PROJECT FINAL REPORT

Grant Agreement number: 241630

Project acronym: NEWA

Project title: New European WAtcher

Funding Scheme: Coordination and support Action

Period covered: 20 months from 01/08/2010 to 31/03/2012

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1 Final publishable summary report

This summary includes 5 distinct parts:

- An executive summary
- A summary description of project context and objectives
- A description of the main S&T results/foregrounds,
- The potential impact (including the socio-economic impact and the wider societal implications of the project so far) and the main dissemination activities and exploitation of results
- Furthermore, the project logo and diagrams illustrating and promoting the work of the project, as well as the list of all beneficiaries with the corresponding contact names are submitted without any restriction.

1.1 Executive Summary

NEWA Project started in 2010 following a proposal submitted at the end of 2008. At those times the European contest was strongly oriented to the individuation of Space contribution to the Security of citizens and all possible methods were investigated. NEWA (New European Watcher) dealt with the implementation of a Moving Target Indication (MTI) System to be used for Maritime and Land applications.

Till 2008 several activities were conducted for the dimensioning of single platforms on which different sensors and techniques were integrated (Naval, Ground, Avionic, etc) but the Space contribution was relegated to “archives” for the detection of changes in Earth and /or Seas conditions.

The *active* contribution of Space to the improvement of Security by means of cooperative sensors and techniques in Civil environment was investigated by NEWA for the first time. In parallel one other project, SeaBILLA (Sea Border surveILLAnce), was funded by the FP7 in the same call in the Theme “Security”. SeaBILLA aimed at integrate a more wider contribution of Space to the European Security of the Border, even if restricted to the Sea case. The demonstrated strong impact on the Space contribution on the Surveillance of the border and more generally on the patrolling of the territories, allows the start of several projects for the development of SW tools in the answer to the Users and Stakeholders needs and requests. One among these tools was a software for the validation of the NEWA results, devoted to the MTI system configuration.

NEWA started from the evaluation of the concrete Civil Community needs and evaluate the on going and planned activities to fulfil such requests both in a European and International frame. The analysis led to the individuation of specific needs that can be satisfied by an MTI System. These operational frameworks were named “Operational Scenarios”. For each operational Scenarios, different technique for measurements with best mission configuration approach and performing instruments are evaluated. The study ended with a Roadmap and a resuming document on the impact of NEWA results on the European scene.

1.2 Project Contest and Objectives

In 2008, when the NEWA proposal was submitted, the international community was confronted with a rapidly evolving strategic environment shaped by globalization. In this context, the EU acknowledged that it was challenged by complex and asymmetric threats, stretching from terrorism to the proliferation of weapons of mass destruction (WMD), from regional conflicts to organized crime. In addition, other global challenges, directly or indirectly, were becoming more and more relevant to both internal and external security of the EU: climate change and natural disasters, poverty, diseases, energy dependence, competition for natural resources. As a major global actor, the EU has engaged in a process of adaptation of its institutions, policies and capabilities to address both regional and global security threats and challenges. Facing these multifaceted and trans-national threats led to the conceptual widening of the notion of security, and therefore to the adoption of a comprehensive approach to it, gradually abandoning the traditional separations between safety and security, as well as between security and defence. For a more secure Europe, it turned out necessary, among the others, to focus and invest more significantly on research in the fields of security and technology, space included. Indeed, space capabilities are recognised as strategic assets serving the security needs of Europe and its citizens[1]. As a result, research and development (R&D) in new useful systems and cooperation among existing infrastructures in a "System of Systems" approach were thought to offer faster and more appropriate answers to urgent and complex needs. Space applications, such as navigation and positioning, satellite communications and Earth Observation (EO), can indeed deliver relevant data for a wide range of activities, from crisis prevention and early warning to active support in safety and security operations.

The NEWA project addressed these security challenges and evaluated the possibility of complementing an active System of Systems in the field of EO adding capabilities for detection and tracking of moving objects in marine and land environments. In the following a brief description of performed activities is presented.

1.2.1 User Engagement and Methodology

The main objective of the first phase of the Project was the identification of policies and operational drivers for the establishment of a Moving Object Capability at EU level, to understand how similar capabilities, and for which services, have been addressed in existing or past European R&D projects, pre-operational services development for the Global Monitoring for Environment and Security (GMES), Contributing Missions to GMES, and other European Earth observation (EO) services. Indeed, initiatives funded at the European level by the European Commission (EC) within the Sixth and Seventh Framework Programmes (FP6, FP7), by the European Space Agency (ESA), and by other agencies (i.e. national space agencies, European Maritime Safety Agency - EMSA) provide a solid background for this preliminary NEWA investigation. Reference to GMES is both essential and necessary, since it represents the EU flagship programme for an EO system functional to the protection of citizens with respect to environment, security, emergences and climate change, while supporting the implementation of a number of EU policies.

[1] "*Council Decision Concerning the specific programme 'Cooperation' implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)*" of 19 December 2006;
"*Communication From The Commission To The Council And The European Parliament*" European Space Policy 2007

The survey served as an input for consequent efforts within other activities: more specific synergies and relationship between GMES and NEWA, both in terms of concepts and services, was investigated during the project (GMES Liaison). In the same way, Contributing Missions to GMES and other national programmes was taken into consideration in "Synergies with space and defence programmes" to explore the potential for their exploitation by NEWA. The analysis of both GMES liaison with NEWA concepts and of synergies with national programmes (civil and military) additionally fed the definition of Operational Scenarios.
The first task was looking at these projects and services, in order to understand how to exploit existent knowledge on the utilization of space radar satellites for detection and identification tasks in public safety and security missions by identifying assets available and assessing current capabilities.
Furthermore, some of these programs provide useful insights into methodological approaches to identify and involve end-users, and then to get relevant information from them.
When surveying existing projects and services, this study principally considers public documents available on official websites. In fact, the team chose to restrict the review of existing projects and services to the official reports appeared in public sources.
The deep analysis of the GMES components as reported in the figure 1.2.1-1, supports the identification of the main reference scenarios and methodology.
In order to identify policy and operational drivers for the establishment of a Moving Object Capability at EU level, the analysis aims at identifying some reference scenarios in which public safety and security actors might benefit from the use of space-based radar systems. Accordingly, the consortium's methodological approach to this research was primarily end user-oriented. Indeed, through a deep involvement of relevant end-users it was possible to gather operational information, details and criticalities emerged during field missions.

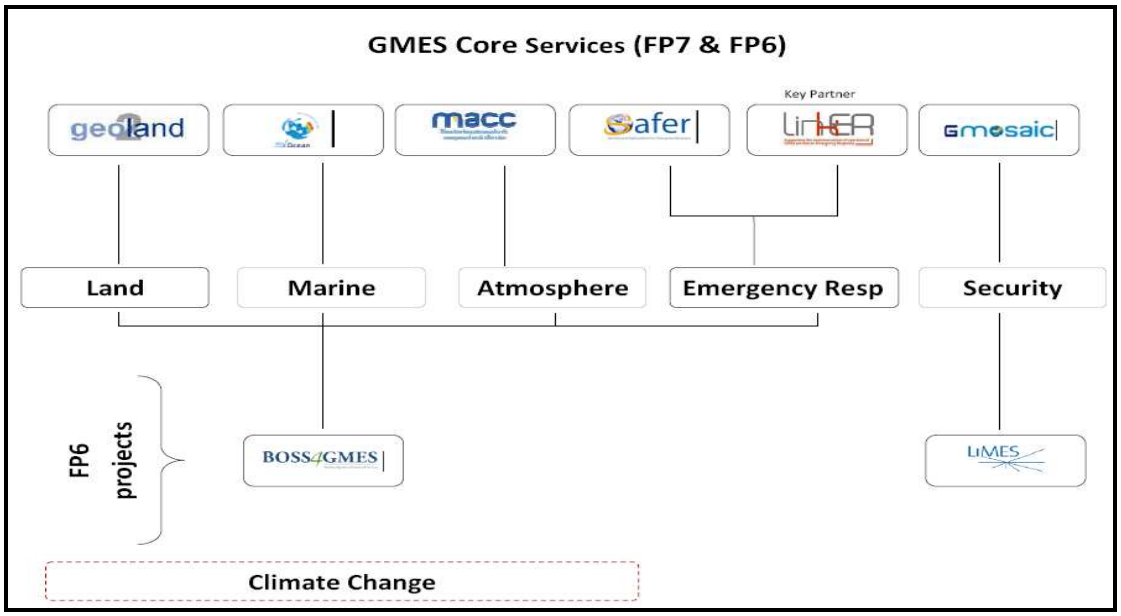

Figure 1.2.1 – 1 GMES Core Services. The GMES Program embrace all the possible available missions already operative, and poses the basis for the future Services to the European Citizen

The methodology used in NEWA was thus focused on a direct engagement of key operational end-users and takes advantage of high-level contacts handled by the consortium during past experiences and similar projects (ASTRO+, SENTRE, LIMES, MAGES, G-MOSAIC, SPEED). Personal interviews with relevant end-users, carried out through a questionnaire

purposely designed, were the selected tools to engage security actors and map their operational experiences. Due to the wide spectrum of potential activities covered by the NEWA system, actors involved belong both to institutional decision-makers (EU and national) and public civilian operational entities, as well as non-governmental organizations and military corps. All these actors provided various (and different) points of view, according to their distinct operational activities and exigencies; this variety considerably strengthens the comprehensiveness of this study.
Thanks to Partner's background, the consortium had at its disposal a set of international public safety and security end-user contacts (Italian, EU MS, third countries) belonging to different communities. Among them, and contact those administrations and/or organizations directly involved in operational activities within the scenarios considered by the project were identified. After having approached relevant end users by phone and e-mail, those of them that showed an interest in contributing to NEWA project were involved, circulating a questionnaire accompanied by an official letter, and setting up personal interviews to discuss and comment the survey content.
The questionnaire was divided into two parts:

a) "*General and organization-oriented questions*" → general aspects of the actor engaged, in order to identify himself and the organization he works for; general operational features of the end-user activity.

b) "*Scenario and operation-oriented questions*" → explanation of operational and technical aspects.

Results were processed by the team, which identified Reference Scenarios which may create drivers for technology developments. Scenarios are described and schematised, posing emphasis on those operational and technological aspects which strongly correlated to detection and identification capabilities.

1.2.2 EU Scenario

"EU Scenario" activity aims to critically review the European state-of-the-art concerning Moving Object Indication techniques in the light of future space-based NEWA establishment. This analysis covers the three fundamental sources for NEWA concepts derivation:

- Current operational and/or planned space techniques and technologies
- Airborne assets for ground and air surveillance
- Terrestrial and naval systems with MTI capabilities.

Techniques and architectural solutions have been identified and described in order to clearly define the scientific baseline for NEWA Concepts definition. Alternatives have been considered in terms of the three fundamental keystones that will compose the NEWA technique concept: Space Mission, Electronic components and Data Processing and techniques. The main reviewed processing techniques were: Displaced Phase Centred Antenna (DPCA), Along Track Interferometry (ATI) and Space Time Adaptive Processing (STAP)

The state of the art in airborne and ground based MTI system was reviewed and an approach was made to the concepts of a space based MTI solution (NEWA concept). A review has been made of the electronic components required for a spaceborne MTI mission. In both cases the availability of technology at European level has been assessed.

1.2.3 Operational Scenarios and International Scenarios

The purpose of the "Operational Scenarios" task was to produce the building blocks that could be used in a rigorous Operational Analysis. Specifically the methodology applied is consistent with that used when undertaking a Combined Operational Evaluation and Investment Appraisal (COEIA).

The "International Scenarios" task provided an overview of non-EU surveillance applications with MTI capabilities.
COEIA is a fundamental step in the process of many large-scale UK MoD procurements. A complete COEIA provides a formal comparison of acquisition options on a "Cost vs Effectiveness" basis, to satisfy a specified capability.
"Effectiveness" is typically determined by some form of simulation of specific operational scenarios. In order to focus the simulation effort on those parts that are relevant to the analysis operational scenarios are typically presented as a series of "Vignettes"
Vignettes depict use cases of interest for applications of space-based MTI technology in order to contribute to the overall assessment of future NEWA design implementation solutions, aiming to provide real-life examples of what specifications and parameter values the NEWA-related technology might have to meet.
Having established a set of vignettes, we need to identify the "Critical Measurable Parameters" (CMP) relevant to the performance of the space-based MTI, and present two "threshold" figures for these parameters:

- "Useless Pd Limit" – This is the Minimum Probability of Detection for the MTI system to provide any significant contribution to the vignette under analysis.
- "Good Pd Limit" – This is the Probability of Detection necessary for the MTI system to be the Difference between Success and Failure in the vignette under analysis.

For example, when considering a particular vignette for tracking smugglers, we may consider the CMP to be:

"Ability to determine heading and velocity of rapid, small rubber vessel, in rough seas
"Useless Pd Limit" to be 20%, and the "Good Pd Limit" to be 70% probability."

A table is presented in section 1.3.2 which provides a synoptic overview the scenarios identified and analysed under NEWA, with their proposed CMP.

1.2.4 Synergies with Space & Defence programmes

It has been identified a growing interest in the cooperation between civilian and defence programmes at European Level in Earth Observation. In particular, a joint task force by European Commission, the European Defence Agency (EDA), the Council Secretariat General and the European Space Agency has already triggered the initiation of survey projects related to civilian, defence and dual ground segments for satellite Earth Observation. The EDA is positioned as a reference organisation in the task to seek for potential synergies between Defence and Civilian Programmes.
The European Data Relay Satellite (EDRS) –a PPP between ESA and Astrium- arises as an important opportunity for shortening the data ageing in MTI applications. The EDRS is a

geostationary satellite which creates a telecommunications link between a satellite in LEO (a typical EO satellite) and its ground segment enabling real time data download. NEWA should definitively be a user of the EDRS. The availability of such a big communications bandwidth (1.8Gbps) from space to ground should trigger the debate on the need for on-board processing vs. the transmission of all the original information to ground.

The GMES programme has significantly evolved in the Security component during the last year. This refers to the completion of the G-MOSAIC project in March 2012 and the inclusion of 8M€ of FP7-Space budget for continuation activities to be initiated at the end of 2012 having the External Action Service from the EU as a reference user. This means that Security (and emergency) applications are finding their gap. GMES picture has to be completed with all the activities related to maritime security, where a major progress is being conducted having EMSA as a reference user and a potential beneficiary of MTI technology.

Finally, we have to remark that in the field of maritime security, there is an important trend for the fusion of satellite data (typically SAR) with in situ information for from collaborative vessel detection identification systems such as. AIS (in the coast) and LRIT (open sea). The usage of Space based AIS has already started and the integration of space based AIS within SAR satellites will be achieved for the first time with the launch of PAZ satellite (Spanish SAR mission). The synchronisation of the capture of AIS data with SAR imagery will be a breakthrough and it is likely that most future SAR missions will integrate an AIS receptor. We expect that this will benefit NEWA concept since the availability of AIS information concurrent with MTI data will make easier the extraction of higher value information.

1.3 Main S&T results and Foreground

1.3.1 Study Logic and Consortium Organization

To better introduce the performed work the Study logic and the Consortium organization is introduced. The required activities and the role in charge to all the partners are presented.

1.3.1.1 Study Logic

It is important to highlight that NEWA was the first project within the 2008, in charge to analyse the real European capabilities in manufacturing and maintaining an MTI system as dedicated Space mission or as a cooperation of different sensors and/or mission. In this view the first steps of NEWA were devoted in the identification of the real User needs, the State of the Art both in Technology and Techniques and compare the European environment with the International scene. The second part of the Project was devoted to a deeper technical analysis of the techniques capabilities and the algorithms useful to extract the MTI data from instrument measurements. In parallel the optimization of satellites orbits and mission configuration together with the technological assessment, identify the best configuration(s) for an MTI system. The third and last phase was devoted to the conclusion and the recommendations for future developments. In the figure below the Study logic is reported with the work packages and the meetings/check points of the Project.

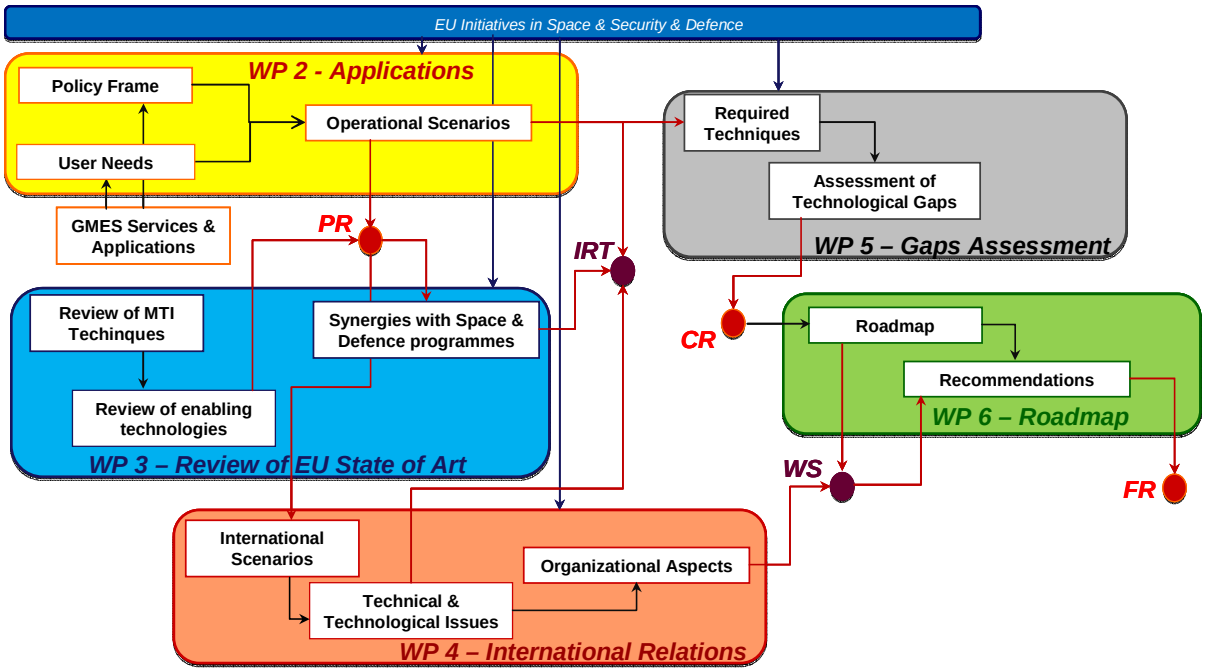

Figure 1.3.1.1- 1 Study Logic – The development of the Project required a fine realignment of the activities and the purposes of the meetings in order to respect the different requests of the Community and the obtained results.

1.3.1.2 Consortium Organization

The organization of the Consortium followed the standard rules of the Program Management. Considering the specific heritage of each partner, the leadership of each work package was assigned at the beginning of the Project and all the partners were represented in an

consortium's Committee devoted to the monitoring of the activities and the compliance with rules. In the reported Table the roles of each partner is reported.

NEWA Consortium Roles	
Company	**Role**
TASI	Main Investigator
	MTI Techniques Assessment
	Roadmap
IAI	User Engagement
	Policies & Analysis
E-GEOS	GMES Liasons
VEGA Space Ltd	Operational Scenario Analysis
FRS	International Policies
TSA	Identification of Gap fill
INDRA ES	Technologies Assessment
UPC	Processing Technologies Review

The communications were assured by the very closed cooperation among the partners. Frequently meetings assured the alignment of each partner's activities and the correct exchange of information and discussions. At the beginning of the Project the Consortium signed a Consortium Agreement containing all the contractual and financial issues, including the IPR management, and the Non Disclosure Agreements on the obtained results.
In the figure below the Consortium Organization is reported:

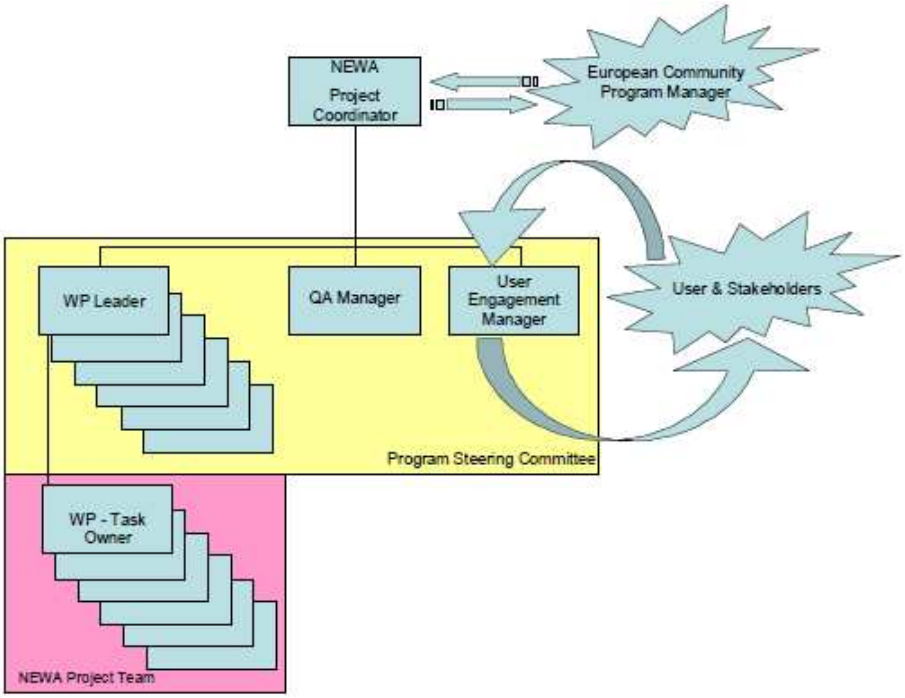

Figure 1.3.1.2 – Consortium Organization. The Consortium was small and flexible, all the Partners were involved into every activity of the Project and the cooperation was assured

1.3.2 NEWA Activities Results

In the following the WP activities are reported with the main results.

WP1 – Overall Management and Project Coordination:

The Project followed the standard approach of the Project Management identifying at the beginning of the Project, the main achievements in the different phases of NEWA:

- measurable and achievable Technical milestones were identified and controlled,
- the overall schedule of the Project corresponded to technical coordination and detailed schedule within the WP activities
- Contractual and Financial issues were routinely monitored, in order to avoid risks and Partner's misalignments

Technical check points were clearly identified in correspondence to specific achievements, each of one corresponded to internal financial milestones. Main Objectives of these internal milestone were:

- Identification of Users Requirements and Operational Scenario (WP2)
- Survey of MTI Techniques and Technologies and Synergies with Defence Projects (WP3)
- Identification of Sustainable Techniques and Technologies for European MTI system (WP4)
- Assessment of Techniques and Technology GAPS (WP4 and WP5)

The very last step of the Project was the completion of the activities with the submission of a second issue of the Roadmap that resumed all the performed activities and give the recommendations for future development in Technology and Techniques in Europe. This last step completed the issuing of the Deliverables and of the Project.

Due to Consortium internal unpredictable inconveniences, the Project suffered an initial delay that was recognised and approved by the Commission in an extension of the duration of the Project of two months. In the schedule the new schedule is reported.

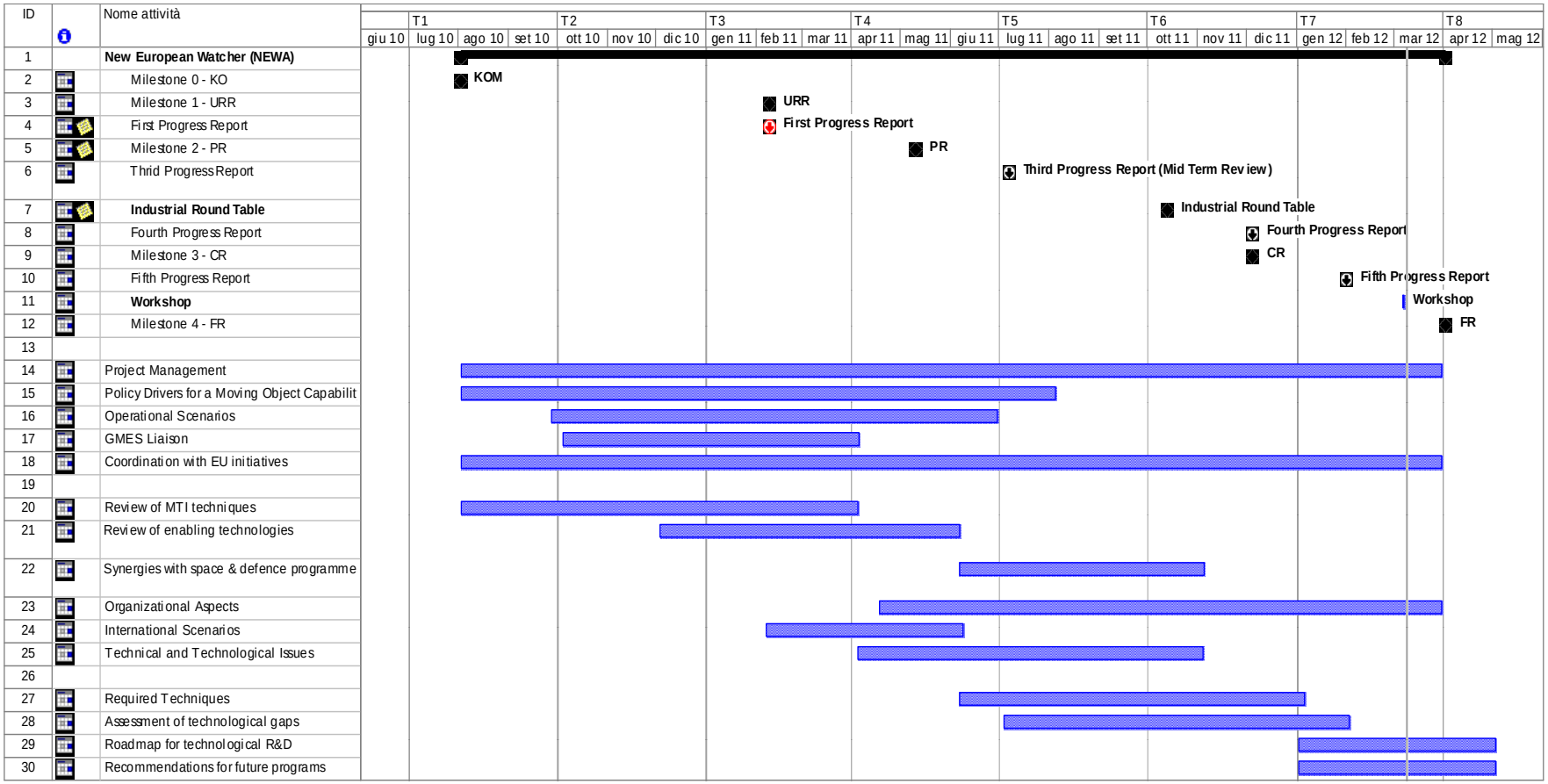

Figure 1.3.2- 1 NEWA Schedule. During the Activities the need of two additional months was justified to the Commission and the extension of the project was agreed. A very tight rearrangement of the activities and the final meetings and their purposes was needed.

WP2 - Applications:
The Consortium was deeply involved into the exploration of capabilities in Space support to Security and Safety of European Citizen but a systematic and quantitative analysis of the User Needs, finalized to required applications, was not available. This constituted the first step of NEWA projects.

WP2.1 - Policy Drivers for a Moving Object Capability

The WP objective dealt with the identification of policy drivers for the establishment of a Moving Object Capability at EU level. The activity has been completed by performing tree main tasks:

- survey of the existing projects/programs/services in the field of radars;
- submission of a Questionnaire to relevant European stakeholders and end-users;
- preliminary scenarios definition.

The WP activity results have been included in the deliverable **D21.1** ***Methodology Report***.
The very initial part of the WP2 research activities was carried out; the activities have been devoted to the identification of potential policy and operational drivers to support the establishment of a space-borne Moving Object Detection capability for the European public safety and security needs.
From a methodological point of view, these drivers have been identified through two separate phases. During the first one – in order to exploit existent knowledge on the utilization of space radar satellites for detection and identification tasks in public safety and security missions, and to narrow the options available and focus the investigation on a limited but relevant number of potential scenarios - IAI has carried out a comprehensive overview of similar capabilities addressed in existing or past European R&D projects, missions and services.
During the second phase, thanks to an accurate engagement of relevant operational end-users, IAI been able to identify those public safety and security context – the Reference Scenarios - in which the availability of a space-based Moving Object Detection capability would add value to operational activities. In this task, stakeholders and end-users - engaged through a semi-guided questionnaire and personal interviews – provided fundamental insights to define current operational practices, to identify strengths and weaknesses in terms of detection and identification systems.
Five different Reference Scenarios have been identified among the broad set of public safety and security missions carried out at the EU and Member State level:

- *Maritime Security, Search and Rescue Operation (S&R);*
- *Maritime Security, Oil Spill Response;*
- *Terrestrial Security, Protection of Critical Infrastructure (Energy Assets);*
- *Iceberg Monitoring and Surveillance of the North Atlantic Shipping Lanes;*
- *Military evacuation of European citizens from a hostile environment.*

After being identified, the Reference Scenario have been systematized by IAI, in order to provide the technical partners with general information concerning end-users' practices and potential needs (what information, when and where), and to characterize them in terms of mission objectives and tasks performed, players involved, geographical and logistics constraints, detection and identification capabilities. It has to be stressed, however, that the objective of IAI task was not the definition of end-users requirements - to be categorized in the following Work Packages - but the identification of the most promising fields of application for these capabilities.

WP2.2 - Operational Scenarios

The WP objective was the identification of realistic Operational Scenarios for a space-based moving target indication (MTI) radar system. According to the WP description the deliverable **D22.1** ***Operational Scenario Report Is. 1*** has been issued. This document has been prepared in accordance with WP 2.1 Questionnaire and Methodology Report resulting from a scoping study across a number of potential stakeholders and users of a NEWA system. The identified scenarios have been analyzed into "vignettes".

The results of the analysis of operational scenarios are presented in Table 1, which presents an overview of the most significant use cases analysed, and proposed the "useless" and "good" limits for the Probability of Detection (Pd) to be applied to each Critical Measurable Parameter. These use cases, CMP and Pd limits together provide the basis for comparison of the performance of different potential configurations for the NEWA system, when undertaking a Combined Operational Effectiveness and Investment Appraisal.

Ops Scenario	Use Case	Critical Measurable Parameter	"Useless" Pd Limit	"Good" Pd Limit
Scenario #1: Maritime Security, S&R Operation	(1) Save and Rescue human beings filling a slow old fishing ship	Ability to detect slow moving, large steel vessel, in rough seas	40% probability of detection (Pd)	80% Pd
	(2) Intercept and arrest smugglers	Ability to determine heading and velocity of rapid, small rubber vessel, in rough seas	20% Pd	70% Pd
Scenario #2: Maritime Security, Oil Spill Response	(1) Detection and characterisation of oil spill in open waters	Ability to detect oil slick within [TBD] of its occurence	Slick detected within 2 hrs	Within 30 mins
	(2) Tracking of ships potentially responsible of the oil slick	Ability to determine heading and velocity of all suspect vessels	40% Pd	80% Pd
	(3) Limitation and recovery of oil spill	Ability to measure development/reduction of area of oil spill coverage	N/A	N/A
Scenario #3: Terrestrial Security, Protection of Critical Infrastructure	Oil pipeline sabotage	Ability to detect moving truck-sized land vehicles	20% Pd	70% Pd
Scenario #4: Iceberg Monitoring and Surveillance of the North Atlantic Shipping Lanes	Iceberg tracking to prevent navigation dangers	Ability to determine heading and velocity of slow moving, large steel vessel, in icy seas	N/A to MTI	N/A to MTI
Scenario #5: Military Evacuation of the European citizens from a hostile environment	EU citizens' evacuation from crisis area	Ability to detect convoy of moving car-sized land vehicles	20% Pd	70% Pd

Table 1: A synoptic overview of all scenarios taken into account

WP2.3 - GMES Liaison

The WP objective was the retrieval of information about the ongoing activities performed in GMES program in the framework of Security domain.
Within NEWA activities the possible interactions between an MTI system and GMES System of Systems was analysed and the complementarities of the "S" in GMES and the NEWA achievements was evidenced.
More specifically GMES program (comprising satellites, ground stations, airborne and ground based ancillary support data, data standardizations,..) is aimed at providing services based solely on MONITORING & FORECASTING capabilities, working on six thematic:

- Marine Services,
- Land Services,

- Atmosphere Services,
- Emergency Services,
- Climate Change Services,
- Security Services.

Security services, as monitoring illegal activities, border control, nuclear capabilities and infrastructures, critical assets, etc., are probably the less mature within GMES domain even if during last two years projects as G-MOSAIC, MARISS; DOLPHIN, SIMTISYS, SeaU, etc, allowed:

- to define a service portfolio, agreed with the involved users, and consolidate service specifications and level agreement;
- to exploit and develop advanced technologies in support to security issues (detection, extraction, MTI solution, etc), mainly thanks to the advantages due to the new satellite missions characteristics.

NEWA allows to identify main recommendations in accordance with the GMES scopes as exploit new operational technologies to improve service level. Projects implemented in last years gave different contributions to the evolution of Security services: some of them, as G-MOSAIC, allowed the definition of a "first issue" of service portfolio to be tested and pre-operate, some others continue working on technologies and improvement of technique to define new products and increase service quality level. NEWA demonstrated both these two last aspects: the achieved results in the Space Technology Readiness Level must be increased in order to reach the required compliance to perform the MTI measurements, and demonstrated that all the aspects that have a role in determining the Service Quality Level, including the target observation geometry, the communication channel, the sea state, the processing approach, the sensors that can be useful for the detection from Space, etc. are fundamental for the correct implementation of Security Service. All these aspects are not mature enough to meet the User requests, but the European Institutions and Stakeholders are well oriented. As a proof the GMES Program will offer a big opportunity with the development of the five sentinels mission, providing datasets for GMES Services, embarking heterogeneous remote sensing payloads.

- Sentinel 1 is a LEO polar-orbiting all-weather, day-and-night C-band SAR payload with a data storage capacity of 1410Gb and a 520 Mbit/s X-band downlink throughput to be embarked on two satellites (Sentinel 1A, 1B).
- Sentinel-2 is a LEO polar-orbiting multispectral (visible, near infra-red, short wave infra-red) high-resolution optical imaging payload to be embarked on two satellites (Sentinel 2A, 2B).
- Sentinel-3 is a LEO polar-orbiting multi-instrument payload comprising a radiometer, a Ku and C band altimeter, a GNSS receiver, and a spectrometer to be embarked on two satellites (Sentinel 3A, 3B).
- Sentinel-4 and Sentinel-5 are a geostationary and LEO payloads respectively comprising IR spectrometers to be embarked on Eumetsat meteorological satellites.

Even if with different timeline, data value will increase, exploiting the capability to provide operational services with a relevant cost-benefit analysis. Clearly SBRs providing both images of the Earth's surface using SARs as well as detecting moving targets on the ground (GMTI) would represent an augmentation of the possible GMES services for the Emergency and Security Services as well as for Land and Marine Services especially for the surveillance of ground vehicles, vessels, and general traffic.

A report, the **D21.1** ***Report on GMES Liaison with NEWA concepts,*** includes all the analysis results.

WP2.4 - Coordination with EU initiatives

The former WP objectives aimed at suggest eventual readdressing of topics discussed within the Project in comparison with on-going activities within EC framework. In particular these activities were conducted with exchange of information, possible contribution and guidelines with the on-going Projects and EC initiatives.
During the Project, the need to have a more close cooperation with the on-going Institutional Projects and Initiatives arose. In this view the participation to the initiatives, taken as reference (as MARSUR) and deeper investigations with the Users were retained crucial for the final results of the Project. To this purposes the scopes of the Industrial Round Table and of the final Workshop were slightly readdressed in order to benefit as much as possible of the foreseen interaction. In particular, in the last meeting, a questionnaire was compiled by the Consortium and filled by the guests of the Workshop. This allowed the have a wider view of the European Users and Stakeholders perspective; infact a different orientation of the Users needs and priorities emerged for the first investigations conducted at the beginning of NEWA. The small gap evidenced, was already known by the Consortium and the readdressing of the purposes of NEWA were already taken into account.

The WP activities results are included in the deliverable **D24.1** ***Contribution to EU Scenario***.

WP3 - Review of the EU State of the Art:
The first collection of the state of the art of Techniques and Technologies useful for the MTI system implementation was performed in order to better individuate the synergies among the different Technological environment and to cross fertilize the results obtained in other Security environment.

WP3.1 - Review of MTI techniques

The WP objective was the critical review of the European state-of-the-art concerning Moving Object Indication Techniques in the light of future space-based NEWA establishment. The performed review covered three different application areas:

- Spaceborne techniques;
- Airborne assets for ground and air surveillance;
- Terrestrial and naval systems with MTI capabilities.

Moreover, in order to identify the scientific baseline for NEWA Concepts definition, three fundamental aspects have been identified and analyzed:

- ***Space Mission***
  Mission key aspects, in terms of system configuration, sensors & downlink capabilities, number of satellites and relevant orbits, have been analyzed in order to support NEWA concept definition.
- ***Electronic components***
  A comprehensive review of the electronic components needed for MTI Space systems and an analysis of the EU current availability of electronic components for NEWA.
- ***Processing***
  A review of MTI data processing techniques (DPCA, ATI, STAP,…)

The WP activity results have been included in the deliverable **D31.1** ***EU Scenario Review Report (Issue 1)***

WP3.2 - Review of enabling technologies

The WP activities have been focused on the review of the enabling technologies that allow NEWA precursor operations. This technological study includes the identification of the NEWA key components, the identification of their performance and limitations, the assessment of their availability in the EU, and the identification of on-going developments regarding such components.
Starting from the WP 3.1 outputs (i.e. **D31.1**) an analysis of the current availability of electronic components for NEWA has been added. The study analyses the state of the art, the on going technological programmes and includes a technology snapshot. Moreover, a performance comparative analysis among DPCA, ATI and STAP techniques has been performed. The WP activity results have been included in the deliverable **D32.1** ***EU Scenario Review Report Is. 2***

WP3.3 - Synergies with Space & Defence programmes

The WP activity was aimed at identifying the on-going institutions, programs, and references within the Defence environment that can represent a synergy with the NEWA analysis, focussing on the issues highlighted in this Project. The WP activity results have been included in the deliverable **D33.1** ***Synergies with Space and Defence Programmes***. After the Final Review the document was augmented with a dedicated section on dual missions (civil and military) for Earth Observation programmes in Europe.

WP4 – International Relation:
The aforementioned synergies were inserted into a European and an International Scenario. It was retained fundamental the check with the European Defence actors by means of a Round Table discussion and Workshop involving the interviewed Users at the beginning of the project.

WP4.1 - Organizational Aspects

During NEWA Project two separate events were organized, the Industrial Round Table (IRT) and the Final Workshop (FW) held, respectively, in October in Rome and in February in Paris. The objective of both the IRT and the FW was to present and discuss the main NEWA findings with qualified interlocutors.
During the IRT - aimed at fostering a dialogue with the consortium and relevant industrial stakeholders from European companies, R&D departments and institutional actors (i.e. MoDs) - have been discussed the potential application of and the perspectives for the industrial development of MTI technologies. After having discussed the preliminary results concerning operational scenarios, MTI techniques and the missions characteristics presented by the NEWA partners, the participants actively contributed to the elaboration of the Roadmap by providing a set of specific indications and recommendations.
The FW, which gathered industrial representatives and institutional officials together with some of the operational end-users engaged during the initial phases of the project (WP2) aimed at getting feedbacks on the NEWA research activities but also at creating a network that could be exploited for current and future projects in the domain of GMES security/SBR surveillance and to support policy-making processes at the EU level. During the FW, the consortium has brought forward to the

audience both the final results achieved by project and the presentation of the EU roadmap for NEWA. Then, a questionnaire specifically prepared for the FW has been submitted to the participants to validate (or not) the outcomes emerged from the different NEWA activities. The questionnaire resulted useful also to collect informed opinions, remarks (and even criticisms) on the security and financial environments in which MTI applications could be eventually developed.

WP4.2 – Scenarios

The WP objective was the identification of realistic Operational Scenarios for a space-based moving target indication (MTI) radar system. According to the WP description the deliverable **D42.1** ***International Scenario Review Report Is. 1*** has been issued. This document has been prepared in accordance with the non-EU scenarios identified within WP 2.1 activity. The D42.1 document also includes a brief overview on non-EU surveillance applications with MTI capabilities.

WP4.3 - Technical and Technological Issues

The WP activities were focused on the analysis of the techniques and technologies that represent the basis of non-EU MTI capabilities, both in operational system and planned R&D programmes. The analysis was oriented to information collection and comparative performance assessment in order to gain knowledge on EU current gaps and potential evolution. The deliverable **D43.1** ***International Scenario Report*** was submitted to the Commission. From the evaluation of non-EU surveillance applications with MTI capabilities the following systems were identified as relevant to the NEWA project and their capabilities presented within the study report:

Military Applications

- RQ-4 Global Hawk (U.S.A.), an unmanned aircraft able to provide high-res SAR images
- TecSAR (Israel), a satellite equipped with an high-res X-Band SAR
- E-8 Joint STARS (U.S.A.), a modified Boeing 707 airplane equipped with radar
- Lacrosse/ONYX (U.S.A.), a series of recognition S/Cs equipped with high power SAR
- RISAT-2 (India), a satellite similar to the Israeli TecSAR (X-Band SAR)
- E-3 AWACS (U.S.A.), a modified Boeing 707 airplane equipped with an S-Band radar

Commercial Applications

- RADARSAT (Canada), a series of EO S/Ls equipped with C-Band SAR
- Yaogan (China), a series of EO S/Ls equipped with an L-Band SAR

WP5 - Gap Assessment:

The Technologies and Techniques analysis combined with the purposes of the users regarding the implementation of a European MTI system focalized on the assessment of the needed technology and the individuation of possible algorithms that can support a sustainable design approach. The evidence of the gaps was also outlined.

WP5.1 - Required Techniques

This WP was devoted to the identification of the techniques that are required for NEWA concept establishment. The activity was aimed at analyzing NEWA-related techniques and identifying sustainable NEWA concepts. Starting from the operational scenarios, the state-of-the-art review (EU and non-EU) of the NEWA candidate architectures and operation concepts were outlined in terms of Mission Aspects, Payload Architecture, and Processing Techniques.
The Mission Aspects comprised the definition of a system configuration related to the user requirement as well as a trade-off analysis for the definition of a baseline system configuration optimized for the management of all scenarios. The Payload Architecture comprised architectural design features for spaceborne payloads for SAR & GMTI along with the key subsystems. The processing techniques comprised the state-of-the-art GMTI techniques for spaceborne applications. The deliverable **D51.1** ***NEWA Sustainable Concepts*** was submitted to the Commission.

WP5.2 - Assessment of technological gaps

This WP was devoted to the analysis of technologies required for NEWA concepts establishment and characterization of existing gaps.
The activity was aimed at identifying gaps for sustainable NEWA concepts. The Mission Aspects, taking into account the NEWA Operational Scenarios, an assessment on the gaps for space-borne radar (SBR) Low Earth Orbit (LEO) constellations was outlined. Moreover possible functional partitioning of the payload architecture subsystems was described in order to cope with the technological constraints of a feasible SBR payload whereas a proper distribution of the Processors functionalities between the Space Segment and Ground Segment was taken as a reference. Extensions on the current state-of-the-art GMTI techniques were selected in order to provide further insight on the feasibility of improved schemes.The deliverable **D52.1** ***GAP Assessment Reports*** was submitted to the Commission.

WP6 - Roadmap:
This is recognized as one of the most important WP of the entire project: the output of the considerations contained into the relative deliverables will directly impact on the beyond activities and will support the European Commission with a concrete and quantified picture of the European capability of Space assets in Security and Safety field. During this last stage of the project the Consortium comes back to the initial phase of the project and offers in a European and International Scenario the correct impact of the MTI capabilities and future activities.

WP6.1 - Roadmap for technological R&D

Aim of this WP was the first identification of a sustainable roadmap for future technological development, considering the NEWA activities performed and the analysis of the status of technology development in Europe together with the techniques applicable to MTI systems. The activity comprised the action identifications for endorsing the engineering lifecycle of a constellation of European satellites feeding a large heterogeneous (i.e. ground-based, ship-based, airborne, and spaceborne) System of Systems (SoS) for modern Data-Fusion-based surveillance. The document was based on harmonizing the overall NEWA project results in terms of mission aspects, processing techniques, payloads architectures, and enabling technologies.
The deliverable **D61.1** ***NEWA Roadmap (Issue 1)*** was submitted to the Commission in due time.

WP6.2 - Recommendations for future programmes

The activity augmented the WP6.1 results with a set of recommendations taking into account public IEEE proceedings, peer-to-peer exchange of ideas within the technical community, end-user workshops feedbacks comprising GMES actors, space agencies, defense institutions, think-tanks, as well as current R&D programs of large aerospace & defense contractors. The scope of the WP was an aid to future actions identifications in order to support European R&D programs.
The deliverable **D62.1** ***NEWA Roadmap (Issue 2)*** was submitted to the Commission, but during the Final Review some comments arose and the document needed additional refinements. An additional augmentation-activity was tailored to the GMES framework eventually identifying market developments and synergies as well as funding priorities among the selected recommendations.

1.3.3 NEWA Foreground

NEWA Project was a Study aimed at identify the State of the Art of Techniques and Technologies available in Europe, useful for an MTI System in Security environment. MTI technique was recently considered as a useful application of Space data in the measurement of moving targets on Ground. The experimental implementation of useful algorithms for the extraction of the information from the images of recent launched SAR instruments, increases the interest in the real capability of European Community to improve Security of citizen both on Land and on the open Seas. In the last decades the performances of the SAR instruments increased drastically and MTI measurements are concretely evaluated as a real capability reachable in the near future.
Till 2008 no systematic approach in Europe was used to evaluate such capabilities, nor the steps to complete the full design process of an MTI system were known. NEWA offered an analytical approach both to the identification of the real user's needs and the consequent identification of the MTI system architecture.
From the Kick Off of the Project till nowadays several parallel EC Initiatives both at Institutional and Stakeholder level have emerged and the NEWA foreground combined with such on-going activities paves the way to the next generation of Instruments and End to End Systems, useful also for MTI measurements.
In particular the NEWA foreground can be addressed in the three main central sections individuated during the Study:

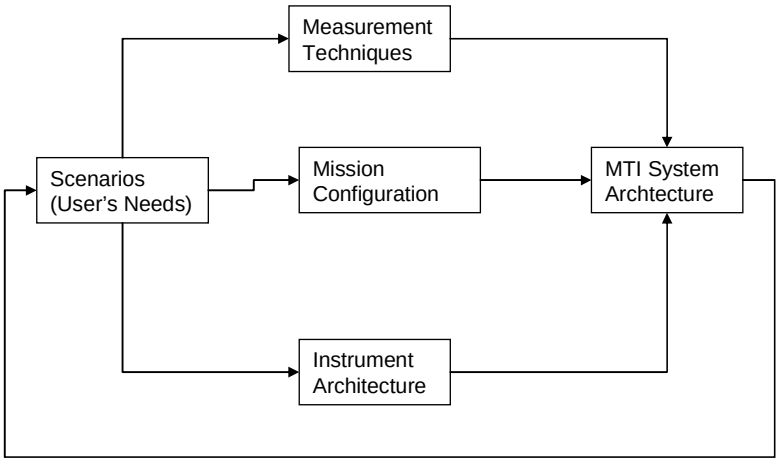

Figure 1.3.3-1 The links among the areas in which the NEWA foreground can be addressed. The Scenarios analysis led to the main three parallel topics of interests and the resulting analysis and the merge of the most promising architecture, led to the MTI Architecture(s).

In particular the addressed areas can contain:

- Measurement Techniques and Algorithms
  - The nowadays Techniques applied to the evaluation of images and the extraction of useful information are mainly experimental and the obtained results cannot be considered as a proof of evidence for the validation of the technique; the number of independent parameters are reduced, in the most of cases the results are known by comparing with other ground based sensors, the scenarios are not fully representative of the real cases. The complexity of the algorithms is very high and additional effort must be spent on their optimization.
  - The resources for the processing are actually not dimensioned and the huge of data processing can be shared on board and on ground. The two possibilities imply several additional analysis that must be faced with the actual state of the art of the processing techniques and management architecture (multi-processor, multi-core, etc.)
- Mission Configuration analysis
  - The mission analysis performed in NEWA demonstrated that a simple approach of a dedicated MTI mission is not feasible in terms of costs and times; the application of a dedicated mission cannot complete justify the very high cost of implementation. This implies that additional evaluation must be made and the final arrangement can be the result of a System of Systems, exploiting the combination of several different sensors
- Instrument Architecture
  - The actual flying instruments are not dimensioned to comply with the MTI techniques useful to indicate all the needed parameters of a moving target. The architectures are individuated, during the project and the best reachable performances are already analysed. Moreover the maturity of the European technology strongly limits the development of the next generation of instruments. Several activities across the Europe are on-going to overcome the actual low TRL. The next SAR generation can embark the well dimensioned technology even if the processing techniques and resource can limit the reachable performance.
- Cost effectiveness
  - This aspect was not included into NEWA project at the beginning but, during the survey and during the technology analysis emerges as a very important aspect that cannot be forget: the costs for the development of the useful technologies must be shared among different applications (also dual); the application itself must be correctly addressed and shared, where possible, among different users, to maximise the usage and minimise the maintaining costs; the final MTI architecture should not avoid the concept of operation in order to better exploit the obtained data and to maximize the final performances.

1.4 NEWA Impact & Exploitation of Results

As a Coordination and Support Action, NEWA project was considered as Technical justification of recommendation for future development and R&D activities in Europe. During the project lifecycle the Technical evaluations, i.e. mission aspects, enabling technologies, payload architectures, and processing techniques, were analysed and the final recommendations on future development and R&D activities were inserted into the complex European framework. In what follow the Impacts and the Exploitation of the obtained results are reported.

1.4.1 Impacts of NEWA Results

The NEWA Sustainability Study has identified technical and technological gaps to be filled in order to provide the European Union (EU) with spaceborne GMTI capabilities. It is worth noting that such an assessment has been performed taking into account a preliminary set of operative scenarios defined by potential final users where high officials within governmental institutions have envisaged the possibility to exploit services for the homeland protection. Spaceborne Radars (SBRs) aimed at providing both images of the Earth's surface using SARs and the detection of moving targets on the ground (GMTI), are a technical challenge similar to the amount of efforts required for the analysis, design, development, and testing of the Global Positioning System (GPS). This results from the fact that SAR imagery from LEO spacecrafts has a well defined, mature and flight proven system engineering framework whereas MTI techniques are manifold and, for SBRs, are still experimental. Mathematical analysis and computer stochastic simulation appeared as the cornerstone for addressing this low-TRL engineering-framework and eventually for simplifying solutions.

It is also worth addressing the links of the NEWA Sustainability Study with the sprouting of GMES services. A preface is necessary in order to outline such a connection within a neat operative framework. More specifically the GMES program (comprising satellites, ground stations, airborne and ground based ancillary support data, data standardizations,..) is aimed at providing services based solely on MONITORING & FORECASTING capabilities related to six remote sensing thematic areas. In synthesis the capabilities of the GMES services are related mostly to IEEE IGARSS communities developments where geoscience and remote sensing topics are discussed. On the contrary radar surveillance (and related services) are related mostly to IEEE RADARCON communities developments where MTI and pulse Doppler radars topics are discussed. Clearly SBRs providing both images of the Earth's surface using SARs as well as detecting moving targets on the ground (GMTI) would represent an augmentation of the possible GMES services for the Emergency and Security Services as well as for Land and Marine Services especially for the surveillance of ground vehicles, vessels, and general traffic.

An endorsement for fostering the evolution of SBRs capabilities with respect to the NEWA project has also been outlined taking into account public IEEE proceedings, peer-to-peer exchange of ideas within the technical community, end-user workshops feedbacks comprising GMES actors, space agencies, defense institutions, think-tanks, as well as current R&D programs of large aerospace & defense contractors. More specifically the type of endorsement for the engineering lifecycle of a satellite constellation providing both SAR mapping & GMTI capabilities was provided as an aid to future actions identifications in order to support European R&D programs.

The following table reports a clarifying note on the recommendations types for the NEWA Sustainability Concept, i.e. on whether they encompass aerospace & electrical engineering R&D Boundary Conditions and/or if they represent R&D Funding Schemes.

Recommendation	Clarifying Note
Grasping acquaintance of the core engineering issue and related R&D methodology	R&D Boundary Conditions
Applying a dual-use approach	R&D Funding Scheme
Funding coherently	R&D Funding Scheme
Fostering centers of excellence	R&D Funding Scheme R&D Boundary Conditions
Exploiting/augmenting in-situ capabilities	R&D Boundary Conditions
Assuming a global vision for operative geo-scenarios and orbital constraints	R&D Boundary Conditions
Endorsing electrical engineering fields	R&D Funding Scheme R&D Boundary Conditions
Relaxing early warning responsiveness	R&D Boundary Conditions
Considering formation flying constellations for surveillance as a second priority	R&D Boundary Conditions
Adopting other performance criteria for SBR constellations	R&D Boundary Conditions

Table 1.4.1 -1 - Clarifying Note on the Recommendations

With no claim to exhaustiveness, the following table reports a preliminary set of key R&D areas to be funded. As a final clarifying note only the key areas that need to be further developed with benefits for GMTI SBRs will be highlighted as a specific funding priority while those key areas whose further developments for SBRs encompass a general benefit also for navigation, telecommunication, and other scientific missions will be indicated, as a general funding priority.

R&D Area	Funding Priority Type
Multi-Channel Phased Array Antennas	General Funding Priority
Digital-Based Payload Architectures	General Funding Priority
On Board Digital Processing Enabling Technologies	General Funding Priority
On Board Storage Enabling Technologies	General Funding Priority
Adaptive Coded Modems (ACM)	General Funding Priority
Surveillance MIMO SBR Techniques Studies	Specific Funding Priority
SAR-GMTI Techniques Studies	Specific Funding Priority
Experimental Data Fitting to Models	Specific Funding Priority
Aerospace Mission Studies	Specific Funding Priority
Aerospace Satellite Studies	Specific Funding Priority

Table 1.4.1 – 2 - Funding Priorities

For the sake of completeness it must be stressed that the consolidation of spaceborne MTI processing techniques and related studies is definitely a temporal priority as it shall be the driver for the requirements on the payload architecture and related allowed diversity. However the required amount of funding and the related development time for the hardware/software breadboarding activities for these techniques represent the most significant funding burden.
Both Multi-Channel Phased Array Antennas and Digital-Based Payload Architectures represent the most structural funding priorities for the NEWA sustainability study since these two areas allow "harmonizing" the available enabling technologies and "instantiating" feasible results of the studies.

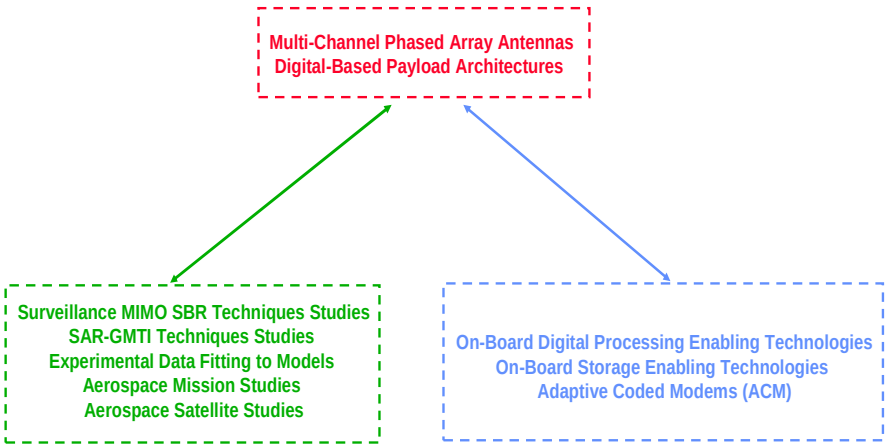

Figure 1.4.4-1 - Structural funding Priorities for the NEWA Sustainability

A preliminary timeline for the development of a scalable flight model for a SBR aimed at both EO and Surveillance can be roughly foreseen as shown in the figure below.

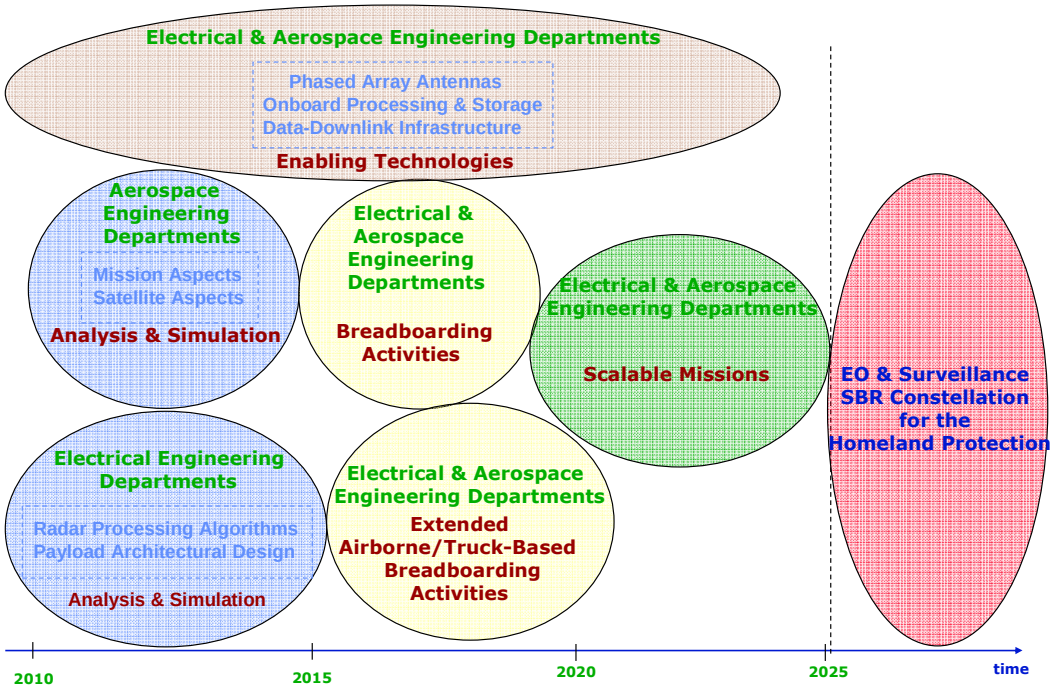

Figure 1.4.1-2 - Preliminary SBR Constellation for EO & Surveillance Timeline

Accordingly both aerospace and electrical engineering departments within centers of excellence should be involved for R&D efforts on a SBR Constellation for EO & Surveillance purposes. The "preliminary" attribute has been included in order to clarify that such a a timeline roadmap is providing a rough order of magnitude alone whereas technical difficulties and bottlenecks as well as simplifying solutions are often inevitable events that could enlarge or shrink the timeline respectively.

1.4.2 NEWA Results Exploitations

The overall MTI system architecture results as a merge of all the analysis and considerations and the most performing MTI system architecture(s) can be designed on the basis of NEWA recommendations. Before the effective design, however, the NEWA Consortium individuated additional questions:

- Is it possible to correctly dimension an End to End MTI system, before the design?
- Are the data coming from one sensor enough or the final measurement or the MTI measurement can be composed by several individual measurements made up by several cooperating different instruments?
- Are the data fusion techniques mature enough to allow such measurements?
- Is the processing technique mature enough to allow a correct MTI result?
- Are the technology mature enough to allow such high volume data management?

As heritage NEWA left several questions that surely help to find the development way in order to better focalise the final solution and arrive to the MTI system design.
European Community is well approaching the answers to the above questions with a plenty of activities in the development of product that can be used into a dedicated MTI mission.

Following the common standard engineering process, the NEWA Consortium believes that before going in details in the design of the most promising MTI system Architecture, a simulation of the reachable performance and the best 'tricks' and solutions to overcome predictable development's problems should be made. With this approach the simulation for the most critical areas individuated during NEWA activities is envisaged. The composition of such SW tools simulator into an overall MTI system architecture will surely help the answer to the above questions.

NEWA Consortium is already engaged to Study such product: SIMTISYS (SImulator for MTI SYStem) will be a SW simulator for an MTI systems and will be built in a modular approach allowing the plugging of different SW modules each simulating instruments, techniques, processing algorithms, mission configuration, etc. The correctly dimensioned functional flow allows the simulation of the measurements required in specific conditions or Operational Scenario. The modular approach allows to add *a posteriori* cooperative sensors as a module simulator and the associated algorithm for the MTI measurement, extending the diversity of sensors and cooperative missions.
Presently SIMTISYS is composed of the basic architecture in order to validate the NEWA choice and quantitatively justify the gaps found in technology developments evidenced by NEWA project.

The final exploitation of SIMTISYS is envisaged on several fronts:

- The User: the simulator will offer an easy and immediate tool to quickly evaluate the possibility to merge data coming from different cooperative missions, in a cost- and time-

saving approach. Moreover the simulator offer immediate answer to the requests in terms of feasibility of measurements.

- The Service: the simulator quickly identifies the correct data to supply to the User by investigating the available mission and by correctly interface the Service with the request in a standard format. The approach allows the Service to quickly evaluate the requests in the correct format and rearrange the data deliver operations.
- The European Research Entities / Industrial Community: the simulator allows to evidence possible gaps in information or data and possible technology areas where the research must be improved.

Other active projects funded in the European and International Agencies include studies on the possible implementation of MTI systems as future daily tools or Space data application in support the Security and Safety monitoring. Actually none of them foresees development of demonstrators in the short term.

NEWA started a systematic study on the GMTI discipline by combining the Industrial and the Research activities for the common goal of improvement new Satellite Earth Observation applications and by fostering the interests of the User community in Security and Safety improvements.

1.5 Consortium and Partners details

1.5.1 Thales Alenia space Italia

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1.5.2 EGEOS

Company	Name of reference Person	Role of reference Person	Email address	Telephone	Fax
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1.5.3 Istituto Affari internazionali

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1.5.4 Universitat Politecnica de Catalunya

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1.5.5 Fondation pour la Recherche Stratégique

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1.5.6 Indra Sistemas

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	R. Romero		rromero@indra.es		

1.5.7 Vega Space Ltd

Company	Name of reference Person	Role of reference Person	Email address	Telephone	Fax
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1.5.8 Thales Sistemes Aeroportes

Company	Name of reference Person	Role of reference Person	Email address	Telephone	Fax
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2 *Use and dissemination of foreground*

A plan for use and dissemination of foreground (including socio-economic impact and target groups for the results of the research) shall be established at the end of the project. It should, where appropriate, be an update of the initial plan in Annex I for use and dissemination of foreground and be consistent with the report on societal implications on the use and dissemination of foreground (section 4.3 – H).

The plan should consist of:

- Section A

  This section should describe the dissemination measures, including any scientific publications relating to foreground. **Its content will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

- Section B

  This section should specify the exploitable foreground and provide the plans for exploitation. All these data can be public or confidential; the report must clearly mark non-publishable (confidential) parts that will be treated as such by the Commission. Information under Section B that is not marked as confidential **will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

2.1 Section A – Dissemination and Foreground

The present section contains a brief description of each individual Partner's foreground and the impact of such additional knowledge on the future activities for each Partner. Each section will be completed with the list of Papers published by each Partner on NEWA topic during the Project timeframe.
Two cumulative Tables (A1 and A2) are reported in the Annex 1 of this report.

TASI: TASI activities was devoted to the identification of possible MTI system architectures that can be develop with the exploitation of full European Technology or exploiting System of Systems concepts, based on European Space missions. The knowledge acquired by TASI during the NEWA lifetime was double:

- Technical: the evaluation of possible mission and instruments architectures, techniques, algorithms and technologies allow Thales Alenia Space Italia to enter in more details with the new field of the MTI techniques.
- European Environment: the very complex frame in which NEWA dealt, and to which the Project contributed, allows TASI to actively participate to the indication of the best R&D developments in the next future and to better address the User needs in terms of Security tools to be develop.

In particular NEWA concepts were presented to the Community in restricted areas, mainly attended by specialists. Recently, due to the last NEWA meetings and a general increasing of interest and resonances around Security themes, as Moving Target Indication techniques, the NEWA activities

allows TASI to readdress in more detail the same topic by developing a specific SW tool to simulate the correct environment and parameters for a MTI systems.

IAI: During the project timeframe IAI has not produced any specific academic paper or publication on the NEWA subject. However, the Institute has been able to give public visibility to the project's activities through its website, its newsletters and its numerous space-related activities (i.e. conferences, seminars and institutional meetings). Not only academic and research centers have been involved in such dissemination efforts, but also institutional and industrial actors. Extremely important has been the continuous – informal – exchange of views with end-users involved in public safety and security missions.

UPC: UPC activity in the project has focused on GMTI processing techniques addressing both the analysis of the state of the art proposed methods and guidelines for improvement.
The main foreground resulting from the project can be summarised in the following points:

- Exhaustive search and analysis of GMTI processing techniques published results in the open literature. More than 150 references have been reviewed in order to analyse the European and Non-European state of the art in the aspects of type of platform, degree of maturity, geographic origin and type of processing technique.
- Performance analysis of the main published GMTI techniques (DPCA, ATI, STAP, ISTAP) when applied to Space-borne Synthetic Aperture Radar observation systems.
- Identification of main limitations of present GMTI techniques and proposal of possible research work topics addressed to GMTI performance improvement.

Proposal of improved sensor architectures and array geometries based on Single Space-borne SAR sensors with non-uniformly spaced antennas phase centres

INDRA: Indra is an active company in several ground segment projects for Earth Observation satellites. In particular, the company works in Pleiades, Ingenio, PAZ, SMOS and Helios. Furthermore, Indra has already been participating in the early definition of satellite missions like MUSIS (a multinational European defence program) and the future TIR sensors for ESA. The results from NEWA project and the applied methodologies will be useful for the development of concepts for new missions and to strengthen the position of the company.

VEGA Space Ltd: The work undertaken under this project has not led to the development of any IPR, or the publication of any research papers, by VEGA Space Ltd. However, the analysis undertaken is being used directly in the development of the Earth Scenario module being developed under the SIMTISYS project, which does has potential for additional applications in future.

TSA: The work undertaken under this project has not led to the development of any IPR, or the publication of any research papers by TSA. However, the work related to GMTI techniques and carried out within the framework of this project may be applicable to the field of airborne radar, which is one of the core business of TSA.

2.2 Section B – Use and Dissemination of Foreground

In the following each Partner of the Consortium reports a predictable exploitation on the basis of the actual market trend analysis and the long term Users requests.

2.2.1 Section B1 – Patents and Trademarks

Being this Project a Study on State of the Art and possible future activities within the MTI interests in Europe, the Consortium didn't addressed any Patents/restricted foreground.

2.2.2 Section B2 – Exploitable Foreground

TASI: TASI is involved in different EC project devoted to the evaluation and implementation of Security tools in Maritime Surveillance. In particular SeaBILLA, SIMTISYS and DOLPHIN are the main project related to NEWA results.
In the former TASI is involved in the evaluation of Space contribution to an integrated European Platform making use of different sensors and platforms. One of the Space issue is related to the MTI possible contribution to the security. The activities are conducted with clear benefit of the NEWA results infact, complementarities with the analysis emerged from NEWA were evident and reported to the Project. SeaBILLA started as NEWA in 2010, then the initial guidelines for the activities to implement were the same. Being NEWA a smaller and more flexible and focussed project the SeaBILLA activities allow TASI to better evaluate the MTI real exploitation in a integrated platform.
DOLPHIN can be considered as a project in charge to develop a set of SW tools useful to integrate the Space data into the on going systems that support the European Maritime Security. In this project TASI is in charge of analyze and correct the useful requirements and parameters for a SW simulator of an MTI system.
SIMTISYS is the natural evolution of NEWA, infact the project was promoted by TASI and the same core Partners of NEWA, in 2010. The project overlapped with the second half of NEWA and benefited by studies and results. SIMTISYS will develop a simulator for a MTI system and will validate the NEWA results and the given recommendations and guidelines.

IAI: Thanks to well established contacts with institutional, operational and industrial stakeholders, IAI expects to continue its informative activity, and looks forward to undertake any relevant initiative (seminar or conference) to give proper visibility to the NEWA projects and its main outcomes.

UPC: To carry out the analysis activities of GMTI processing techniques in the project, new methodologies of efficient simulation and analysis of SAR GMTI data and sensor configurations have been proposed:

- Fast simulation of clutter and targets raw data cubes based on convolution techniques
- Performance analysis of non-uniformly spaced apertures for GMTI applications

Foreground dissemination: The developed techniques have originated 2 papers that will be presented in Synthetic Aperture Radar (EuSAR) and Remote Sensing (IGARSS) International Conferences:

- Eduardo Makhoul, Antoni Broquetas and Oriol Gonzalez, "Evaluation of State-of-the-Art GMTI techniques for Future Spaceborne SAR Systems- Simulation Validation" , will be presented and published in the Proceedings of the 9th European Conference on Synthetic Aperture Radar (EuSAR 2012), Nürenberg, Germany, April 23-26 2012.

- Eduardo Makhoul, Antoni Broquetas and Josep Ruiz Rodon, "Evaluation of State-of-the-Art GMTI techniques for Future Spaceborne SAR Systems- Simulation Validation", will be presented and published in the Proceedings of the 2012 IEEE International Geoscience and Remote Sensing Symposium, München, Germany, July 22-27, 2012.

Both papers contain explicit acknowledgement to NEWA project and FP7 funding support. This foreground will be used for future research activities in particular in the context of project SIMTISYS funded by FP7.

INDRA: The actual case for an MTI mission has also provided Indra with a vision which can be exploited in the context of several GMES Security projects on which the company is currently involved (negotiations are on-going) and which are expected to be initiated in late 2012 or early 2013. We refer to G-SEXTANT (Coordinated by Indra) and G-Next (coordinated by e-Geos with the participation of Indra) where the future of operational activities of GMES security applications is to be fully consolidated. In particular, G-SEXTANT will pave the way for future products and NEWA findings can be taken into consideration for recommendations.

VEGA Space Ltd: The work undertaken under this project has not led to the development of any IPR, or the publication of any research papers, by VEGA Space Ltd. However, the analysis undertaken is being used directly in the development of the Earth Scenario module being developed under the SIMTISYS project, which does has potential for additional applications in future.

TSA: Scope of TSA activities was the identification of possible cross fertilization between the Space and Avionic field, in terms of technologies available in Europe useful for MTI application or to be developed, and the identification of actions in charge of European Institutions for such develops. Several similarities were found with the studies conducted by TSA on the electronic technologies (electronic components) in the core activities of Company and the same gaps in Europe for being independent from US generally apply to space electronics, were found.

2.2.3 Section B2 – Exploitation Plan

The aim of an exploitation plan is to propose recommendations on how to promote the future take-up and exploitation of results as well as to support a wider and correct use of the MTI data from Satellite platform in Security and Safety domains.

The principal effects on the implementation of an MTI system can be envisaged on the monitoring of the wild areas not immediately reachable via land or in open seas. The NEWA land Operational Scenarios are focalised where critical infrastructures such as pipelines lay: wild land, desert areas or disaster areas where the usual monitoring systems haven't the necessary autonomy or, in case of conflicts, are simply not allowed to survey.
NEWA Maritime Operational Scenarios are mainly focussed on the European Sea Border where several crimes must be monitored, but are also indicative for what concerning the Open Seas where other crime typology are declared.

In addition to the above service applications, NEWA project aimed at survey the development of European Technology to foster the non-dependence of Europe's growth from the legal limits posed by International Industries and/or Countries; NEWA also foster the independence from International Research and Developments entities.
Through the results obtained in NEWA project the implementation of next generation of SAR instruments that support at the same time, both the Earth Observation and the MTI measurements must be envisaged. Actually several Initiatives at European and National level are on going to such the indication as already emerged during the lifecycle of NEWA. The project contributions allow to have technical justification in support the next generation European Missions and to encourage the Cooperation among the main Stakeholders.

The study results surely support the activities of European Joint Task Force initiative (ESA, EDA, EC) for the critical technologies harmonization process as well as look after the cooperation for the utilization of the same instrument for different but complementary purposes. Synergies are strongly recommended by all the Stakeholders

3 Report on societal implications

Replies to the following questions will assist the Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

A General Information *(completed automatically when **Grant Agreement number** is entered.*

Grant Agreement Number:	241630
Title of Project:	New European WAtcher
Name and Title of Coordinator:	Ms. Fulvia Verzegnassi

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	***No***
2. Please indicate whether your project involved any of the following issues (tick box) :	***NO***
RESEARCH ON HUMANS	
• Did the project involve children?	
• Did the project involve patients?	
• Did the project involve persons not able to give consent?	
• Did the project involve adult healthy volunteers?	
• Did the project involve Human genetic material?	
• Did the project involve Human biological samples?	
• Did the project involve Human data collection?	
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	
• Did the project involve Human Foetal Tissue / Cells?	
• Did the project involve Human Embryonic Stem Cells (hESCs)?	
• Did the project on human Embryonic Stem Cells involve cells in culture?	
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	
• Did the project involve tracking the location or observation of people?	

RESEARCH ON ANIMALS	
• Did the project involve research on animals?	
• Were those animals transgenic small laboratory animals?	
• Were those animals transgenic farm animals?	
• Were those animals cloned farm animals?	
• Were those animals non-human primates?	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	
DUAL USE	
• Research having direct military use	0 Yes 0 No
• Research having the potential for terrorist abuse	

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	0	1
Work package leaders	3	6
Experienced researchers (i.e. PhD holders)	0	1
PhD Students	0	0
Other		

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	
Of which, indicate the number of men:	0

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project? ○ Yes ◉ No

6. Which of the following actions did you carry out and how effective were they?

	Not effective at all				Very effective
❑ Design and implement an equal opportunity policy	○	○	○	○	○
❑ Set targets to achieve a gender balance in the workforce	○	○	○	○	○
❑ Organise conferences and workshops on gender	○	○	○	○	○
❑ Actions to improve work-life balance	○	○	○	○	○

○ Other:

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify

◉ No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

○ Yes- please specify

◉ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

○ Yes- please specify

◉ No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

◉ Main discipline[2]: 2.3

○ Associated discipline[2]: ○ Associated discipline[2]:

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)* ○ Yes ◉ No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

[2] Insert number from list below (Frascati Manual).

- ○ No
- ○ Yes- in determining what research should be performed
- ○ Yes - in implementing the research
- ○ Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	○ ○	Yes No

12. Did you engage with government / public bodies or policy makers (including international organisations)

- ◉ No
- ○ Yes- in framing the research agenda
- ○ Yes - in implementing the research agenda
- ○ Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- ○ Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
- ◉ Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
- ○ No

13b If Yes, in which fields?

Agriculture		Energy		Human rights	
Audiovisual and Media		Enlargement		Information Society	
Budget		Enterprise		Institutional affairs	
Competition		Environment		Internal Market	
Consumers		External Relations		Justice, freedom and security	
Culture		External Trade		Public Health	
Customs		Fisheries and Maritime Affairs		Regional Policy	
Development Economic and Monetary Affairs		Food Safety		Research and Innovation	
		Foreign and Security Policy		Space	
Education, Training, Youth		Fraud		Taxation	
Employment and Social Affairs		Humanitarian aid		Transport	

13c If Yes, at which level?

- ○ Local / regional levels
- ○ National level
- ◉ European level
- ○ International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	**3**
To how many of these is open access[3] provided?	**3**
How many of these are published in open access journals?	**0**
How many of these are published in open repositories?	**0**
To how many of these is open access not provided?	**0**
Please check all applicable reasons for not providing open access:	
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[4]: ……	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		**None**
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	**None**
	Registered design	**None**
	Other	**None**
17. How many spin-off companies were created / are planned as a direct result of the project?		**None**
Indicate the approximate number of additional jobs in these companies:		

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑	Increase in employment, or	❑	In small & medium-sized enterprises
❑	Safeguard employment, or	❑	In large companies
❑	Decrease in employment,	◉	None of the above / not relevant to the project
❑	Difficult to estimate / not possible to quantify		

[3] Open Access is defined as free of charge access for anyone via Internet.
[4] For instance: classification for security project.

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:*
	None
Difficult to estimate / not possible to quantify	❑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

○ Yes ◙ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Yes ◙ No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

❑	Press Release	❑	Coverage in specialist press
❑	Media briefing	❑	Coverage in general (non-specialist) press
❑	TV coverage / report	❑	Coverage in national press
❑	Radio coverage / report	❑	Coverage in international press
◙	Brochures /posters / flyers	❑	Website for the general public / internet
❑	DVD /Film /Multimedia	◙	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

❑	Language of the coordinator	◙	English
❑	Other language(s)		

***Question F-10*:** Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]

1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

1.3 Chemical sciences (chemistry, other allied subjects)

1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)

1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY

2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]

2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]

4 ANNEX 1 - Tables

4.1 A1 - Scientific Publications

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES										
NO.	**Title**	**Main author**	**Title of the periodical or the series**	**Number, date or frequency**	**Publisher**	**Place of publication**	**Year of publication**	**Relevant pages**	**Permanent identifiers[5] (if available)**	**Is/Will open access[6] provided to this publication?**
1	Evaluation of State-of-the-Art GMTI techniques for Future Spaceborne SAR Systems- Simulation Validation	Eduardo Makhoul, Antoni Broquetas and Oriol Gonzalez	Proceedings of the 9th European Conference on Synthetic Aperture Radar	23-26 April 2012	VDE	Nürenberg	2012			YES
2	GROUND MOVING TARGET INDICATION USING MULTI-CHANNEL SAR WITH NON-UNIFORM DISPLACED PHASE CENTERS	Eduardo Makhoul, Antoni Broquetas and Josep Ruiz Rodon	Proceedings of the 2012 IEEE International Geoscience and Remote Sensing Symposium	22-27 July 2012	IEEE	München	2012			YES
3										

4.2 A2 - Dissemination Activities

Template A2: List of all dissemination activities (publications, conferences, workshops, web sites/applications, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters).

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES

NO.	Type of activities[7]	Main leader	Title	Date	Place	Type of audience[8]	Size of audience	Countries addressed
1	Coordination Meeting	TASI	MASUR	October 2010	Brussels	Specialist	20-30pp	
2	Conference	TASI	Let's Embrace Space 22011	12-13 May 2011	Budapest	Specialist	50pp	
3	Dissemination Meeting	TASI	Space Foundation	29 May 2012	Rome	Managers	20-30pp	

4.3 B1 - Patents, Trademarks, Registered Designs, etc.

N.A.

4.4 B2 –Exploitable Foreground

N.A.

END OF DOCUMENT