be created (as part of the ANDROMEDA Web Site implemented in WP7) to foster interactions. The user community will be set-up involving user partners as well as external end users invited to join the initiative and links of consortium partners of the ANDROMEDA consortium to past and on-going initiatives in the domain (EUCISE2020, EWISA, MARISA, RANGER, CLOSEYE, PERSEUS, CoopP etc.) will speed up the process.”

The T2.1 work started in October 2020 in 2<sup>nd</sup> Plenary Meeting where the User Community structure, building strategy and responsibilities were presented and agreed. The basement of the Andromeda User Community was built on Consortium members and the nature of the organisations gave a natural and logical formation for User Community roles of Industrial, Academic & RTO and End-User Community.

The User Community was extended with External Partners who were not part of consortium but are ready to support and advise the project with their knowledge, expertise and experience from other projects. The User Community extension strategy was based on ANDROMEDA Trials objectives and goals. According to Trials objectives and as part of T2.1 work, the potential external partners were investigated from ongoing and recently closed EU funded projects and from other beneficial organisation from the EU countries and outside the EU. The main projects in the focus were ARESIBO, ARCSAR, CAMELOT, EUROSUR, EUCISE 2020, MARISA, MEDEA, ROBORDER, OCEAN2020 and TRESSPASS. By using the OODA method, the potential and beneficial external partners were chosen and invited to ANDROMEDA User Community using the Letter of Support. The process is continuous and new external partners will be searched through the project’s duration. The figure 1 presents the User Community forming methodology.



*Figure 1: The User Community forming methodology*

The User Community extension was continuous process and all partners were encouraged to invite potential external partners to support the project during the projects life time. However, for extending the User Community with External Partners, three separate recruitment camping were organised. The first one was organised in timeframe February 2020 – May 2020 and it focused to all External Partners Communities using the methodology described in Figure 5. The potential External Partners were familiarized to ANDROMEDA and invited to ANDROMEDA User Community with an intentional Letter of Support. During the first campaign, 47 invitations were send to potential external partners and 20 new External Partners form 8 countries responded positively.

The second campaign, focused on land border authorities and itwas carried out during the summer 2020.

The third campaign was launched in Autumn 2020 after receiving the mid-term review report where it was stated that User Community should be extended to include land border authorities outside the Mediterranean basin. The outcome of the third campaign were 3 new External Partner who joined the ANDROMEDA User Community.

During the project’s final phase in Spring 2021, three additional external partners joined the ANDROMEDA User Community. The final ANDROMEDA User Community consists of 19 consortium members, 3 EU Agencies, 12 external End Users (four representing Land Border authorities), 7 external Academies and Research organisation and 4 Industrial partners. Additionally, 5 EU funded projects provided their support to ANDROMEDA project. The figure 2 presents the ANDROMEDA User Community.



Figure 2: ANDROMEDA User Community

For co-operation and information sharing purposes project and T2.1 provides several possibilities. The ANDROMEDA Forum was opened in May 2020 for ANDROMEDA User Community. The original idea was to provide the discussion and information sharing forum for partners. The ANDROMEDA Forum consists of five different discussion forums in order to guide the discussions according the area of interest (Figure 3). All partners were able and encouraged to start the discussions in all available Forums. The idea of different forums was to make the Forum functional and well defined. The structure of ANDROMEDA Forum is presented in Figure 3.



Figure 3: ANDROMEDA Forum

However, the forum did not have the expected results due to the low level of interaction between the user community. Therefore it was deemed to organize additional surveys and open discussions for User Community to clarify partner’s opinions and to receive their feedback.

As a part of 3<sup>rd</sup> project meeting the User Community session was organized in May 2020. The session focused to external and potential external partners, including presentations of ANDROMEDA innovative and technical solution and ANDROMEDA Trials. The Sessions concluded the discussion part where the new partners had the opportunity to inform their ability to support ANDROMEDA project. Altogether, 77 participants from 26 organisations attended the User Community Session.

Trials were utilised for T2.1 work in three different ways. Firstly, the objectives of the Trials were the T2.1 approach to recruiting external End-Users (partners). Secondly, Trials were a mean to the project to validate and share the ANDROMEDA’s achievements to End-Users and external partners. Thirdly, the Trial results were used as basement of this deliverable sections 2.4 User Community interactions, 2.5 Implication, 4.3 Gap analysis and 4.5 Potential of ANDROMEDA.

Task 2.1 arranged three surveys during the Trials and one after the Final Workshop and Demonstration Event in purpose for collecting end-users and external partners opinions of the gaps in information sharing, to find out the Potential of ANDROMEDA and ANDROMEDA’s implications regarding the Command and Control, Economy and Authorities co-operation. Additionally, the Forum was used as a discussion forum for gathering partners’ feedback. Results of the surveys are used for formulating the section 2.5 implication and section 4.5 Potential of ANDROMEDA. The EU-Survey online tool has been used to organize the Surveys. The Survey questions are presented in Annex B and main received feedback in Chapter 4 User Community Reflection and Recommendations.

### 2.4.1 User communities and their purposes

European Commission Maritime Affairs and Fisheries identified seven functions referred as User Communities or sectors relevant to the maritime surveillance on 2010. User Communities have following functions: 1) Maritime Safety (including Search and Rescue), Maritime Security and prevention of pollution caused by ships; 2) Fisheries control; 3) Marine pollution preparedness and response; Marine environment; 4) Customs; 5) Border control; 6) General law enforcement; and 7) Defence.

User Communities and their monitoring and supporting purposes are described in Table 12 below.

*Table 12: User Communities and purposes*

User Community	Monitoring and supporting purposes
Maritime Safety, Security and prevention of pollution	• Vessel traffic management
	• Vessel Traffic Safety
	• Monitoring of security of ships
	• Search and Rescue
	• Support of response and enforcement operations (anti-piracy, SAR, salvage)
Fisheries Control	• Early warning of illegal fisheries or fish landings
	• Monitoring of compliance with regulations on fisheries
	• Support of response and enforcement operations
Marine pollution preparedness and response	• Monitoring of compliance with regulations
	• Early warning of environmental accidents and incidents
	• Support of pollution response operations
Customs	• Monitoring of compliance with customs regulation on import, export and movement of goods
	• Support of enforcement operations

User Community	Monitoring and supporting purposes
Border Control	<ul style="list-style-type: none"> <li>Monitoring of compliance with regulations on immigration and border control crossings</li> </ul>
	<ul style="list-style-type: none"> <li>Support of enforcement operations</li> </ul>
General Law Enforcement	<ul style="list-style-type: none"> <li>Monitoring of compliance with applicable legislation in sea areas where police competence is required</li> </ul>
	<ul style="list-style-type: none"> <li>Support to enforcement and response operations</li> </ul>
Defence	<ul style="list-style-type: none"> <li>Monitoring in support of defence tasks such as national sovereignty at sea</li> </ul>
	<ul style="list-style-type: none"> <li>Combatting terrorism and other hostile activities outside the EU</li> </ul>
	<ul style="list-style-type: none"> <li>Other Common Security and Defence Policy (CSDP) tasks as defined in Articles 42 and 43 TEU</li> </ul>

## 2.4.2 Interactions in Trials

The interaction for trials could be seen taken place throughout the project’s duration. During the Task 2.2 (User Requirements and Technical Specification) User Community specified the requirements for the ANDROMEDA components and in the Task 2.4 (Operational Scenarios & Trial Definition) the User Community had central role for detailing trial scenarios and validation metrics which were used for ANDROMEDA evaluation. For the execution phase for each Trial, seven authorities from five countries and consortium’s seven industrial companies worked together for planning and carrying out three long-lasting Trials. Interaction and co-operation had two levels. The high level co-operation of the authorities was the willingness and positive attitude to participate in ANDROMEDA’s Trials. Authorities provided their operational centre’s facilities, C2 systems and personnel for enabling the trials’ arrangements. The connections between operational centres and C2 systems were the key element of evaluation in ANDROMEDA trials. The second level of co-operation was performance-level collaboration, where operators and technicians built the environment and operated in their own roles through their operational C2 systems.

While trials’ scenarios are based on the use cases defined in CoopP, the deliverable D2.1, Initial User Community Report, includes the description of authorities typical co-operation and interaction in the activities and basic idea was to describe the actualized interaction in this Final Report. However, to avoid duplicated information and due to potential sensitive information regarding the execution of the trials, the respective scenarios and detailed results are documented in deliverable D6.2 Operational Trials Results Report and Lessons learnt. In the following sections the overall goal and the main objectives per Trial are described.

### 2.4.2.1 Interactions in Trial 1

The main objective of this trial is to improve the situational awareness of the Maritime Operational Centres allowing the exchange of information between them through the ANDROMEDA tools. The end users involved in this trial were Italian Navy and Portuguese Navy testing the CoopP use cases 47 and 34 (monitoring all events at the sea in order to create conditions for decision making on interventions also in case of maritime accidents/ disasters and request of identification, position and activity of vessel). The interaction in this trial took place mainly between C2 systems using ANDROMEDA and CISE hub. From the technical partners Inovaworks as the trial leader was responsible for the arrangements and Engineering and Codin were involved in their own roles in the arrangements. The trials structure, activities and general geographical location are presented in Figure 4.

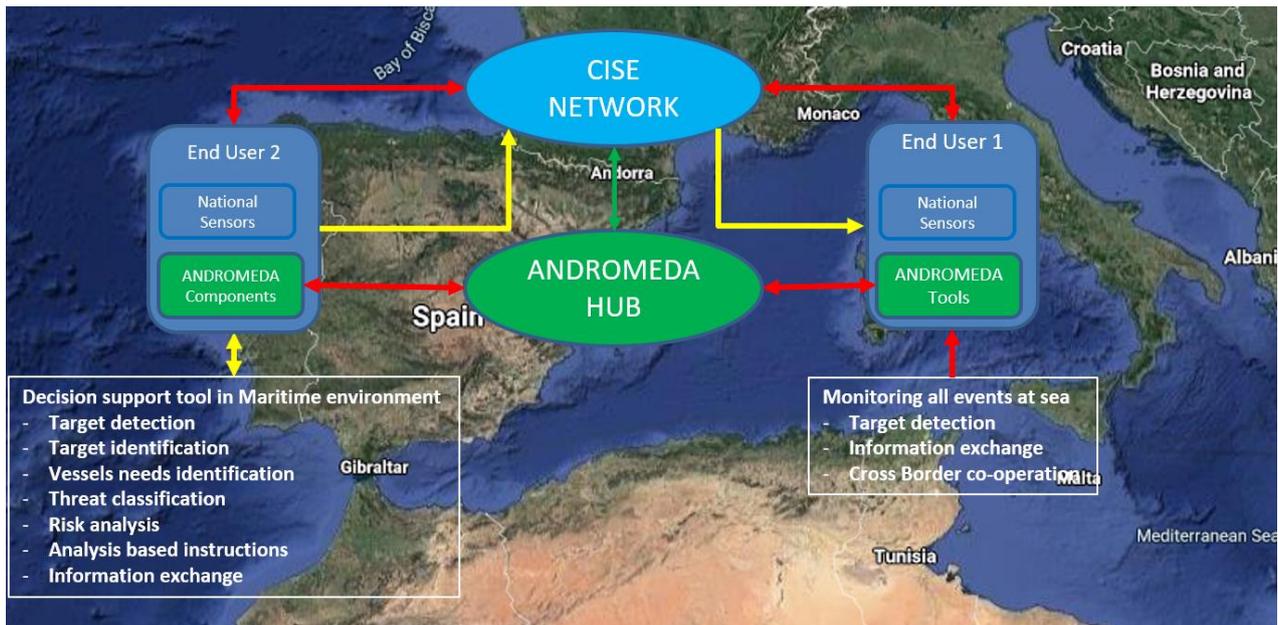


Figure 4: The Iberian Maritime Border Trial

#### 2.4.2.2 Interaction in Trial 2

This trial indicates the ANDROMEDA value of user community interactions for cross border, cross sectorial Maritime & Land border control operations as well as land and maritime surveillance including the information sharing between partners. The Trial indicates in best ways the beneficially of User Community interaction in this kind of project. The Trials preparation for making the Trial become reality required flexibility, innovative thinking and above all willingness for co-operation. The Trial covered both ANDROMEDA’s target groups, Land and Maritime authorities. The planned scenarios provides a fruitful platform for authorities interaction and the system level interaction highlighted the CISE enhancement on Land Border operation which was one of the ANDROMEDA goals. Satways was the trial leader, MMAIP, EAMA, Hellenic Police, Hellenic Coast Guard and Hellenic Navy participated as End-Users in this trial.

The main objective of these scenarios was to demonstrate to the end users interoperability through advanced CISE with the improvement of situational awareness using the ANDROMEDA services and providing the improved common operational picture (COP) in parallel with the legacy automated surveillance system controlled by the local C2. On its own way the trial was unique and demonstrate in proper way one of the main interest of the ANDROMEDA by testing the enhanced CISE capabilities for Land Border activities. The trials structure, activities and general geographical location are presented in Figure 5.

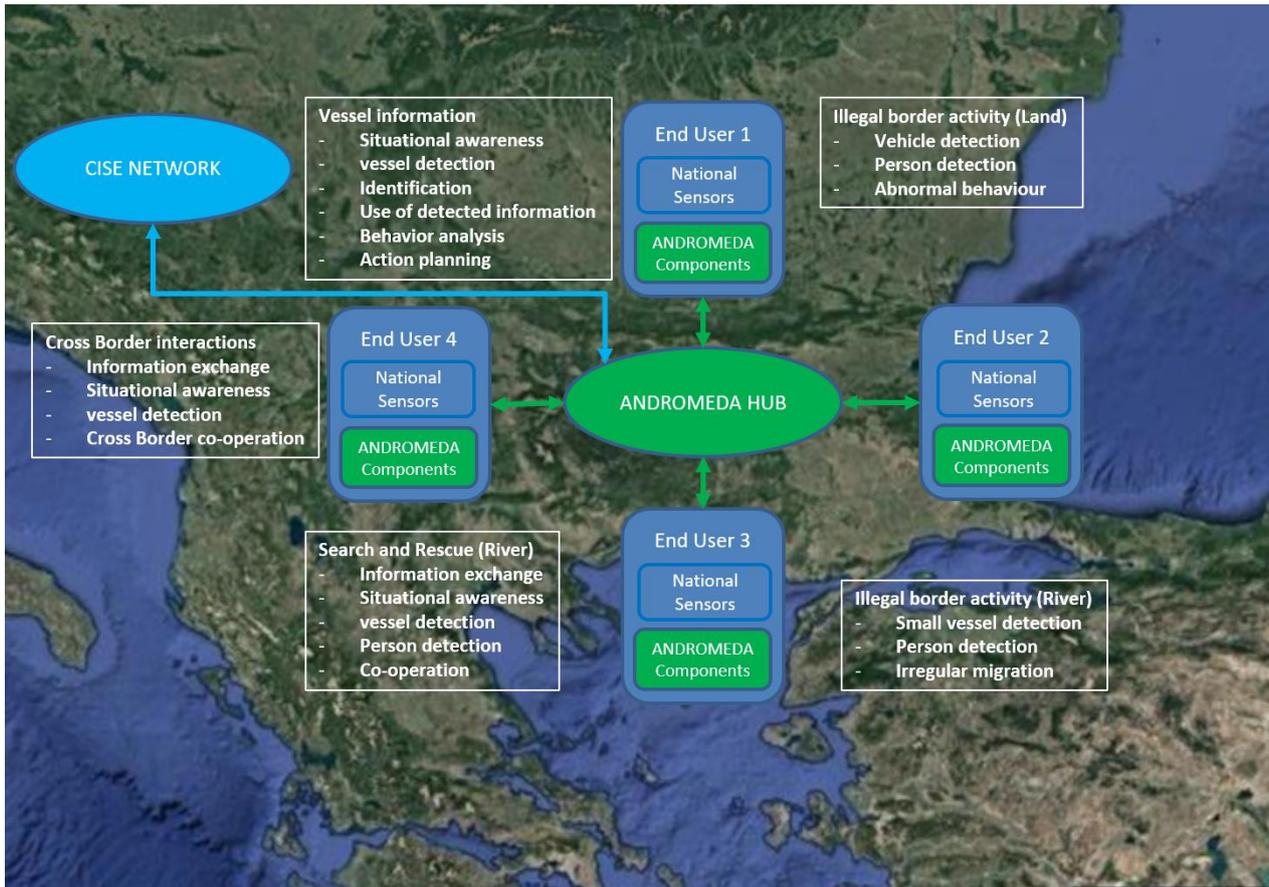


Figure 5: The Greece-Bulgarian Land Border – Maritime Trial

The context of this trial was illegal immigration from Turkey to Europe. Immigrants gather in the main Turkish cities (e.g. Istanbul and Edirne) and cross irregularly from Turkey to Europe, trying to avoid physical or other obstacles (e.g. fences). In many cases, the route of choice is one crossing the Evros river on the border between Greece and Turkey while the route is shorter but also often a treacherous one<sup>7</sup>. Along land and / or river borders, facilitators take over to illegally transfer them to Greece or Bulgaria or forward them near the border and then show them where and how to continue.

The specific objectives of this trial were:

- the detection of possible patterns of anomalous behaviour of the vessels/vehicles used for trafficking in human beings;
- the anomaly of the movement / detection of objects that identify a group of people moving along the land borderline or objects left on the riverbank;
- best performing tools for timely detection of suspicious vessels/vehicles and identification of threats and support tool for search and rescue decisions;
- demonstration of an improved COP among the main actors in the area.

Detection of suspicious behaviour alarmed by specific ANDROMEDA services will be automatically injected into the ANDROMEDA C2. The respective End User will manage this information for task services such as mission preparation, tasking and automatic asset control, mission data management followed by a reporting

<sup>7</sup> <https://www.infomigrants.net/en/post/11678/migrant-route-from-turkey-more-popular-60-stopped-in-2018>

cycle with local C2s. The purpose is to support common border control operations as well as land-based and maritime surveillance.

### 2.4.2.3 Interactions in Trial 3

The objectives of this trial were to demonstrate the advanced C2 system interoperability through the enhanced CISE and Situational Awareness through the advanced DF, Analytics and Decision Support Services.

The area of interest in this trial is the Ionian-Adriatic Sea, where human trafficking represents the second step irregular migration way to ship migrants from Turkey to EU by using many different kinds of vessels. The trials structure, preliminary activities and general geographical location are presented in Figure 6.



Figure 6: The Ionian-Adriatic Trial

The trials specific objectives are:

- the detection of possible abnormal behaviour patterns of vessels used for human trafficking, a common intervention in case of maritime accidents;
- a better performing tool for earlier detection of suspicious vessels and identification of threats even in high (summer) traffic density;
- the demonstration of an improved common situational picture between main actors in the area;
- a short reporting cycle between the C2 that detect the suspicious vessel and other C2s for continuously tracking the suspicious vessel and usage of Decision support tools such as oil spill, ship routing and search and rescue.

The trial was led by CODIN. The Italian Navy, Hellenic Navy, Hellenic Coast Guard and Administration for Maritime Safety and Port Management of Montenegro (former Maritime Safety department of Montenegro) involved the trial in End-Users role.

## 2.5 Implications

The ANDROMEDA ambition is to unlock the full capabilities of the CISE Model by extending the scope to Land Surveillance and distribute a set of systems which enable faster detection of new events, better informed decision making and improves joint understanding and undertaking of the situation across borders. The approach for implications discussed in this section is focused on End Users operational interactions and needs.

The implications of ANDROMEDA User Communities interactions are specified from three perspectives; Command and Control, Economical and Co-operation perspective. The implications under these three subject areas described in this section are formulated by combining the ANDROMEDA technical utilities, user community discussions in workshops and observation during the trials. The technical utilities and advantages ANDROMEDA accomplished are in detailed presented in deliverable D6.2 Operational Trials Results Report and Lessons learnt. The Tables 13 – 15 present the overall subjects regarding each area.

*Table 13: The implications regarding the Command and Control*

Influence	Indication
Situational awareness and decision making	The ANDROMEDA solution increases the Situational Awareness and provide new tools for C2. The sensor fusion, automated threat calculation, and information sharing combined with information sources, e.g. INUS, VISIR, WITOIL ease the decision making process by presenting only the relevant information. The e-CISE data model enlarge the situational awareness among ANDORMEDA Users to Land Border activities. One of the main implication related to situational awareness ADNROMEDA brings is the ECCA tool which enables the information sharing between CISE and ANDROEMDA e-CISE data format.
Authorities cooperation	Related to above mentioned capabilities ANDROMEDA improves the authorities' cooperation regarding SAR operations, assist to prevent environmental disasters and support the action to be taken in case of an accident. The ANDROMEDA approach is fully in line with CISE standards and allows all participants to complement their national expertise and share information to raise maritime safety and security to a higher level. The information, experience and practices shared between the competent authorities will lead to a safer and more secure maritime area, ease of risks, a better response to SARs, environmental protection, etc. Good impact on relations between maritime safety agencies contributes to strengthening the international institutional framework.
Interoperable C2 systems	ANDROMEDA supports the C2 systems interoperability without making any changes on existing Legacy Systems both in Land and Maritime domain. Automatic information sharing, multiple sensor connectivity, areal coverage, information flow. The C2 platforms have many utilities for professionals and users as they correspond to the defined maritime use cases defined in the previous stages of project implementation.
Usability in different networks/ consortiums	The trials have shown the ANDROMEDA's flexibility to use in different networks. ANDROMEDA could be used in centralised (local area) networks build on ANDROMEDA solution providing possibility to share information from land and maritime domains. In decentralised networks such as CISE or Frontex, ANDROMEDA could be used to prove its utilities of e-CISE data format improving the land domain information for the network. In hybrid networks the benefits are the combination of centralised and decentralised network utilities.

Influence	Indication
Environmental disaster	<p>Increased information of suspicious vessels provided by information sharing, data fusion and analysing components increases the situational awareness and assists the command centres to foresee potential risks. The mission cards functionality eases the co-operation between operational centres, keep up the situational awareness and assists in the decision making process and tasking the units in disaster control and response measures.</p> <p>The sea current stimulation enables the navigational instruction for the vessels carrying cargo which could in case of marine accident cause environmental disaster. Moreover, it provides forecasts to authorities and assists them in disaster cases to direct the prevention activities according to wind and sea in advance. CISE network provides the information needed.</p>
Search and Rescue	Improved C2 to C2 information exchange, mission planning, tasking, reporting. The mission cards ease the information sharing who is doing and what. It also enables the cross sector and cross border authorities' joint operations. Threat calculation, abnormal behaviour patterns combined with data fusion and near real time information sharing increase the SAR operations effectiveness.
Crime prevent efficiency	<p>Early warning of illegal refugees/immigration, mitigation of smuggling, ANDROMEDA offers several capabilities useful for risk analysis, target profiling and live operations from the perspective of anti-drug trafficking operations.</p> <p>The Service Providers weather forecast shared via ANDROMEDA hub provides to the authorities the information where the illegal human trafficking as well as anti-drug trafficking is able to carry out and the counter measures could be directed for potential areas.</p>

The development and use of joint systems between collaborating member states forms a cost effective operational environment compared to isolated development and point to point integration. For joint Border Control operations ANDROMEDA has the potential to increase the operational efficiency and reduce operational costs in cross border cross sector operations. Table 14 describes ANDROMEDA User Community's influence to Economy.

Table 14: The implications regarding the Economy

Influence	Indication
Authorities cooperation	The cross-sector and cross-border authorities cooperation lead in improved situational awareness. The improved SA by sharing the information in ANDROMEDA context means less duplicated data, mitigation of illegal traffic in border areas, wide range of surveillance tools mitigating the need of human resources in border surveillance. The cooperation also enables multinational purchases of surveillance material. The introduction of the ANDROMEDA in maritime safety and security agencies will contribute to overall cost reduction of information sharing processes.
Interoperable C2 systems	ANDROMEDA enables the C2 systems interoperability via the Node and ANDROMEDA Hub. The e-CISE data model provides the solid foundation for cost effective information sharing among Land and Maritime border authorities daily routines. ANDROMEDA is an advanced tool for enhancing control and information exchange, can have a good economic impact, as it covers both land and sea areas in a very efficient way. Deployment of the CISE network is the future of coordination and communication between agencies in the maritime sector.

Influence	Indication
Operators work payload	Sensor fusion, data fusion, threat calculation and the overall automation in information processing ease the operators stress and work payload. The well-being of the employees has the indirect connection economic benefit ANDROMEDA could provide. Investments in the ANDROMEDA system application will benefit users, they will benefit organizations after deployment, and the continued deployment of the CISE network will be the future of coordination and communication between maritime agencies.
Joint procurement	According the Gap analysis presented in section 4.3 the authorities interest in information sharing is geographically focused and subject related. ANDROMEDA could be tailored according to local needs assessments for information sharing and the joint system procurements provides economical synergy benefits for the information sharing community. The joint procurement of information sharing solution influence also with long term economic savings e.g. in maintenance, training, system upgrade.
Search and Rescue operation	Better situational awareness is key to cost-effective use of resources in SAR operations. Being able to focus sufficient resources in right time in the right place in each operation the injuries could be mitigated, the environmental casualties minimized and reach economic savings.

The success in processes, interests and actions related to border surveillance is mainly based on cross border cross sector authorities cooperation. The enhancement of CISE to Land borders more over facilitate and increase the importance of the User Community’s cooperation in European level Border and Coast Guards. The Table 15 describes the ANDROMEDA components and systems influence to cooperation.

Table 15: Implications regarding the Co-Operation

Influence	Indication
Situational awareness	For co-operation ANDROMEDA provides a valuable tool. The solution could be used in authorities local area, e.g. Baltic sea, information sharing as well as it could connect the centralised networks to decentralised networks as the CISE represents. e-CISE data model enables the integration with land border command and control systems to maritime domains increasing the co-operational possibilities among the authorities. The ANDROMEDA is compatible with existing C2 systems which increase its’ potential when discussing about cross sector and cross border situational awareness.
Search and Rescue operation	Authorities using the same COP which the ANDROMEDA components could provide have the better readiness for co-operation in SAR operations. Planning preparation and common procedures the solution provides basement for successful SAR operations and co-operation during the operations. Improved C2 to C2 information exchange, mission planning, tasking, reporting and e-CISE adaptor functionalities for trajectory information sharing supports the co-operation in SAR operations.
Crime prevent efficiency	<p>Early warning of illegal refugees/ or immigration, mitigation of smuggling, ANDROMEDA offers several capabilities useful for risk analysis, target profiling and live operations from the perspective of anti-drug trafficking operations.</p> <p>The Service Providers weather forecast shared via ANDROMEDA hub provides to the authorities the information where the illegal human trafficking as well as anti-drug trafficking is able to carry out and the counter measures could be directed potential areas.</p>

Influence	Indication
Enhancement to Land border surveillance and security	This is the one of the main advantages of ANDROMEDA. By extending the CISE to Land domain ANROMEDA provide efficient tools for cross border cross sector information sharing and co-operation for authorities in both Land and Maritime domain.
Environmental disasters prevention	<p>Increased information of suspicious vessels provided by information sharing, data fusion and analysing components increases the situational awareness and assists the command centres to foresee potential risks. The mission cards functionality eases the co-operation between operational centres, keep up the situational awareness and assists in the decision making process and tasking the units in disaster control and response measures.</p> <p>The sea current stimulation enables the navigational instruction for the vessels carrying cargo which could in marine accident cause environmental disaster. Moreover, it provides forecasts to authorities and assists them in disaster cases to direct the prevention activities according to wind and sea current in advance. CISE network provides the information needed.</p>

### 3. Methodology

In this part of the deliverable report, the central methodological issues of ANDROMEDA research, development and innovation action activities are described: (1) introduction of the quality approach; (2) animated operation and quality assurance processes as data collection practices; (3) continuum of the research, development and innovation methods used; (4) triangulation as a basis for analysis in development; (5) research and development attributes; and (6) the setting of readiness level measures. In this report, the term ‘research and development method’ refers to procedures for collecting and analysing data, and the term ‘analysis’ addresses the processes of investigating and interpreting quantitative and qualitative data in order to gain a deeper understanding of and new knowledge for designs and realization of ANDROMEDA Project trials.

#### 3.1 Approach to Quality

In ANDROMEDA, the approach to quality is addressed to the six aspects in terms of quality: (1) internal validity; (2) construct validity; (3) authenticity and transparency; (4) reliability, dependability and auditability; (5) a real sense of objectivity; and (6) the utilization of the trials and concepts. The description of the quality terms are comprised to the followed table.

*Table 16: The Description of Quality Aspects in ANDROMEDA*

Description of Quality Aspects in ANDROMEDA	
Internal validity	The term “internal validity” refers to newly created three trials, both parallel and alongside the analyses and methods, models and new processes; the objective is to ensure that the new concepts and models are logical, authentic and internally valid from the perspective of realization of information systems, security and service, as well as that trials are suitable to the operative domain and dissemination.
Construct validity	The term “construct validity” refers to the correct operational measures for the theme being developed; then, the view of construct validity is addressed to the extent that “what was to be measured was actually measured” or “it measured what you think it measures”.
Authenticity	The terms “authenticity and transparency” refers to participators’ thinking and new ideas which emerge, new models, new services and new information systems; in this, the realization process is seen as a continuum of proactive-strategy-process-result-impacts and its feedback, such as: development by success; learning by failure; and incremental development by feedback.
Reliability	The terms “reliability, dependability and auditability” refers to demonstrating that the operations of a trial, such as the data collection procedures and development interventions, can be repeated with the same results.
Objectivity	There is a real sense of “objectivity” when the quality-system-based data that are gained directly from the practice are not tainted or manipulated by the perspectives, biases, defences or experience of participators or other facilitators; therefore, the samples of evidence are gathered from concrete evidence and partially from the reality that came from the participators’ anticipation-experimentation, which bring forth their experience based assumptions, views, thinking, beliefs, trust and spirit along with the collective reflection of the data.
Utilization	The terms “utilization of the trials and concepts”, is the use of guidance models and an action logic of quality with implementation of operational development and globalization to everyday learning, development, and research activities in the domain,

Description of Quality Aspects in ANDROMEDA	
	which refers to the utility of new artifacts (trials and services), possible further adapted services and methodologies.

### 3.2 Operative Process and Data Collection

In ANDROMEDA, the discussion of a common operation process (data collection from operations) has been diverse and relatively challenging theme; however, the observe, orient, decide and act (OODA) loop has been commonly considered to be one of the most expressive operation process models in the ANDROMEDA context. The process cycle includes the (1) observe, (2) orient, (3) decide and (4) act phases. The OODA loop was developed by military strategist and United States Air Force Colonel John Boyd. Boyd applied the concept to the combat operations process, often at the operational level during military campaigns; regardless of its military origin, it is currently also applied to understand commercial operations and learning processes (cf. resilient learning theme in the discussion part). The approach examines how agility and resilience can overcome the raw power in dealing with human opponents as element comprised to followed table.

Table 17: The Description of OODA Process

Continuous OODA Process (cumulative data collection) in ANDROMEDA		
Observe	Unfolding circumstances.	Outside information to orient.
Orient	Cultural traditions; previous experience; new information; genetic heritage.	Analyses, synthesis and implicit guidance and control to action.
Decide	Discussions.	Forward to action.
Action	Produce feedback.	Unfolding interaction with environment.
Feedback for OODA		

The OODA loop has become an important concept in litigation, business, law enforcement and military strategy. According to Boyd, decision-making occurs in a recurring cycle of observe-orient-decide-act. An entity, whether an individual or an organization, that can process this cycle quickly, observing and reacting to unfolding events more rapidly than an opponent, can thereby ‘get inside’ the opponent’s decision cycle and gain the advantage. Boyd developed the concept to explain how to direct one’s energies to defeat an adversary and survive. Boyd emphasized that ‘the loop’ is actually a set of interacting loops that are to be kept in continuous operation during combat. He also indicated that the phase of the battle has an important bearing on the ideal allocation of one’s energies. The O-O-D-A loop, which is described in the previous table, focuses on strategic military requirements; however, it has a strong resonance for the business and public sectors’ operational continuity planning, and it can be compared with the plan-do-check-act (PDCA) cycle or the Shewhart cycle.

Boyd’s OODA Loop diagram, as a proposal for a process model, focuses on decisions that are based on observations of the evolving situation and are tempered with implicit filtering of the problem being addressed. According to Boyd, the observations are the raw information on which decisions and actions are based. Here, the first O represents observed information that can be processed to orient towards decision-making, as Boyd described in ‘Organic Design for Command and Control’. The second O is orientation, as the repository of our genetic heritage, cultural tradition and previous experiences can be seen as the most important part of the O-O-D-A loop since it shapes the way we observe, the way we decide and the way we act.

### 3.3 Applied Design Science Research Methodology

The DSRM ([Design Science Research Methodology](#)) is applied in the ANDROMEDA project and it addresses the incremental alignment of the innovative services to the end-user needs and evaluates the implementations with respect to the needs. A key element driving in the ANDROMEDA User Community is the collaborative involvement not only to end-users but also of all stakeholders, bringing together expertise in data fusion technologies and maritime as well as land surveillance solutions, during and beyond the scope and lifetime of ANDROMEDA. In this case, the word “stakeholders” refers not only to project partners, but also to additional organizations, both end-users and providers of data and services not directly involved in the project that support and advise project partners with their experience and know-how throughout the project’s duration. In ANDROMEDA, the DSRM is addressed to provide end-user-centred “co-creative space” for the design, development, improvement, integration, and validation responsibilities and to serve as a structured approach on which the harmonization and standardization proposals stemming from this project can be built. The ANDROMEDA DSRM process model includes interdisciplinary approaches and involves the use of stakeholders’ knowledge for product-service design and development. The setting of the ANDROMEDA DSRM process (1-7) model is described in the following Figure 7 (cf. ANDROMEDA GA Page 22 of 174).

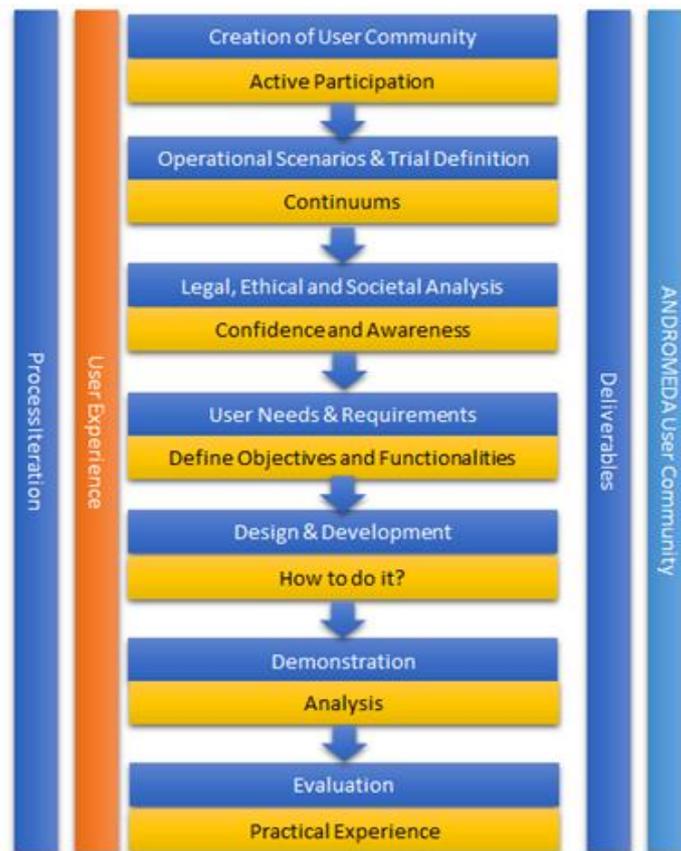


Figure 7: Revised Design Science Research Methodology (DSRM)

In this respect ANDROMEDA adapts a revised version of the improved DSRM, a user-oriented methodology for the design and development of Information Systems. The improved DSRM is adapted to fit ANDROMEDA purposes (see Figure 1) and provided the means of continuous involvement of the user community driving the user needs and evaluations of implementations incrementally in 3 trials. Finally the user-centred approach provided a first class opportunity to build the harmonization and standardisation proposals stemming from this project. The research doctrines of DSRM in ANDROMEDA are collected to the followed table.

Table 18: Revised DSRM in ANDROMEDA

Revised DSRM in ANDROMEDA	
Artifacts	The practical means for doing DSRM in ANDROMEDA is in the development of maritime and land surveillance services and products as produce a workable artifacts in the form of a construct, a model, a method, or an instantiation: it can be said that doing research for ANDROMEDA innovations. The expected outcome is that ANDROMEDA tools and services are purposeful.
Problems	The objective of ANDROMEDA DSRM is to develop technology-based solutions as tools in the three trials to important and relevant operational and business problems. ANDROMEDA outcomes are addressed to the specified maritime and land surveillance domain.
Design	Design includes the utility and efficiency of a design artifact which are rigorously demonstrated via verification, evaluation and validation methods. ANDROMEDA tools and services have the high readiness for integration of the artifact within the technical infrastructures of the maritime and land surveillance environments.
Contributions	ANDROMEDA Deliverables offers clear and verifiable contributions in the areas of the design artifact, design foundations and design methodologies. This is addressed to the novelty as solving problems in more effective and efficient manners in ANDROMEDA.
Rigorous	DSRM in ANDROMEDA relies upon the application of rigorous methods in the construction and evaluation-validation of the design artifacts as ANDROMEDA tools and services. This is addressed to adherence to appropriate data collection and analysis techniques such as triangulation.
Searching	The search for an effective artifact involves utilizing available means to reach desired ends while satisfying laws in the problem environment. This is addressed to discovering of an effective solution to problem with an appropriate ethical-legal consideration.
Ethic & Legal	Consolidation of analysis of the ethical-legal frameworks and societal implications; ethical issues in order to guarantee that all ethical and legal issues related to activities have been properly considered; providing guidance on legal, ethical and societal issues of solutions; and reporting of traditional research ethics and implementation of fundamental rights and the data protection aspects.
Communication	ANDROMEDA DSRM is presented effectively to technology-oriented, management-oriented and ethic-oriented audiences. ANDROMEDA project offers technology-oriented, management-oriented and ethical-legal oriented presentations and deliverables for reviews and audiences.

The practical means of DSRM are in doing research for the development of maritime and land surveillance services and viable products as doing research for co-creating of ANDROMEDA innovations. The ANDROMEDA DSRM process model is based on the triangulation of existing research data. It offers a model upon which the DSRM can be built, as well as the evaluation and representation of the results. The ANDROMEDA DSRM process contains seven phases that cover the parts of the system design-development-dissemination process in the ANDROMEDA project. Here, the traditional DSRM process model is improved: it more effectively takes end-users and stakeholders and ethical-legal consideration into account when planning new information systems or when the system is changed, even fundamentally. Additionally, it can include a ready-made system or service (adoption) into the process or the phase for which it is designed. In this setting, the basic thought behind the DSRM process is that, too often, only the designer knows the purpose for which the system is built; the difficulty with that is that the designer alone may know the processes and procedures, thus making the end-users unmotivated and their participation unnecessary.

Usability and confidence are vital parts of any information system; hence, the end-user and the user experience are considered when designing a system or information-intensive service. End-users and stakeholders are

involved throughout the entire design process, making them more committed and giving confidence to the deployment of the artifacts, tools and services. Design theories and DSRM can be used in the engineering, but they also need to offer services and solutions for the actual end-users, actors and authorities that build confidence and promote trust-building-sharing, as well as the supporting co-creativity aspects and consolidation of analysis of the ethical-legal frameworks and societal implications. The contribution of the ANDROMEDA and MARISA (first version) DSRM process model continuum is in line with those in the literature in that many systems and services fail because technical experts do not fully understand the complicated processes and the requirements of the end-users and actors. It was discussed in the ANDROMEDA User Community that even a poorly-designed system can function for a long time if it fulfils end-user and stakeholder needs. However, so far, the ANDROMEDA project remarked for the future that it is still possible to learn to contribute to the information systems and services design process. One difficulty involved with the methods may also be that these methods use only what has been used previously; they confer path-dependency of development and knowledge transfers as more or less a vintage or legacy. The challenges for ANDROMEDA were to create something new (anticipation-experimentation and ethical-legal aspects), to support co-creativity and to make (possibly outdated methods) and literature better for the next service development process.

### 3.4 Triangulation Fashion and Validation

The principle of data collection is to use several sources of evidence. Triangulation is a powerful technique that facilitates the validation of data by cross-checking from multiple sources. There are four types of triangulation when doing evaluations: data triangulation, investigator triangulation, theory triangulation and methodological triangulation. Data triangulation means collecting information from several sources aiming to confirm the same fact. Triangulation can test the consistency of observations obtained across different assets and increase the ability to manage and assess some threats or multiple causes that affect alerts or outcomes that require additional action. Following table introduces certain types of triangulation.

Table 19: Triangulation types.

Proposal for triangulation types		
1	Operational	Cross-over verification from more than two operations.
2	Organisational	Cross-over verification from more than two organisations.
3	Method	Cross-over verification from more than two methods (algorithms).
4	Service	Cross-over verification from more than two services.
5	Architecture	Cross-over verification from more than two architectures.
6	Data	Cross-over verification from multiple data sources.
7	Information	Towards information fusion.
8	Infrastructure	Critical infrastructure protection.
9	Resilience	Technical resilience: adaptive, dynamic and reconfigurable; functional resilience; resilience engineering (i.e. anticipation-experimentation-simulation).

## 4. User Community Reflections and Recommendations

ANDROMEDA User Community has an open call for issues, opinions and recommendations in the form of the manuscript and publishing themes as part of the ANDROMEDA deliverable (D.2.1 and D.2.5). The User Community discussion document collection in ANDROMEDA addresses in the open category. It provides a forum for the communication of well-articulated position statements concerning emerging, paradoxical, or even controversial development and research issues for progress of current ANDROMEDA capability development and further artificial continuums. The Issues and Opinions submissions channel should open new areas of discourse in ANDROMEDA project, close stale areas, and offer fresh views and recommendations on development-research topics of importance in the project and its continuums. The topic should identify the issues in terms and forms that are “as easy as” possible to understand and provide appropriate conceptual frameworks for the issue to offer opinions and supportive arguments that describe the suggestions of these opinions to the ANDROMEDA capability-service development and research, practice, or teaching to be supported, where appropriate, by empirical evidence. The themes are open and in the end of the document, there are some examples of useful subjects discussed in ANDROMEDA interactions. ANDROMEDA represents an opportunity to set a tool to bring together land and maritime surveillance data, co-existing in a shared context.

### 4.1 Pattern of Life

The suitability of an effective Situational Awareness (SA) is essentially dependent on two factors:

- technological capability;
- knowledge of the maritime and land environment.

While the first factor is a function of the development of technological systems in order to meet specific requirements, the knowledge factor is collective to several and mutual aspects related to the (i.e. maritime/land) environment among which the concept of Pattern Of Life (PoL) is considered a pillar. PoL can be defined as the set of usual or recurrent behaviours that, as such, can be foreseen in consideration of factors of various nature (political, economic, social, technological, environmental, legal, safety, security), influencing behaviours and activities in a given area (not necessarily/not only geographical). In this perspective, an approach to SA restricted to the operations or areas of operation is limiting to the extent that it does not take into account what happens outside of them. Hence the need to improve the knowledge and develop algorithms for the exploitation of a huge variety of sources/flows (real-time, near real-time and available in the “historical” archives/database. For example, those associated elements distinguishing and/or insisting on a single contact of interest and the events that interested him in the past or related to it). In synthesis, it is necessary to develop the POL knowledge that is activities that occur with cyclic repetitiveness and whose knowledge allows to predict, locate, recognize, identify and assess behaviours/anomalies relevant to the building of a reliable Recognized Picture and to the different levels of the decision making process.

The PoL concept is applicable to different environments/sectors and therefore in ANDROMEDA to both maritime and land with a shared perspective.

### 4.2 Towards Resilience

As in ANDROMEDA project, it is almost frequently impossible to clearly define the work objectives and user requirements as “R&D-related learning scopes” in advance; instead, they are specified throughout the cyclic anticipation-experimentation-solution development process (elastic nature and needs of high-maturity skills levels). However, the R&D-related learning process requires critical thought strategies and expert skills to

justify solutions, resilient dimensions and the design of evidence evaluation. Here, R&D work consists of a multidisciplinary setting, a continuous solution-development process that focuses on research, cyclic anticipation-experimentation, artifact development and generating new competencies and action-related capabilities. The outcomes as described in deliverables may include, for example, a creation, an artifact, a new operating method, an improved methodology, a model, an action capability, a service or a product.

In ANDROMEDA project, the used term “resilience<sup>8</sup>” and “resilient learning” refers to the increased rate of interactions in community and external R&D&IA extended pipelines as more resilient-elastic targets for evidence of lessons learnt continuums and catalytic agents in IA processes, which share that knowledge and learning targets can be preserved as a service, methodology, product, activity, capability, demand of change, required adaption, performance, policy, or as educational, innovative or intellectual assets that can be exported for high-value and impact returns. This resonates with the collective utility-related higher education model such as “Humboldtian university model<sup>9</sup>”: (1) the school as a centre of inquiry, (2) metaphors of learning, (3) situated learning and (4) interaction between learning and development.

### 4.3 Gap analysis

In the area of information sharing, the Gaps could be categorised at least to Gaps in national procedures, political, legal, operational, technical and geographical areas. The covered Gaps are kind of obstacles for effective and wide range information sharing. Additionally, they prevents on their own way the use of the Responsibility to Share principle and decrease the situational awareness among Land and Maritime Domain actors. The Gap analysis has been formulated as part of task 2.1 work. The whole ANDROMEDA User Community, including the external partners, has been involved to the work by utilising the workshops discussions, ANDROMEDA trials, bilateral discussions and ANDROMEDA Forum for taking into account all aspects of the gaps regarding the cross-border cross-sector information sharing. The results are presented in Table 21.

Table 20: Gap analysis of cross-border and cross-sector information sharing.

Gap	Description	Reference / Source
Network Security: Lack of security level information sharing network.	So far, most of the information sharing networks (excluding military networks) are able to share public information. The gap is in capability to share more restrict information than public due to network security level.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020. European Commission, Research Executive Agency. General project review consolidated report. 16.6.2020.
Liability for correctness of the information.	The liability for information correctness rise to a state of the art when a juridical action or force will be used based on the information from second or third partner (other nation).	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.
Trust between partners.	Partners still have some doubts: not able to trust what will be done with the shared information and reasoning for information sharing is unclear. These gaps have	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.

<sup>8</sup> <https://en.wikipedia.org/wiki/Resilience>

<sup>9</sup> [https://en.wikipedia.org/wiki/Humboldtian\\_model\\_of\\_higher\\_education](https://en.wikipedia.org/wiki/Humboldtian_model_of_higher_education)

Gap	Description	Reference / Source
	qualitative and quantitative affects to the shared information.	
Data model standardization.	The existing CISE data model used in CISE network support only maritime domain. ANDROMEDA e-CISE data model includes both maritime and land border data. However, existing CISE Nodes are not capable to use the land border entities such as defined in e-CISE data model and in other related information sharing models.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.
Lack of existing standards for interoperability.	Extending CISE structure, model and practises for authorities' interoperability.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.
Lack of interest to join in information sharing projects or consortiums.	The interest in information sharing is geographically focused and subject related.	ANDROMEDA User Community activities. (External partners' recruitment).
Network capability and the costs to transfer the data e.g. Shore –Ship – Shore network.	The costs of sharing the information to the areas where it has to be done by using the satellite network are high especially in the case of large data types. New cost benefit technics or methods for information sharing are needed.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.
The capability to handle and analyse big data in effective manners.	“New equipment and new methods for collecting the information has been developed. New information sharing networks, more sensors, and more information lead to questions which information is relevant, how or by whom relevant information is selected.”	ANDROMEDA 1 <sup>st</sup> Workshop 28.-29.10.2020.
National situational awareness among national authorities.	In some cases the information exchange among national authorities is minimal or don't exist at all.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.
Several innovative/R&D projects are addressed on almost same area of interests. The synthetisation of these projects should be addressed in the near future.	At the moment several R&D projects are in the active phase. The co-operation is quite limited and consecrated to workshops and bilateral discussions. Synthetisation should provide a more improved operational system feasible for production.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.
Third countries access to EU databases.	“Third countries have limited access or not at all access to EU databases.” (Policy implication).	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020

From the User Community perspective, gaps seem to be e.g., in information exchange, collaboration, interoperability, and missing standards for interoperability and expansion. The table 21 presents an outcome of observations found during the ANDROMEDA project, its trials, workshops and bilateral discussions with the consortium and external partners.

*Table 21: Gap analysis from the User Community perspective.*

Gap	Description	Reference / Source
Information exchange between national land border authorities.	Limited / no access to another authorities' land border database.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020.
Collaboration and information exchange between Member States.		ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020 (GMV).
Interoperability between Border Control Systems.	Validating and demonstrating CISE for land borders, adapting C2 solutions, and associated services. Embed services and C2 systems into existing Legacy Systems.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020 (GMV).
Lack of existing 'standards' for interoperability and expansion.	Extending CISE model in land border surveillance.	ANDROMEDA 1 <sup>st</sup> Workshop presentations 28.-29.10.2020 (SATWAYS).
Lack of land border end users and stakeholders.	Restricted completeness of land border requirements, i.e. perimeter guards, seismic sensors, radio sensors, etc. sensors.	European Commission, Research Executive Agency. General project review consolidated report. 16.6.2020.
Feedback from land border end users.	More feedback from land border end users on trials and their results analysis should be gathered.	European Commission, Research Executive Agency. General project review consolidated report. 16.6.2020.
Lack of end users outside of Mediterranean basin.	Mediterranean basin's end users are well represented, but other European geographical areas are not.	European Commission, Research Executive Agency. General project review consolidated report. 16.6.2020.
Trials as dissemination and exploitation events.	Trials are important events to attract new end users.	European Commission, Research Executive Agency. General project review consolidated report. 16.6.2020.
Communication and dissemination actions.	A wider geographical audience to Workshops.	European Commission, Research Executive Agency. General project review consolidated report. 16.6.2020.

NOTE: "These functional areas should be supported by increased availability/commitment to data sharing between countries/institutions/agencies in order to make the most of the CISE concept and architecture".

NOTE: "This is a fact (rather than a gap) concerning any project/collaboration/agreement that aims to exchange data / information, considering the different categories of the institutional bodies involved, the different rules / authorizations for the release of data at national / EU level and the ownership of the data".

## 4.4 Learning by Andromeda

The triple-quadruple helix<sup>10</sup> integration of R&D activities in the ANDROMEDA with outcomes such as high-value impacts is a complex and interaction-based process, not only within technology but merged with economic, legislative and social environments, where research, development and innovation action (R&D&IA) is also influenced by government policy and programmes, financial instruments, laws and regulations, and economic boundary conditions. In the ANDROMEDA project, an investigation of higher education functions and EU research systems addresses the collective contribution of: (1) knowledge, (2) competence, (3) capability, (4) operative performance, (5) action proficiency, (6) adaptive capability, (7) ethics and (8) resilience. Learning by Resilience and Development, research activities, and high-value impacts achieved by adaptive capability and resilience have become important not only for demonstration of applied solutions to enhance border and external security but also for regional-national development and security societies, due to the requirement for new competencies and for competent networking experts to meet and adapt to current and future challenges for novel ways of learning.

NOTE: “The expansion of networks and networking to different entities that in various ways can share data/services, brings with it the possibility/opportunity of being able to exploit other sensors, other assets, other services and above all a different perception of surveillance. This meaning that the same data/track of interest are, in principle, observed and managed with different perspectives/awareness by the different institutional bodies involved, requiring different actions/decision making reactions. In this perimeter, one of the main learning of the Andromeda is the need of a continuous development process of the CISE service/data model, aiming at the improvement of a standardized form of data exchange modules and rules”.

## 4.5 Potential of Andromeda

In the course of ANDROMEDA project, the T2.1 has collected the feedback from the consortium, end-users and external partner using several methods as described in previous sections. The potential of ANDROMEDA described in this chapter is a combination of theoretical studies of ANDROMEDA’s technical solution, the project trials results, end-users and external partners feedback from the questionnaire arranged during trials and round table discussions outcome of the workshops. The summary of the study results is presented in Table 23.

Table 22: The Potential of ANDROMEDA

Potential of ANDROMEDA	
CISE Enhancement to land borders	One of most relevant ambition of ANDROMEDA is to unlock the full capabilities of CISE Model by enhancing the Maritime CISE Model and extend it to the Land Border surveillance and information exchange. The enlargement to the land borders surveillance increase the effectiveness of authorities and end users situational awareness by providing the possibility to interconnect wide range of systems and services according the CISE principles. The ANDROMEDA new services and components increase the situational awareness, enable faster detection of new events, provides more informative decision making and increase the cross-sector cross-border understanding of the situation in border areas.
Improvement of the Safety at Sea	Safety at Sea is mandatory to all Seamen and authorities working in maritime domain. ANDROMEDA provides a wide range of

<sup>10</sup> [https://en.wikipedia.org/wiki/Quadruple\\_and\\_quintuple\\_innovation\\_helix\\_framework](https://en.wikipedia.org/wiki/Quadruple_and_quintuple_innovation_helix_framework)

Potential of ANDROMEDA	
	<p>components and solutions for improvement of Safety at Sea. The interoperability and connectivity to existing Legacy and C2 systems increase the situational awareness in Maritime domain. ANDROMEDA components such as TRITON Analytics Engine, GeoC2 Real Time and Predictive Analytics, Mission Planning, Analytics, SOCRATES Data Fusion Services, EXUS early warning engine and CMCC OCEAN-SAR support the operators decision making, ease the mission planning and tasking and helps to find the abnormal behaviour and increased risk for accidents at sea.</p>
ANDROMEDA for EUROSUR	<p>For EUROSUR, ANDROMEDA provides a potential platform for border areas surveillance, security and information sharing. The CISE enhancement to land border by updating the data model with new land border entities enable the system use in FRONTEX scenario. The flexibility for decentralised – centralised system and connectivity to extending legacy systems and different surveillance systems provides new dimension for FRONTEX authorities cooperation. For future understanding of the FRONTEX needs, a close collaboration with FRONTEX is mandatory.</p>
Centralised, decentralised, hybrid operations	<p>Even it is not an objective of ANDROMEDA project the ANDROMEDA solution could be used as centralised or decentralised versions. The centralised version means that areal cross border, cross sector authorities could form the end user community and use ANDROMEDA for their national or international daily routines and information sharing according the their common interests. When the partners has common interests and similar threat scenarios the consensus of access rights and shared information is easier to define. The areas of centralised use could be for example Baltic, Artic, Black Sea, North Sea, the English Channel.</p> <p>The decentralised and hybrid version follows more the CISE principles and could be implemented for example by having one or more connections to CISE network.</p>
ANDROMEDA technical solutions for improvement of situational awareness	<p>The ANDROMEDA solution increases the Situational Awareness and provide new tools for C2. The sensor fusion, automated threat calculation, and information sharing combined with information sources, e.g. INUS, VISIR, WITOIL ease the decision making process by presenting only the relevant information. The e-CISE data model enlarge the situational awareness among ANDORMEDA Users to Land Border activities. One of the main implication related to situational awareness ADNROMEDA brings is the ECCA tool which enables the information sharing between CISE and ANDROEMDA e-CISE data format.</p>
e-CISE data model	<p>As it is mentioned above e-CISE data model is in a key role when sharing information between Land and Maritime domain authorities. The possibility to integrate of Land border command and control system information to Common Operational Picture support authorities success in actions of large scale crime prevent operations.</p>

## 4.6 User Community Surveys

As mentioned in Chapter 2.4 three surveys during the Trials and one after the Final Workshop and Demonstration Event were arranged in purpose for collecting end-users and external partners opinions of the gaps in information sharing, to find out the Potential of ANDROMEDA and ANDROMEDA’s implications regarding the Command and Control, Economy and Authorities co-operation. Until the day when this deliverable was submitted, 37 answers were received of which eight 8 from the external partners and 29 from the consortium End-User partners spanning from a variety of Operational Departments & Communities. The Table 23 presents the main results of the User Community Survey.

*Table 23: The main results of User Community Survey*

Survey subject	Analysed answers
Overall impression	The ANDROMEDA platform is user friendly, easy to use and efficient in most real-life operations. ANDROMEDA solution also supports interagency cooperation for land and maritime border surveillance and information sharing between agencies. The platform provides interaction between different operation centres and Command and Control (C2) systems on the available assets. Speed, clarity and reliability impressed multiple answerers.
Main advantages	The extension of CISE model, fusion of different sources, interoperability and scalability among other border surveillance agencies were seen as main advantages for land and maritime information exchange. The ANDROMEDA platform provides interagency cooperation, enhancement of decision makers and savings in resources (time, money, efforts, decision making tools). Other advantages are integrating different data sources and the exchange of information between C2 entities. The platform easiness on the delivering of automated alerts/warnings based on a predefined set of rules, along with threat assessment, targets detection and correlation; the ability to efficiently cooperate with various agencies across Europe; and the increased levels of awareness on the full maritime picture.
A respond to the land-border surveillance challenges	The ANDROMEDA platform is CISE based, extending the existing CISE model and efficient use of resources and prompt decision making based on the information provided and shared from different sources. Platform responds early detection, better situation awareness, information exchange and interagency cooperation between land and marine border authorities.
Missing capability	The communication system and satellite capabilities should be considered.
Missing feature	Predictability, recognition of human movement, possible several users from same C2 entity should be able to access the information. The mobile application is limited because of the use of commercial mobile phone networks which don’t have enough coverage away from the shore.
Further developing	More tests are needed during real-time operations, including further capabilities for automatic target detection. Incorporate social media and satellite services could improve the overall performance and offer advantageous capabilities. The user interface could be more user friendly and easier to use. Communication (exchange of information) in offshore locations should be improved.
Respond to the maritime surveillance challenges	The ANDROMEDA platform is compatible with CISE, including exchange of information and interoperability. Efficient use of resources and prompt decisions are based on the information provided from different sources. More and better information is provided to the decision makers and interagency cooperation is strengthened and fastened. Performance regarding communication between Land and Marine border authorities has strengthened. The platform allows C2 to provide timely support for accidents at sea, optimizing national and international

Survey subject	Analysed answers
	resources. The platform has a great and fast capability to detect objects and potentially disruptive events which subsequently assist in a more precise and efficient decision-making by the competent law enforcement authorities.
New potentials to the market	The ANDROMEDA platform gives the extension of the CISE model for the land domain and its effectiveness on operational use. The supplied interoperability among authorities and scalability is the added value the platform brings to the border community. The real-time exchange of information for an operational and strategic level for both land and sea borders improves the dynamics that already exist in the market by the platform's Command and Control and quick and easy information sharing. Platform brings to the market its high-quality data fusion services and its interoperability with various C2 systems and particularly its link with CISE.
Improving cooperation between authorities	Cooperation between authorities is improved, since different resources and information can be shared amongst them in a swift manner and thus, decision makers are better informed. The platform provides a technological tool in the area of direct interagency communication for data and voice. The real-time exchange of information through different organizations contributes to the overall cooperation level between authorities. ANDROMEDA platform at the international level increases the readiness and security between the cooperating countries and it promotes trust by providing services and responds successfully to the arising real conditions
Implications related to Command and Control	ANDROMEDA is a platform for land and maritime incidents, extension of CISE compatible and extendable model. The involved C2 improves the capabilities of both the operational and strategic level. The platform has the control and the hierarchy so that all the services work uninterruptedly in the task that will be assigned to them without disturbance. ANDROMEDA platform has improved, validated and demonstrated CISE by extending its scope to land borders and adapting relevant Command and Control solutions and related services.
Implications to authorities Co-operation	ANDROMEDA fosters faster direct information sharing and cooperation between authorities for better situational awareness, more accurate and effective joint operations and better-informed decision making. The platform allows access to the CISE network, optimizing resources and improving response in support of incidents.
Economic implications	ANDROMEDA's economic implications include better situational awareness results to better and more effective use of assets (personnel, vessels, etc.), better allocation of resources that lead to lower costs during operations. ANDROMEDA system provides savings in all resources – time, money, efforts and decision-making tools. Due to the built in CISE integration, entities won't waste time in adapting/integrating other systems with CISE.

## 5. Conclusions

According to Grant Agreement, the task 2.1 forms the ANDROMEDA community of practitioners focused on the goal of “innovation”, delivering the benefits of the Information Sharing Environment through the enhanced CISE models for Land and Maritime Border Surveillance and Monitoring. The formed User Community was a combine consortium partners and external partners who were invited to provide their experience and expertise to the project. The User Community consists of a wide range of leading European industrial organisations, research & technology organisations, and academies and of course end-users. The ANDROMEDA User Community is formed according the partners’ background, Industrial, Academic & RTO, End-User, EU agencies and EU funded project communities. The original Consortium consisted of 19 partners from 9 countries and included partners from industrial, academic & RTO and End-User side.

As a part of T2.1 work during the project’s duration external partners were invited to provide their expertise and knowledge for the project to achieve its ambition. The external partner community includes the same groups as the consortium. As the results of three recruit campaign and partners active recruiting throughout the projects duration 3 EU Agencies, 12 external End-Users, 7 external Academies and Research organisation and 4 Industrial partners joint to ANDROMEDA User Community and 5 EU funded projects provided their support to ANDROMEDA project. The external partners represent 12 countries, 6 from the European Union 6 outside of European Union.

The role of Land Border authorities should be increased in current and towards reflection of ANDROMEDA’s User Community, especially the actors outside the Mediterranean area. One difficulty for all authorities in ANDROMEDA project was that the User Community formulation and the actual possibilities effected to the project's goals and ANDROMEDA’s requirements had quite narrow timescales and relative short project duration. Additionally the Covid-19 pandemic closed the world and focus at that time were in everyone’s own business.

The External Partners were activated and allowed to participate and provide their expertise and experience in several manners. Workshops, including Use Community session and Trials were the main events where the External partners were invited to have updated information about the project’s achievements and providing them the possibility to provide their knowledge and support to the Project. For the informal and open discussion and for collecting opinions the ANDROMEDA Forum was established. Notwithstanding of the partners good initiatives the discussions remained limited.

The established User Community provided its input for the ANDROMEDA’s achievements throughout the project duration. During the Task 2.2 User Requirements and Technical Specification the User Community specified the requirements for the ANDROMEDA components and the Task 2.4 Operational Scenarios & Trial Definition the User Community had a central role in detailing the trial scenarios and validation metrics which were used for ANDROMEDA evaluation. For the execution phase for each Trial seven authorities from five countries and consortium seven industrial companies worked together for planning and carrying out three long lasting Trials. The outcome of these interactions and co-operation could be seen in Trials results described in deliverable D6.2 Operational Trial Results Report and Lessons learnt.

Although several high level meetings, discussions and long term continuums of EU level projects for improving the cross-border cross-sectoral information sharing the gaps could still be found, especially underlined here as implications for future EU projects, applications and research continuums. As a part of T2.1 work the User Community, including the external partners, were involved to the work analysing the existing gaps in cross-border cross-sectoral information sharing and in User Community perspective. The outcome of this analysis were identified twenty gaps: the gaps varied from soft gaps, human and policy related gaps to hardware gaps in technical possibilities.

ANDROMEDA User Community and the interactions during the project and especially during the long lasting Trials improved on its own way the mutual trust among the partners and create the way ahead for cross-border cross-sectoral information sharing among the partners.

The ANDROMEDA's wide experienced User Community provided an excellent foundation for enhancing the CISE Model to the Land Border information sharing. According the master plan of User Community activities the External partners could provide their input for the project in the project's Workshops and Trials. The Workshops as well as the Trials were organised virtually due to Covid 19 pandemic. Apart from project's Workshops and Trials, it is worth mentioning that a dedicated User Community Session has been organized to interact with the external partners on May 2020. Altogether, 77 participants from 26 organisations attended the User Community Session.

As stated in the Grant Agreement, Deliverable D2.5 description, the report should include the final assessment of user community Gap analysis. The results of the surveys organised during the trials and final Workshop stated that ANDROMEDA project and solution have at least reduced, if not totally eliminated, the gaps related to thrust between partners, the obstacles of information sharing between national authorities and liability to for information correctness.

As the name of this deliverable express, the nature of this Final report of User community is to give the description of ANDROMEDA User Community, User Community interactions, methodological issues of ANDROMEDA research, development and innovation action activities and User Community reflections and recommendations. Throughout the project duration User Community activities were carried out by using ANDROMEDA Forum, Workshops and Trials for supporting the project to achieve its ambition.

The ANDROMEDA approach is fully in line with CISE standards and allows all participants to complement their national expertise and share information to raise maritime safety and security to a higher level. The information, experience and practices shared between the competent authorities will lead to a safer and more secure maritime area, ease of risks, a better response to SARs, environmental protection, etc. Good impact on relations between maritime safety agencies contributes to strengthening the international institutional framework.

ANDROMEDA has unlocked some CISE Model capabilities by enhancing the Maritime CISE Model and by extending its objectives to those related to the Land Border surveillance, and has laid the foundation for the development of a maritime-land combined common standardized form of data exchange and rules which is believed to be pursued.

## 6. Annex A: Reviews and Quality

The ANDROMEDA Consortium uses the Quality Review Report process for its internal quality assurance for deliverables to assure consistency and high standard for documented project results.

The Quality Review Report is used individually by selected peer reviewers. The allocated time for the review is 7 calendar days. The author of the document has the final responsibility to reply on the comments and suggestions of the peer reviewers and decide what changes are needed to the document and what actions are to be undertaken.

### 6.1 Reviewers

Project Coordinator	Athina Foka (MMAIP)
Management Support Team Member	Alkis Astyakopoulos (KEMEA)
Internal Peer Reviewer	Lazaros Karagiannidis (ICCS) Dimitris Katsaros (EXUS)

### 6.2 Overall Peer Review Result

The Deliverable is:

- Fully accepted  
 Accepted with minor corrections, as suggested by the reviewers  
 Rejected unless major corrections are applied, as suggested by the reviewers

### 6.3 Consolidated Comments of Quality Reviewers

(Please note that they will be transmitted to the author and the European Commission)

General Comments	
<b>Deliverable contents thoroughness</b>	Reviewers comment: The deliverable is thorough and comprehensive Author's reply:
<b>Innovation level</b>	Reviewers comment: Not applicable Author's reply:
<b>Correspondence to project and programme objectives</b>	Reviewers comment: Yes, the deliverable is fully in line with project and the programme objectives. Author's reply:
Specific Comments	
<b>Relevance with the objectives of the deliverable</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Not applicable Reviewers comment: Author's reply:
<b>Completeness of the document according to the its objectives</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially

	<input type="checkbox"/> Not applicable Reviewers comment: Author's reply:	
<b>Methodological framework soundness</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Not applicable Reviewers comment: Author's reply:	
<b>Quality of the results achieved</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Not applicable Reviewers comment: Author's reply:	
<b>Structure of the deliverable with clear objectives, methodology, implementation, results and conclusions</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Not applicable Reviewers comment: Author's reply:	
<b>Clarity and quality of presentation, language and format</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Not applicable Reviewers comment: Author's reply:	
<b>Detailed Comments (please add rows as appropriate)</b>		
<b>No.</b>	<b>Reference</b>	<b>Remark</b>
1		
2		
3		
4		
5		

## 6.4 Ethics Compliance Checks

Work package/deliverable	D2.5 User Community Final Report
Research/development project name	ANDROMEDA
Form completed by (name & partner)	Tuomas Tammilehto (LAUREA)
Date	29.6.2021

1. Can this deliverable/WP be justified on ethical grounds, i.e. does it respect fundamental rights and other applicable legislations, regulations and values?	No___ Yes <input checked="" type="checkbox"/> n/a _____
Please specify (unless not applicable).	
2. Can the information that ANDROMEDA collects, based on this WP's/deliverable's research activities, be used for discrimination or other such unethical purposes?	No <input checked="" type="checkbox"/> Yes _____
If No, please specify.	
3. Since, any use of technology in third states' coastal waters should be carried out in the framework of explicit cooperation agreements with these states as well as in conformity with international law and regulations, third countries in the Mediterranean and land borders shall be seen as ANDROMEDA end users and as true partners in solving shared problems with new technology. Thus, based on this WP's/deliverable's research activities, are any third country been involved?	No <input checked="" type="checkbox"/> Yes _____
If Yes, please specify.	
4. ANDROMEDA is likely to result in changes in the daily work routines of different end-user groups (e.g. coast guards and SAR teams). Thus, it is important that end user communities are involved in the development. Therefore, have any end users being involved in this WP's/deliverable's research activities?	No___ Yes <input checked="" type="checkbox"/>
If Yes, please specify.  Taking into account the topic of this deliverable, it naturally had a strong involvement of end-users.	

<p>5. Both the data and the system shall be transparent when developing ANDROMEDA. Moreover, AI systems and their decisions shall be explained in a manner adapted to the stakeholder concerned. Humans must be aware that they are interacting with an AI system, and shall be informed of the system's capabilities and limitations. Have these taken into account in the research activities of this WP/deliverable?</p>	<p>No <input checked="" type="checkbox"/> Yes <input type="checkbox"/></p>
<p>If Yes, please specify. If No, please specify too, unless not applicable.</p>	
<p>6. Any decisions on Maritime and Land Border Surveillance and SAR must always be made by the competent human decision makers - computer systems can only have an assisting role in operational decision making. Based on the research activities of this WP/deliverable, is this the case?</p>	<p>No <input type="checkbox"/> Yes <input checked="" type="checkbox"/></p>
<p>If No, please specify. If Yes, please specify too, unless not applicable.</p>	
<p>7. The principles relating to processing of personal data, such as lawfulness, fairness and transparency, purpose limitation, data minimisation, accuracy, storage limitation, integrity and confidentiality as well as data controller's accountability must be embedded in the ANDROMEDA technology. Based on the research activities of this WP/deliverable, is this the case?</p>	<p>No <input type="checkbox"/> Yes <input checked="" type="checkbox"/></p>
<p>If no, please specify. If Yes, please specify too, unless not applicable.</p>	

<p>8. Are a) Social media strategies, policies and accounts, b) Relationship with the existing public security services, c) Internal collaboration and information sharing, and/or c) the anchoring of data processing in legislation relevant in this WP/deliverable?</p>	<p>No <input checked="" type="checkbox"/> Yes <input type="checkbox"/></p>
<p>If Yes, please specify.</p>	
<p>9. AI systems must be resilient, secure accurate, reliable and reproducible. A fall-back plan must be in place to ensure safety in case something goes wrong. Also, mechanisms to ensure responsibility and accountability for ANDROMEDA AI systems and their outcomes must be established. Auditability, which enables the assessment of algorithms, data, and design processes, plays a key role therein, especially in critical applications. Are these relevant in this WP/deliverable, and are they taken into account?</p>	<p>No <input type="checkbox"/> Yes <input checked="" type="checkbox"/></p>
<p>If no, please specify. If Yes, please specify too, unless not applicable.</p>	
<p>10. ANDROMEDA is not used to identify individuals but phenomena. However, individuals could be identified nevertheless. Thus, have respecting privacy and rights of people being addressed?</p>	<p>No <input type="checkbox"/> Yes <input checked="" type="checkbox"/></p>
<p>If no, please specify. If Yes, please specify too, unless not applicable.</p>	

## 6.5 Ethical self-evaluation

Work package	WP2 D.2.5 User Community Final Report
Research/development project name	ANDROMEDA
Form completed by (name & partner)	Tuomas Tammilehto (LAUREA)
Date	29.6.2021

<b>1. HUMAN EMBRYOS/FOETUSES</b>	
Does your research involve Human Embryonic Stem Cells (HESCs)?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
If yes, please specify. (And wait for further instructions from the ethics committee before starting the R&D work).	
<b>2. HUMANS</b>	
Does your research involve Human Participants?	No <input type="checkbox"/> Yes <input checked="" type="checkbox"/>
Activities to be taken (if yes):  The researchers should provide Informed consent forms with an information sheet specifying the nature of the research. Furthermore, a normal approval from the University Research Ethics Committee or from the relevant Member State authority for non-academic institutions should be mandatory if the human participants come from outside the project consortium organisations.	Consent was asked and given in all events related to this and/or anonymity was secured.
<b>3. HUMAN CELLS / TISSUES</b>	
Does your research involve human cells or tissues (other than from Human Embryos/ Foetuses, i.e. section 1)?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
If yes, please specify. (And wait for further instructions from the ethics committee before starting the R&D work).	
<b>4. PERSONAL DATA</b>	
Does your research involve personal data collection and/or processing?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
Does it involve tracking or observation of participants?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
Does your research involve further processing of previously collected personal data (secondary use)?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
Activities to be taken (if yes):  1. Informed consent forms collected from the participants are the general prerequisite for this data processing. (See D8.1)	

<p>2. The researchers should provide the details of the procedures regarding the collection, storage, protection, retention, transfer and destruction or re-use of the data, as well as those regarding data safety procedures, data transfers to third countries and tracking and observing methods. (See D8.5, D8.7 and D8.10)</p>	
<b>5. ANIMALS</b>	
Does your research involve animals?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
<p>Activities to be taken (if yes):</p> <p>The researchers should obtain the necessary authorisations and provide a detailed analysis of the procedures, justifications and legal compliance.</p>	
<b>6. THIRD COUNTRIES</b>	
Does your research involve non-EU countries?	No <input type="checkbox"/> Yes <input checked="" type="checkbox"/>
Do you plan to import any material from non-EU countries into the EU?	No <input type="checkbox"/> Yes <input checked="" type="checkbox"/>
Do you plan to export any material from the EU to non-EU countries?	No <input type="checkbox"/> Yes <input checked="" type="checkbox"/>
<p>Activities to be taken (if yes):</p> <p>The researchers should provide a risk-benefit analysis, the details of the activities and compliance checks with the EU and local legislations. (See D8.10)</p>	The material was the answers to different questionnaires and related to the participation to the user community. No personal data was collected nor shared.
<b>7. ENVIRONMENT &amp; HEALTH and SAFETY</b>	
Does your research involve the use of elements that may cause harm to the environment, to animals or plants?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
Does your research involve the use of elements that may cause harm to humans, including research staff?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
<p>Activities to be taken (if yes):</p> <p>The researchers should obtain the necessary environmental authorizations and provide a risk-benefit analysis and compliance checks regarding legislation.</p> <p style="text-align: center;">and/or</p> <p>The researchers should obtain the necessary health and safety authorizations and provide the details of safety procedures and legal compliance.</p>	
<b>8. DUAL USE</b>	
Does your research have the potential for military applications?	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>
<p>Activities to be taken (if yes):</p>	

<p>The researchers should provide an explanation on the exclusive civilian focus of the research, a justification of military technologies, the details of the needed export licenses, explanation on how the research might affect current standards in military ethics, and measures to apply to avoid negative implications on military ethics standards.</p>	
<b>9. MISUSE</b>	
<p>Does your research have the potential for malevolent/criminal/terrorist abuse?</p>	<p>No <input checked="" type="checkbox"/> Yes <input type="checkbox"/></p>
<p>Activities to be taken (if yes):</p> <p>The researchers should provide a risk assessment and impact on human rights, the details on the applicable legal requirements and the measures to be taken to prevent abuse.</p>	
<b>10. OTHER ETHICS ISSUES</b>	
<p>Are there any other ethics issues that should be taken into consideration?</p>	<p>No <input checked="" type="checkbox"/> Yes <input type="checkbox"/></p>
<p>Activities to be taken (if yes):</p> <p>If yes, please specify. (And wait for further instructions from the ethics committee before starting the R&amp;D work).</p>	

## 7. Annex B: User Community Survey

# The ANDROMEDA User Community Survey

Fields marked with \* are mandatory.

This questionnaire's aim is to collect additional information for the ANDROMEDA project's Work Package 2 User Community Interactions report "User community Final Report". The report includes among other things sections for GAP analysis of cross border, cross sector information sharing, ANDROMEDA's implication from Command and Control, authorities' co-operations and economical perspective. We hope you can enlarge our impression of these areas with your expertise and experience by filling out the survey.

You are able to provide your answers anonymous if you want to and your answers will be used only for User Community Report results. Your answers will be stored by Laurea until the end of the ANDROMEDA project and destroyed when the project ends.

In case the answers contain personal information (included in the consent form) they are processed in compliance with the General Data Protection Regulation and stored securely for the time period mentioned in articles 18.1 and 22.1 of the ANDROMEDA Grant Agreement (5 years after the completion of the project) for accountability reasons.

## The ANDROMEDA User Community Survey

---

Your name (you may answer anonymous as well)

Your organization

- \* What is your overall impression of the ANDROMEDA platform?
- \* What are the main advantages of the ANDROMEDA?
- \* How does the ANDROMEDA respond to the land-border surveillance challenges?
- \* Is there any capability that is missing from the ANDROMEDA system?
- \* Is there any feature that is missing from the ANDROMEDA system?
- \* How would you like this system further developed?
- \* How does the ANDROMEDA respond to the maritime surveillance challenges?
- \* What are new potentials that ANDROMEDA provides or brings to the market?
- \* How ANDROMEDA affects or improves cooperation between authorities?
- \* What are the ANDROMEDA's implications related to Command and Control ?

- \* What are the ANDROMEDA's implication to authorities Co-operation.
- \* What are the ANDROMEDA's economical implication

Thank You for your time and contribution for this survey

### **Contact**

jari.rasanen@laurea.fi