Roadmap
AAM (2021-2030)

Allegato 1

ENAC
ENTE NAZIONALE PER L'AVIAZIONE CIVILE

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Executive summary

- The rapid increase of the world population, the increase of urban centers and the acceleration of the population mobility rate, require an **important structural change to the offer of mobility services**
- The United Nations estimates that by 2030 the world will have 43 cities with a population of over 10 million people, and by 2050, about 6.7 billion people will live in cities, 68% of the total world population[1]. In response to these trends, the adoption of electric and hybrid aircraft for urban, suburban and rural operations is identified as a **transformative element that allows to change the way goods and people are moved, influencing different sectors of the national economy**
- In December 2019, acknowledging the social need to develop smarter mobility in order to improve the quality of life in cities, the **President of ENAC signed, with the Minister for Technological Innovation and Digitization**, a **Memorandum of Understanding** for the launch of the national Urban Air Mobility (UAM) project "Innovation e-Mobility"
- As part of this Memorandum of Understanding, with the aim of sharing a unified national strategy, the "**Creation of an Italian ecosystem for Advanced Air Mobility (AAM)"** project was launched, which aims at the development of the advanced air mobility ecosystem in Italy.
- The concept of **Advanced Air Mobility (AAM) incorporates that of Urban Air Mobility (UAM),** including non-specific applications of urban operations such as interurban commercial transport, freight transport, public services and private and / or recreational transport
- International experiences show that **urban air operations require a much wider range of competences** with respect to traditional aviation. Hence, a **complete ecosystem** integrating competences (industrial, institutional and research centers) across different sectors was **engaged in the project**
- The project had as its **ultimate goal the development of the national roadmap** containing clear objectives and tangible actions for the large-scale dissemination and commercialization of AAM services
- The working group was mobilized starting from July 2020 and has been **working on**:
  - Identification of **AAM applications** (CONUSEs) considered most **strategic for the Italian ecosystem** (air taxi, medical & goods delivery, inspection & mapping and agricultural support)
  - Identification of **gaps and challenges** to be overcome for the implementation of the selected commercial applications in Italy
  - Development of a clear **roadmap to fill the gaps** identified and reach the expected operational scenarios

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1) Numbers refer to *2018 Revision of the World Urbanization Prospects published by the Population Division of the United Nations Department of Economic and Social Affairs (UN DESA)* - pre-COVID projections

GLOBAL VISION

Enable services to make mobility in the third dimension accessible to all

OBJECTIVES

Allow entry into service of advanced air mobility applications and enhance national cutting edge industrial and technological capabilities with multidomain applications (e.g. land, air, sea transportation)

MEANS

Build an ecosystem to develop a clear National Strategic Plan for Advanced Air Mobility

APPLICATIONS

Develop drone applications for passenger transportation, goods and medical delivery, monitoring and inspection and agricultural support

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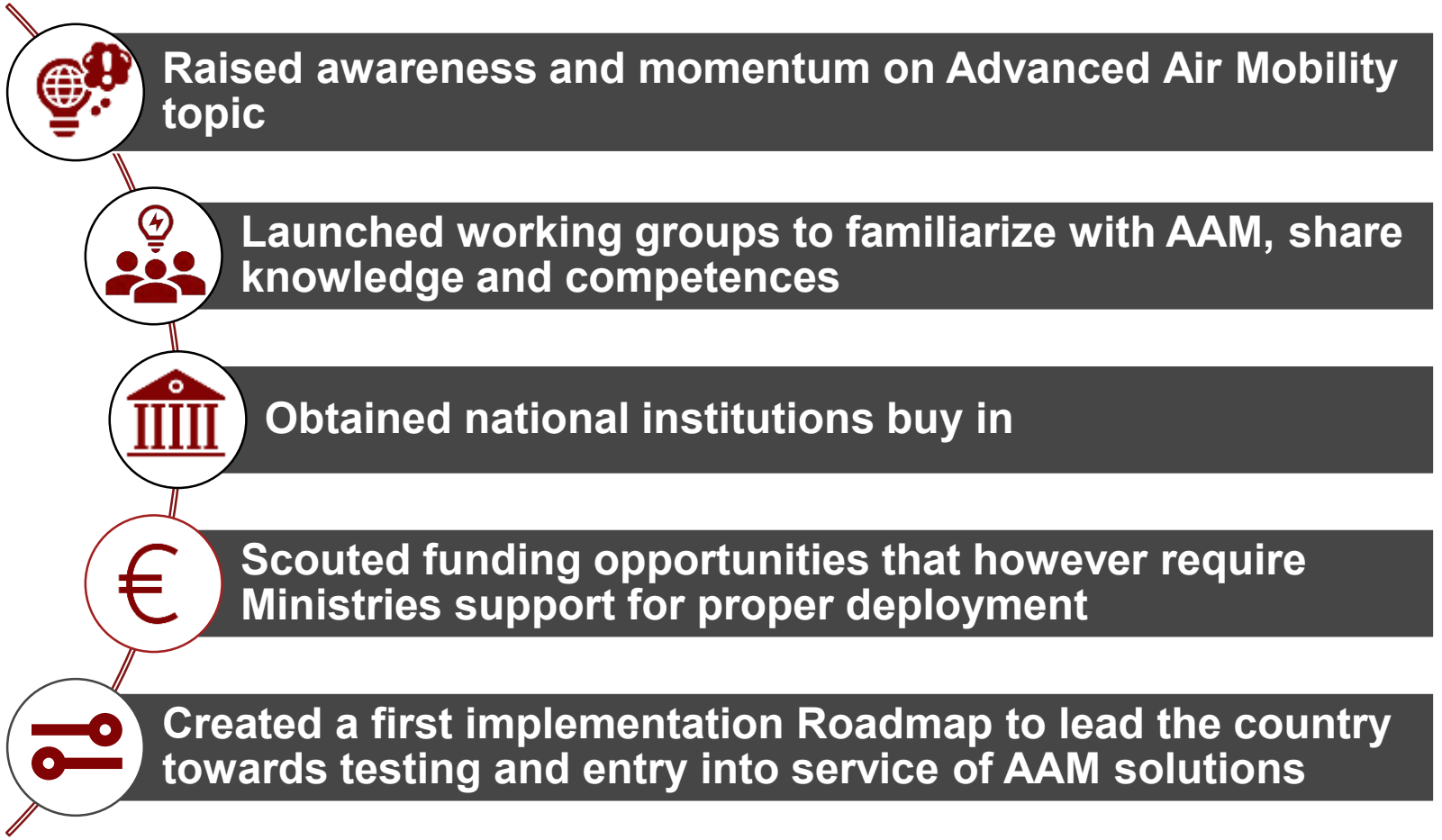
Overall, the project had some key benefits for the national ecosystem which can be summarized as follows

Key project benefits

Key project benefits:



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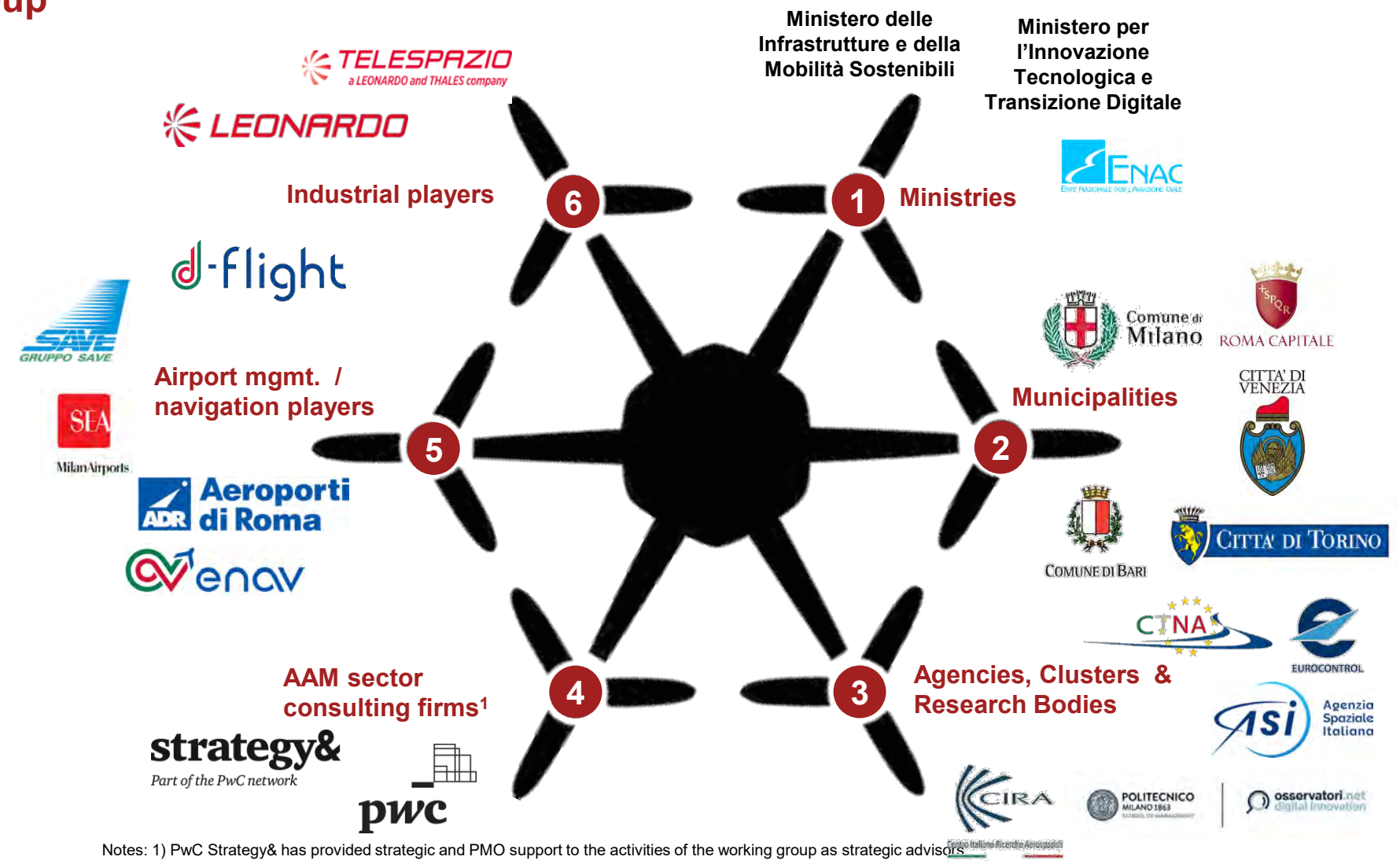
The project engaged a wide variety of experts integrating industrial, institutional and research competences

Working Group



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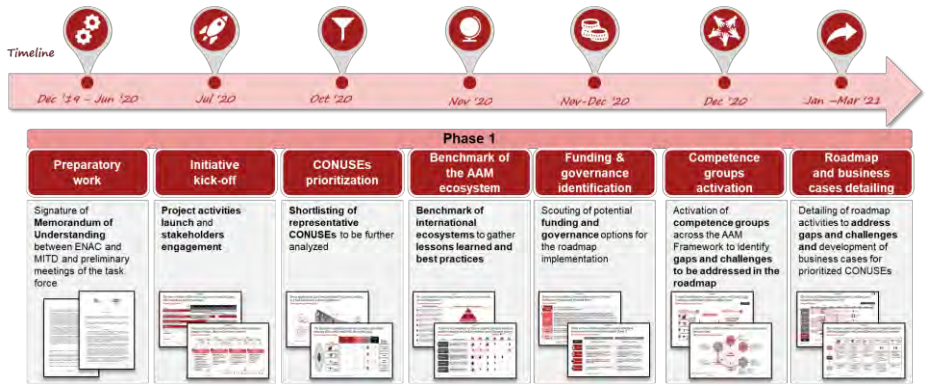
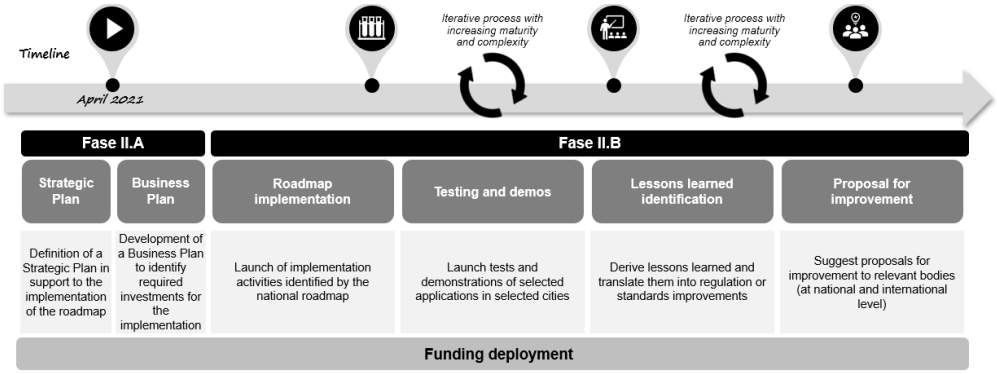
Notes: 1) PwC Strategy& has provided strategic and PMO support to the activities of the working group as strategic advisors

The project is structured in two main phases: roadmap development and implementation

Project phases

Phase	Phase 1	Phase 2
Timing	*December '19 – March '21*	*From April '21*
Objective	• Development of the **national roadmap** containing clear objectives and tangible actions for the **large-scale dissemination and commercialization of AAM services**	• **Definition of the Strategic Plan and Business Plan** in support to the implementation of the roadmap that will see the launch of the activities identified to fill the gaps in the ecosystem and through the use of testing and demonstration initiatives
See details in next slides		

Focus on next slide

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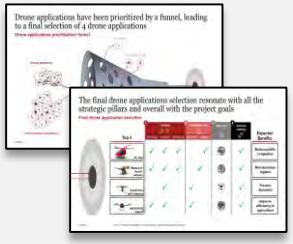
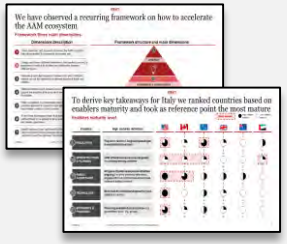
The Italian AAM ecosystem journey started in December 2019 and achieved the finalization of the Roadmap in March 2021

Phase I – Activities

Timeline

Dec '19 – Jun '20	Jul '20	Oct '20	Nov '20	Nov-Dec '20	Dec '20	Jan –Mar '21

Phase 1

Preparatory work	Initiative kick-off	CONUSEs prioritization	Benchmark of the AAM ecosystem	Funding & governance identification	Competence groups activation	Roadmap and business cases detailing
Signature of **Memorandum of Understanding** between ENAC and MITD and preliminary meetings of the task force	**Project activities launch** and **stakeholders engagement**	**Shortlisting of representative CONUSEs** to be further analyzed	**Benchmark of international ecosystems** to gather **lessons learned and best practices**	Scouting of potential **funding and governance** options for the roadmap implementation	Activation of **competence groups** across the AAM Framework to identify **gaps and challenges to be addressed in the roadmap**	Detailing of roadmap activities to **address gaps and challenges and** development of business cases for prioritized CONUSEs
						

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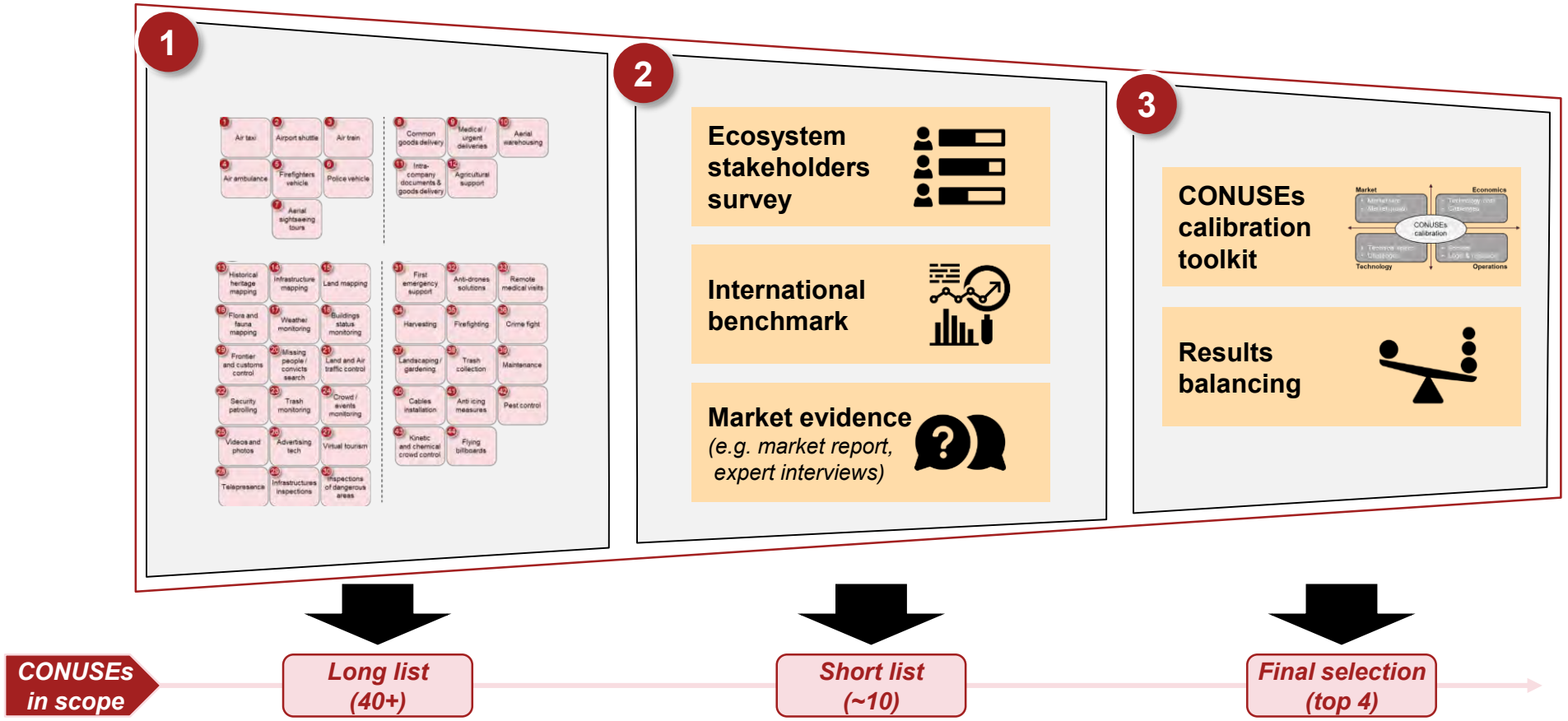
CONUSEs have been prioritized according to a three step approach

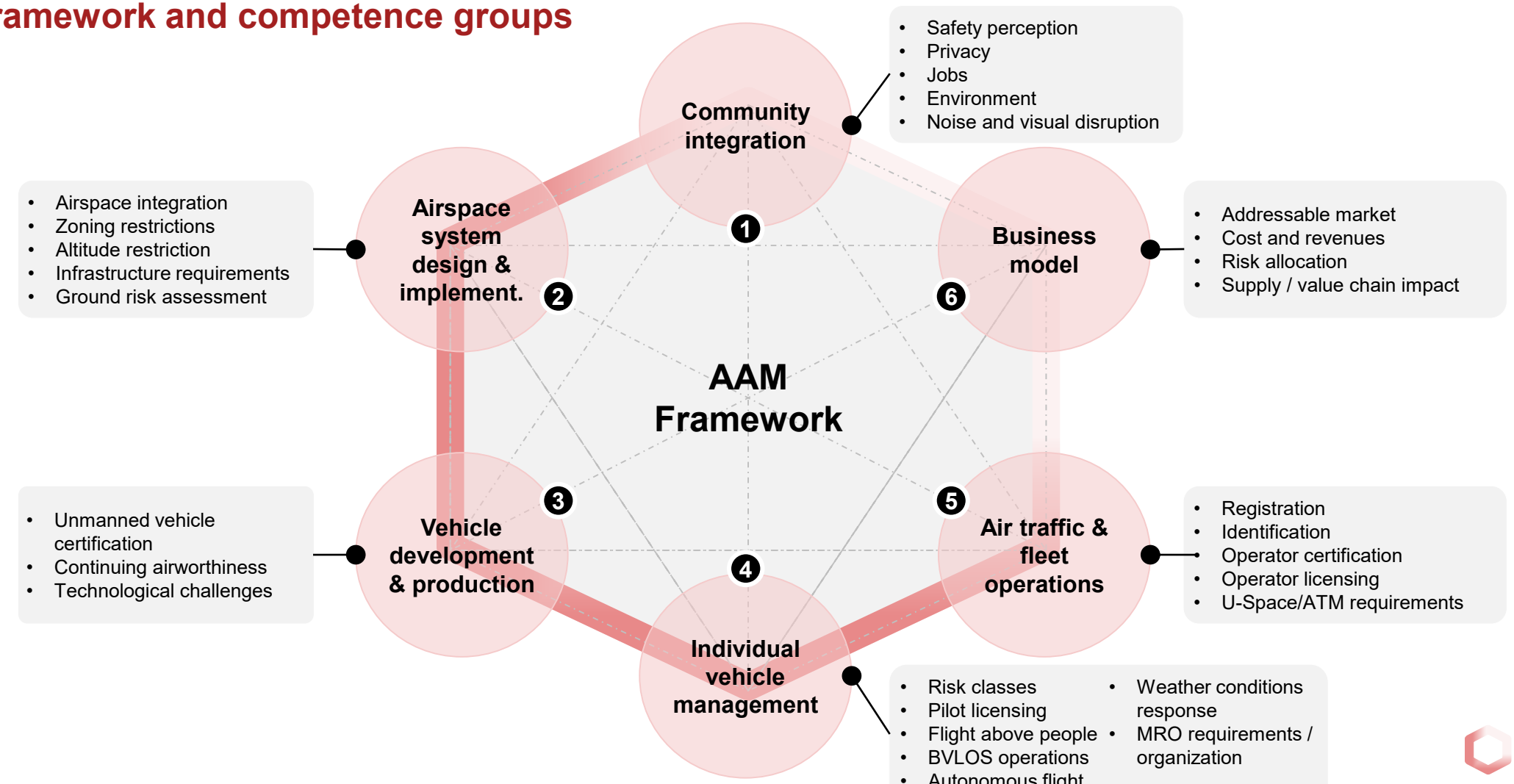
CONUSEs prioritization funnel



Source: Working Group insights

In line with the AAM framework, six competence groups have been activated

AAM Framework and competence groups



Regulation

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Source: NASA Advanced Air Mobility National Campaign Framework; Working Group insights

With reference to the selected four CONUSEs, competence groups identified gaps / challenges and actions to address them

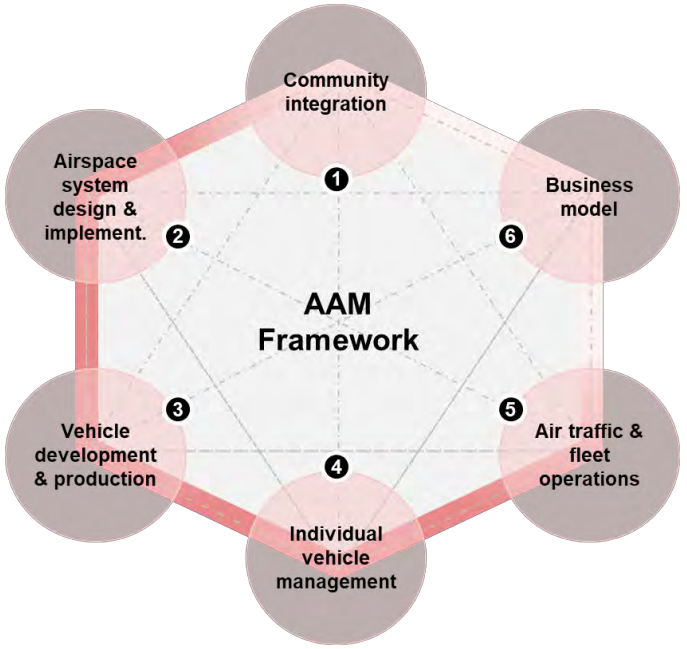
Competence groups input and output

ILLUSTRATIVE

Provided input

1. Air Taxi
2. Medical & Goods delivery
3. Inspections and mapping
4. Agricultural support

Competence Groups



Output

Gaps / challenges identification

Activities, owners and timeline to bridge gaps and overcome challenges

Roadmap

Starting from the analysis of gaps and challenges across each area of the AAM framework…

Key gaps and challenges

AAM Gaps and Challenges

Community integration	Airspace system design & implementation	Air traffic & fleet operations	Vehicle development & production	Individual vehicle management	Business Model
• **Mitigate risks** related to collection, management and storage of third parties' **data and images** • Need to **develop new types of capabilities** and integrate **new procedures and ways of working** • Communicate **benefits and address concerns** related to **environmental impact, noise and visual impact and flight safety**	• Need to **review airspace corridors design** to enable less complex AAM applications • **Need to re-design the airspace** in order to enable integrated operations of more advanced AAM applications • Need to **develop U-space-type services** and required AAM airspace services to enable operations • Lack of **air and ground infrastructure specifications**	• To enable mixed operations two elements are required: a **tactical separation algorithm; a common conspicuity technology** • **Integration of U-Space and ATM** requires the definition of standardized SWIM[1] interfaces between U-Space and ATM but also between other stakeholders • **Permitting authority** is shared among different institutional actors making the overall process lengthy and not allowing for coordinated action • Development of autonomous **sense and avoid technologies**	• Need to define **Acceptable Means of Compliance** that allow quality requirements and testing evidence to be produced by subcomponents providers instead of UAS operator/designer • There is currently no specific **Airworthiness Certification** standard for sUAS • Need to develop **onboard and ground safety and security systems** exchanging data for communication/navigation • Need to address technological challenges such as **long distance operations battery capacities**	• Uncertainty on the **role of the remote pilot** in case of operating multiple UAS simultaneously • Need for **performance-based requirements for BVLOS** and **enabling technologies for BVLOS navigation** • Need for **integration of UAS Autonomy Level**, Functions and related OR within the UAM/AAM ecosystem • Need for ConOps targeting **low cost, low burden, operational flexibility and safety MRO**	• Need to identify **adequate sustainable models** for the implementation of AAM applications in Italy • Need to define **specific timelines for the implementation of AAM applications** based on the **waves of studies, trials and regulations developed**

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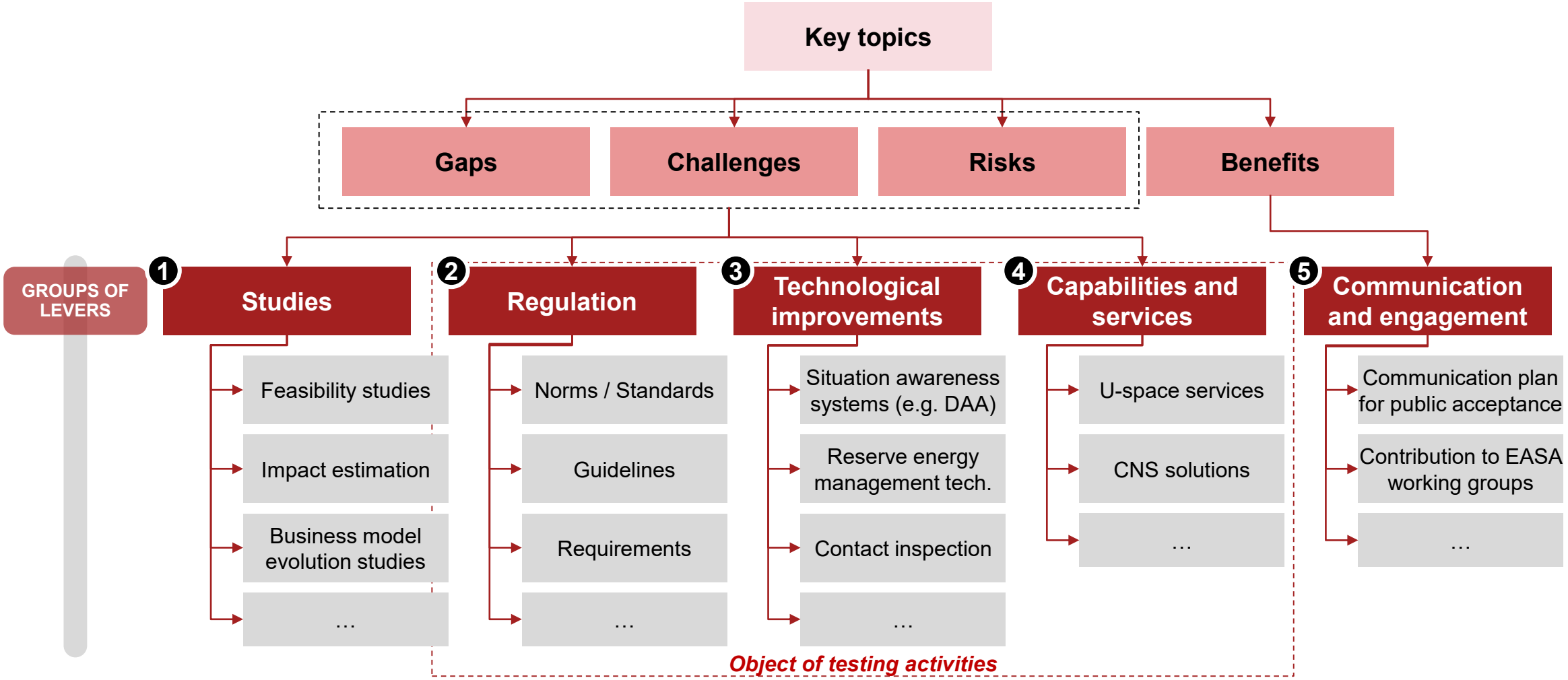
1) SWIM: System Wide Information Management
Source: Working Group insights

...five groups of levers were identified in the roadmap to enable implementation of CONUSEs

Groups of levers

NON EXAUSTIVE



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Source: Working Group insights

The roadmap has some key attributes which we should keep in mind when reading it

Roadmap key attributes

Objective

- *Unlock **ecosystem complexity** to **enable testing activities***

Perimeter

- ***Advanced Air Mobility (AAM)** incorporating Urban Air Mobility (UAM) and including non-specific applications of urban operations such as interurban commercial transport, freight transport, public services and private and / or recreational transport*
- *Focus on four main applications: **air taxi, medical & goods delivery, inspection & mapping and agricultural support***

External consistency

- *Coherence **with European Union** regulatory milestones*
- ***Inclusion of benchmark results** (e.g. US, Europe, Canada, etc.) and lessons learned from international experiences*
- *Coherence with **national legal framework***

Living document

- ***Living document:** additional activities to be included as regulation, technology and testing develop*
- *Combination of **competences** expected to **be expanded** with input from other players*
- *Requiring continuous engagement of **local communities** for testing activities*

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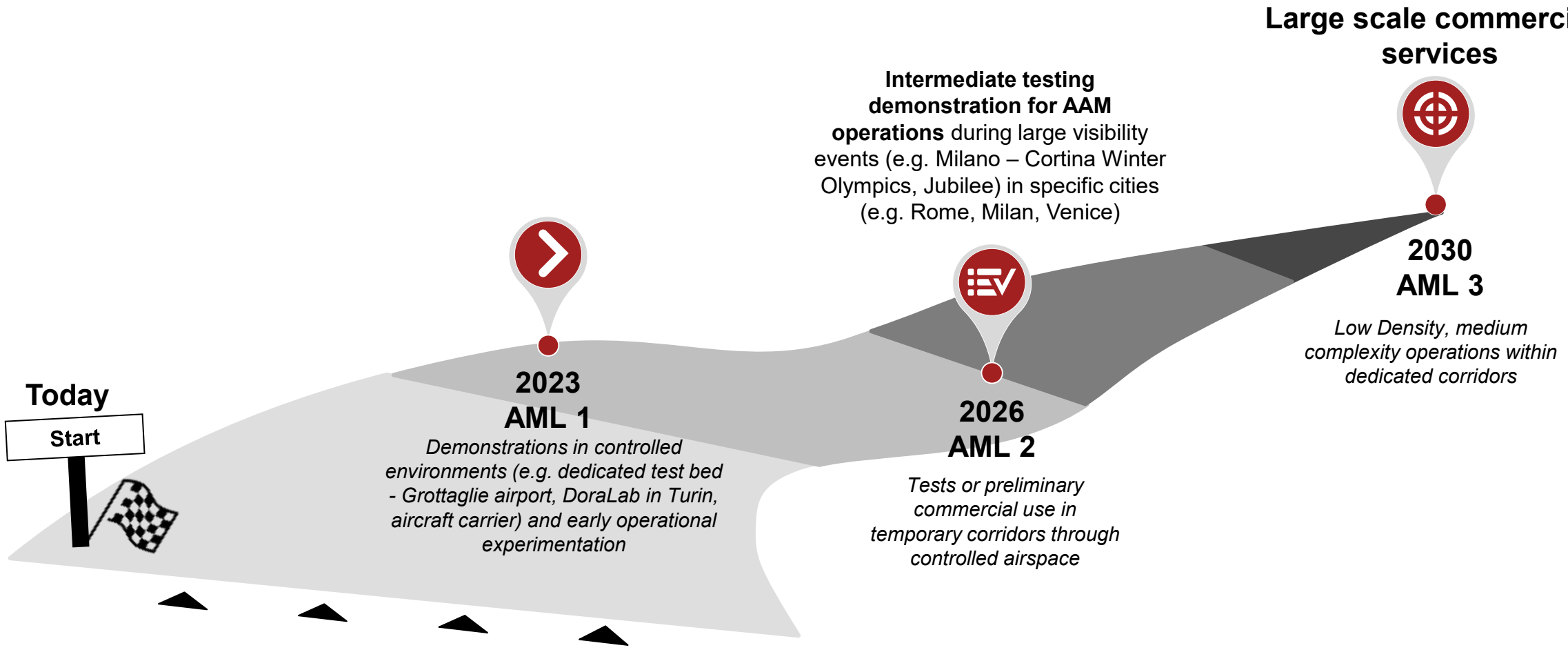
Source: Working Group insights

The agreed-upon roadmap to achieve Italian competitiveness at global level foresees the achievement of AML 3 by 2030

The Italian Advanced Air Mobility roadmap



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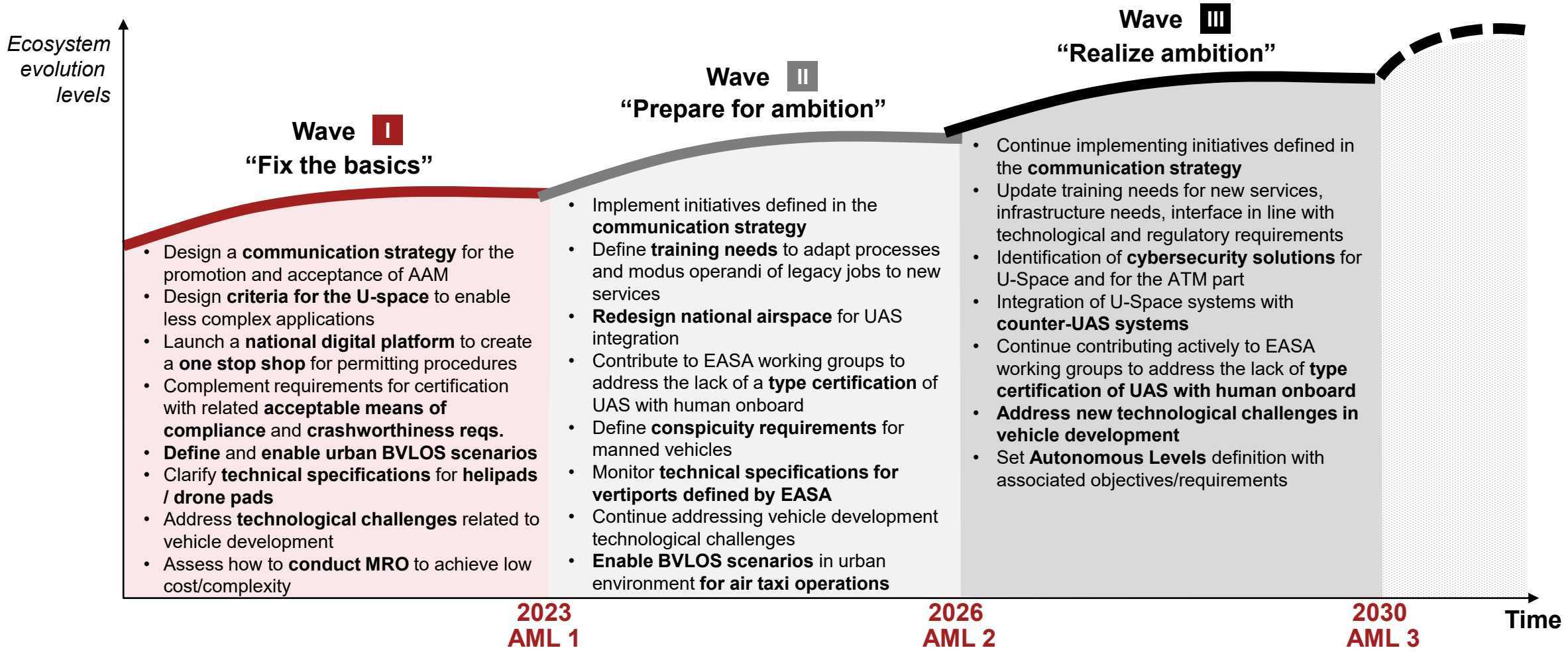
Notes: AML = Advanced Air Mobility Maturity Level
Source: Working Group insights

The roadmap foresees three waves with an increasing degree of complexity

Roadmap waves overview



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Source: Working Group insights

To support the roadmap, we developed business cases for each CONUSE with four key goals in mind

Goals of the model

Investigate market opportunity

- Scenario based **estimation of demand** for CONUSEs in 2030 and 2040
- Number of **circulating vehicles** for different applications in Italy in 2030 and 2040 based on forecasted demand for each CONUSE

Evaluate value chain impact

- **Forecasted revenues and profitability** for key actors along the value chain (i.e. OEM, service operators and MRO providers)

Calibrate infrastructure requirements

- **Quantity and density of key AAM infrastructures and investment required** relative to the calculated demand

Support to decision makers

- Support decisions of institutional stakeholders with further **ad-hoc analysis on specific geographies and use cases**

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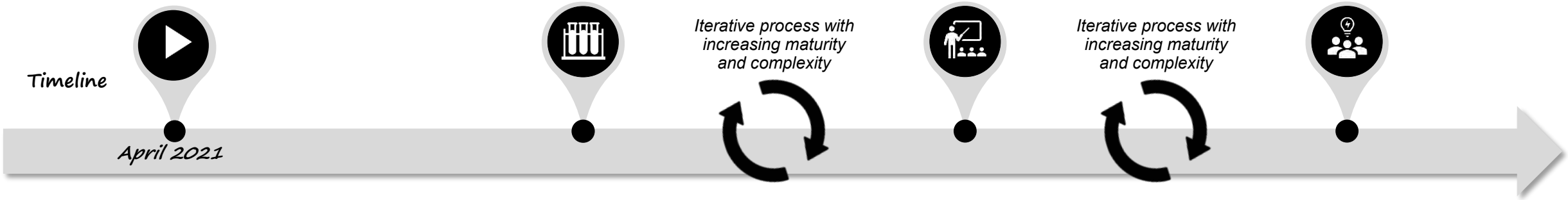
Phase 2 will see the implementation of the national roadmap defined in Phase 1

Phase 2 – Activities



Fase II.A		Fase II.B			
Strategic Plan	**Business Plan**	**Roadmap implementation**	**Testing and demos**	**Lessons learned identification**	**Proposal for improvement**
Definition of a Strategic Plan in support to the implementation of the roadmap	Development of a Business Plan to identify required investments for the implementation	Launch of implementation activities identified by the national roadmap	Launch tests and demonstrations of selected applications in selected cities	Derive lessons learned and translate them into regulation or standards improvements	Suggest proposals for improvement to relevant bodies (at national and international level)

Funding deployment

Strategic PMO

Focus on next slide

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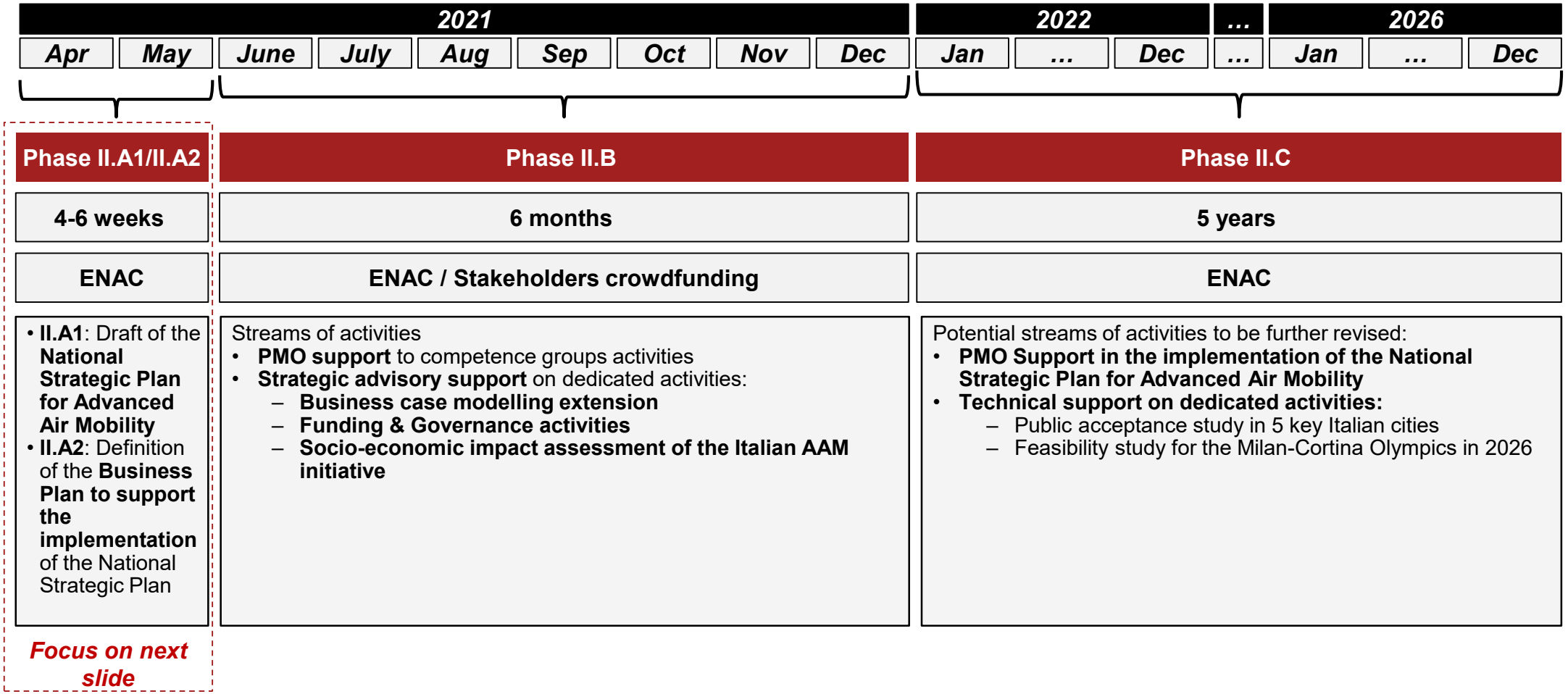
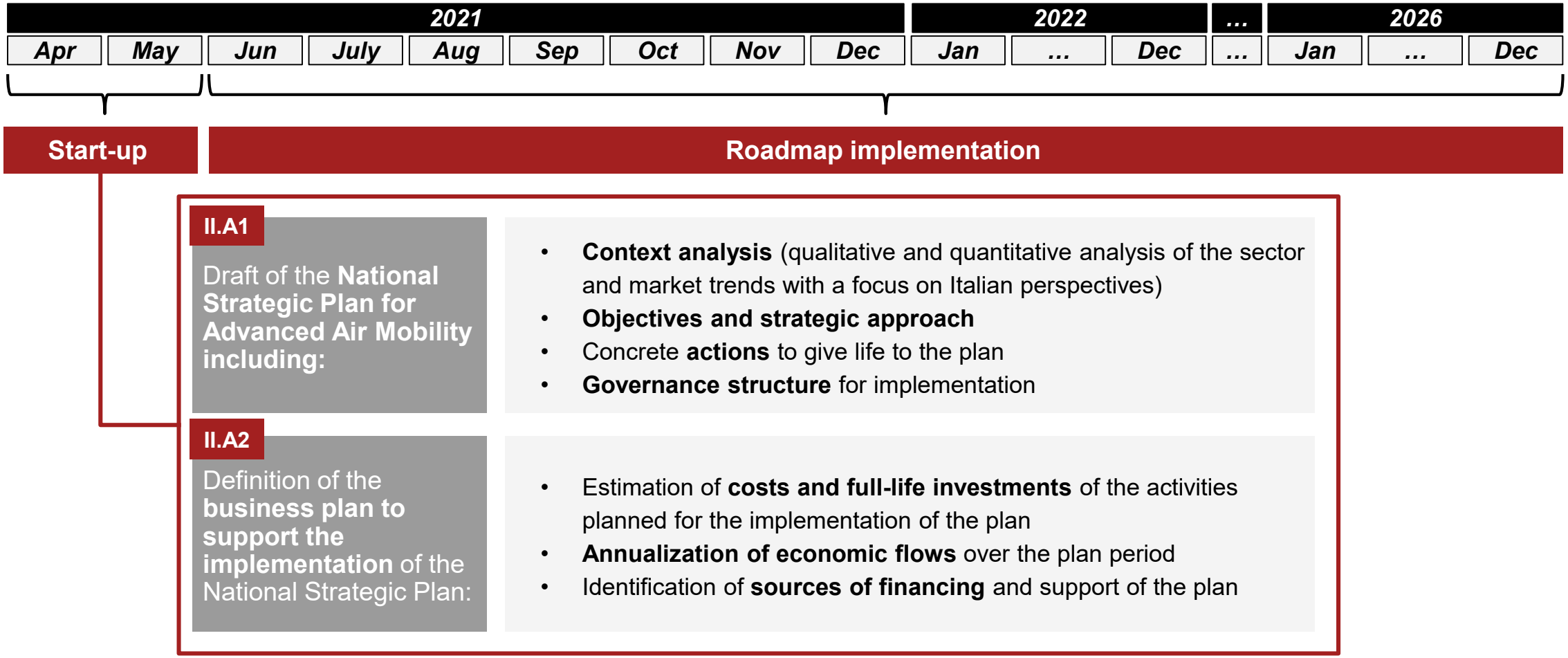
Phase II has been divided in three main steps supported by different funding instruments starting from April 2021

Phase II – steps and funding



To initiate Phase II.A of the project we will now launch two activities

Next steps



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The Italian AAM ecosystem journey started in December 2019 and achieved the finalization of the Roadmap in March 2021

Phase I

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		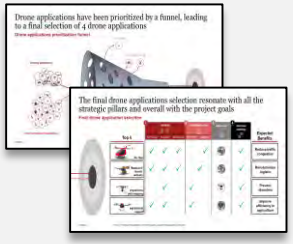	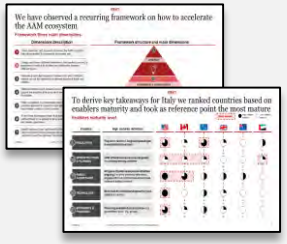			

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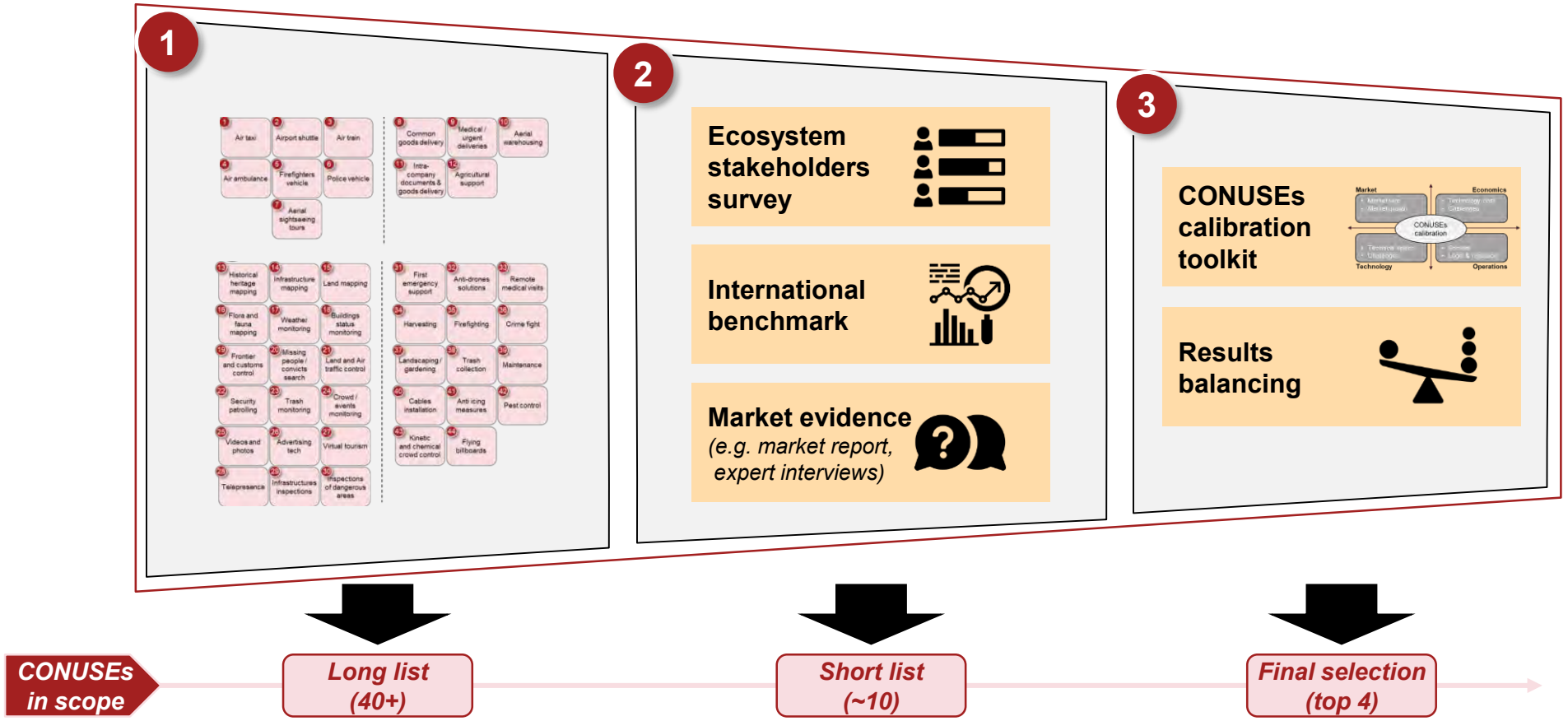
CONUSEs have been prioritized according to a three step approach

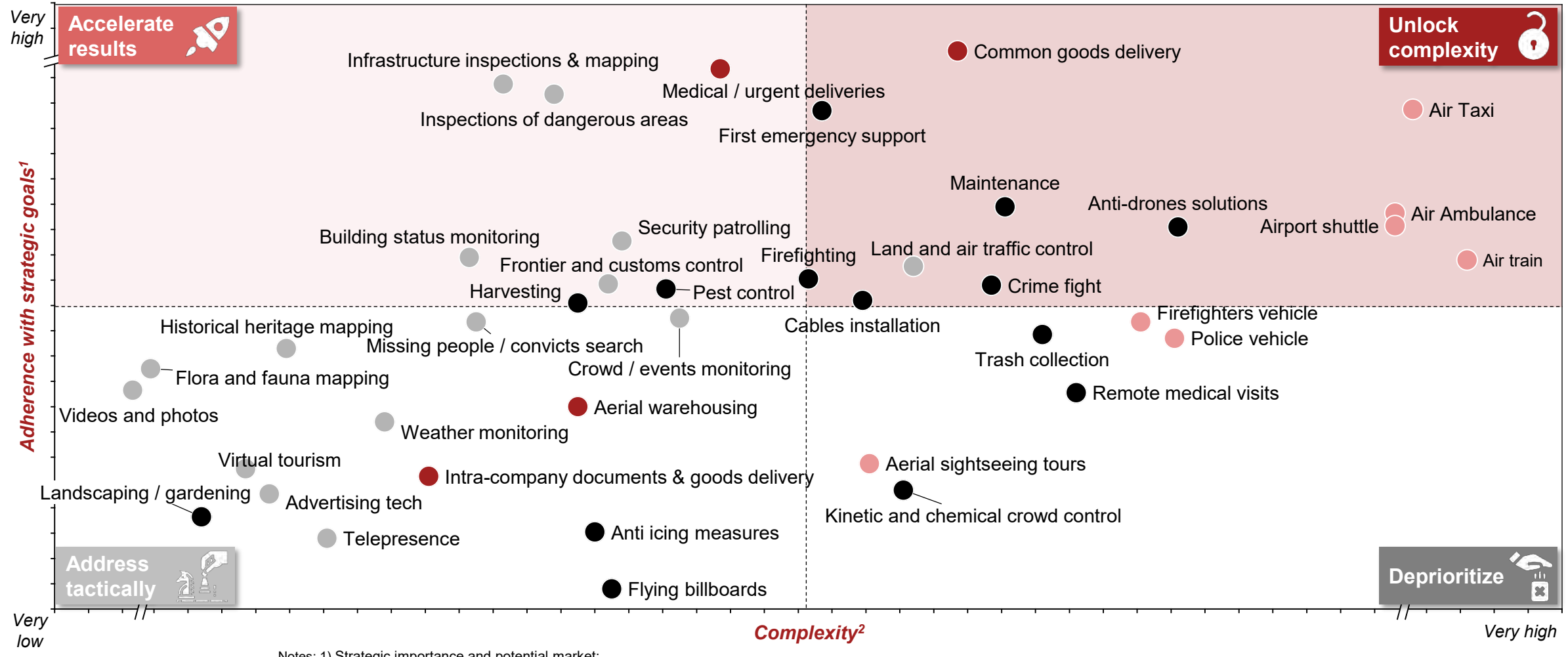
CONUSEs prioritization funnel



Source: Working Group insights

At first, stakeholders were asked to classify CONUSEs based on their complexity and adherence with strategic goals

Stakeholders response



Notes: 1) Strategic importance and potential market;
2) Technical, Operational and Regulatory complexity
Source: Working group survey

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In addition, an analysis was conducted to identify CONUSEs developed by benchmark countries

Public sector main CONUSEs

Level of initiative development: Programming | Identification | Definition | Implementation

CONUSEs Mission	Rationale	USA	EIP-SSC UAM Countries								SG	UAE	CN	#Countries prioritizing CONUSE
			DE	FR	UK	CH	BE	BL	NL	GR				
Medical / urgent deliveries	Respond to the recent pandemic	✓	✓	✓			✓	✓	✓	✓			✓	8
Common goods delivery	Reduce use of other slower and more polluting means of transportation	✓	✓	✓	✓			✓			✓	✓	✓	8
Security patrolling	Improve patrolling activities enhancing public safety	✓	✓	✓			✓		✓	✓				6
Air Ambulance	Decrease response time to emergency situations		✓	✓		✓	✓		✓					5
Air Taxi	Introduce a more efficient and fast way to move around the city	✓									✓	✓	✓	4
Inspections of dangerous area	Reduce risks for humans in critical and unsafe situations		✓				✓		✓					3
Airport Shuttle	Connect airports much faster and more efficiently		✓	✓				✓						2
Aerial sightseeing tours	Reshape current services in tourism industry (e.g. aerial city tours)			✓									✓	2

Notes: Excludes local/ city driven initiatives such as medical delivery drones in Switzerland or air taxi initiative in Paris with RATP
Source: NASA; Booz Allen Hamilton Urban Air Mobility Market Study; EIB Urban Air Mobility; The Global Urban Air Mobility Project Report; Desk research

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The final selection was conducted by maximizing each strategic pillar resonance across the CONUSE set

CONUSEs strategic pillars

1. **Unlock ecosystem complexity to set the basis for less complex CONUSEs to flourish independently**

2. **Develop a roadmap that allows, via development waves, to deliver results in the short term and set the basis for the long term**

3. **Maximize entry into service, in the long-term, of all kinds of missions[1]**

4. **Ensure the prioritization of key national strategic services and industrial ecosystem capabilities**

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Notes: 1) Passenger transportation, movement of goods, visual and data acquisition, aerial work
Source: Working Group insights

The final CONUSEs selection resonate with all the strategic pillars and overall with the project goals

Final CONUSE selection

Top 4	Unlocks			Roadmap wave		Missions[1]	National strategy	Rationale
	Technology	Regulation	Infrastructure	Short term	Long term			
1 Air Taxi	✓	✓	✓		✓	Passenger transportation	✓	• Air taxi is the **longest-term oriented** CONUSE • Air taxi allows an **almost complete Regulation unlock**, as well as Technological and Infrastructural (for big sized drones)
2 Medical & Goods delivery	✓	✓	✓		✓	Goods transportation	✓	• Medical & Goods delivery **unlocks the Infrastructure** and a great deal of Technological topics (navigation and for high-AML weight and lift) • Medical & Goods delivery deals with **Regulations regarding mostly low altitudes**
3 Inspections and mapping		✓		✓		Images and data acquisition	✓	• Inspections and mapping represents the **"Visual and Data" mission-type**, while also being the shortest-term oriented CONUSE in the set • Infrastructure inspections is also **a theme of national relevance** and overall strategic for Italy
4 Agricultural support	✓	✓		✓		Aerial work	✓	• Agricultural support represents the **"Aerial Work" mission-type**, unlocking related Regulation • Agricultural support deployment **unlocks the "Payload" topic in the Technology gap** framework • Agricultural support is a theme of national relevance

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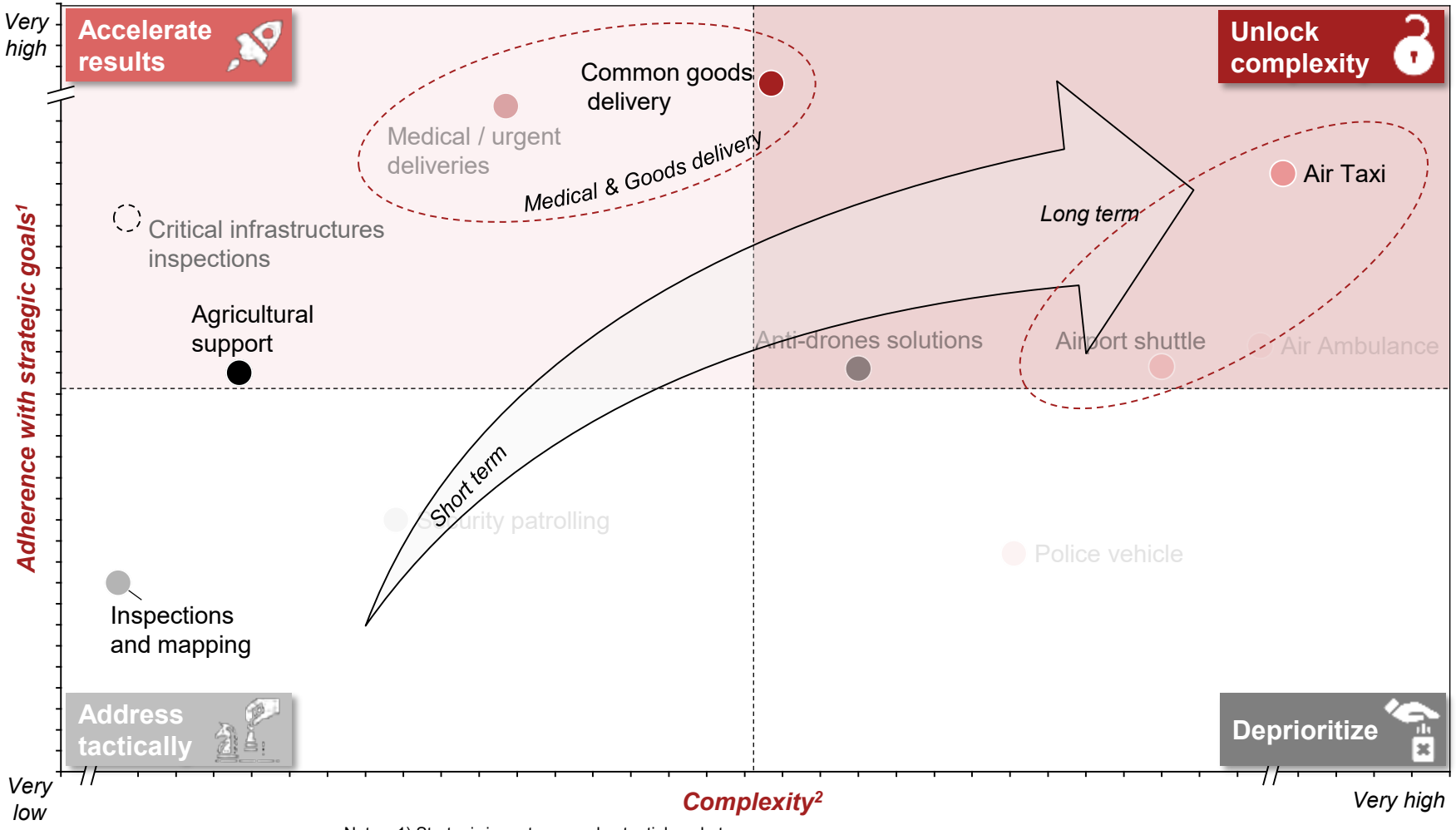
Notes: 1) Passenger transportation, movement of goods, visual and data acquisition, aerial work
Source: Working Group insights

This CONUSE selection allows a journey across the perceived complexity, progressively unlocking all top CONUSEs

Preliminary Italian AAM roadmap at a glance (stakeholder survey positioning, top 10 CONUSEs only)



Comments

- The selected CONUSEs, allow the construction of a **roadmap that delivers tangible results in both the short and long term**
- This is achieved by **moving clock-wise across the complexity/strategy matrix**, from easy and already in development CONUSEs (e.g. inspections and mapping) to averagely complex ones (e.g. agricultural support)
- **The final goal of the roadmap**, in 10-15 years, will be to **deploy very complex CONUSEs** (Air taxi as a final goal, but also its lower AMLs, e.g. Air ambulance)
- **Meanwhile**, the Technological, Infrastructural and Regulatory **effort to make the ecosystem ready** for such feats will create a **fertile environment** for all the other CONUSEs

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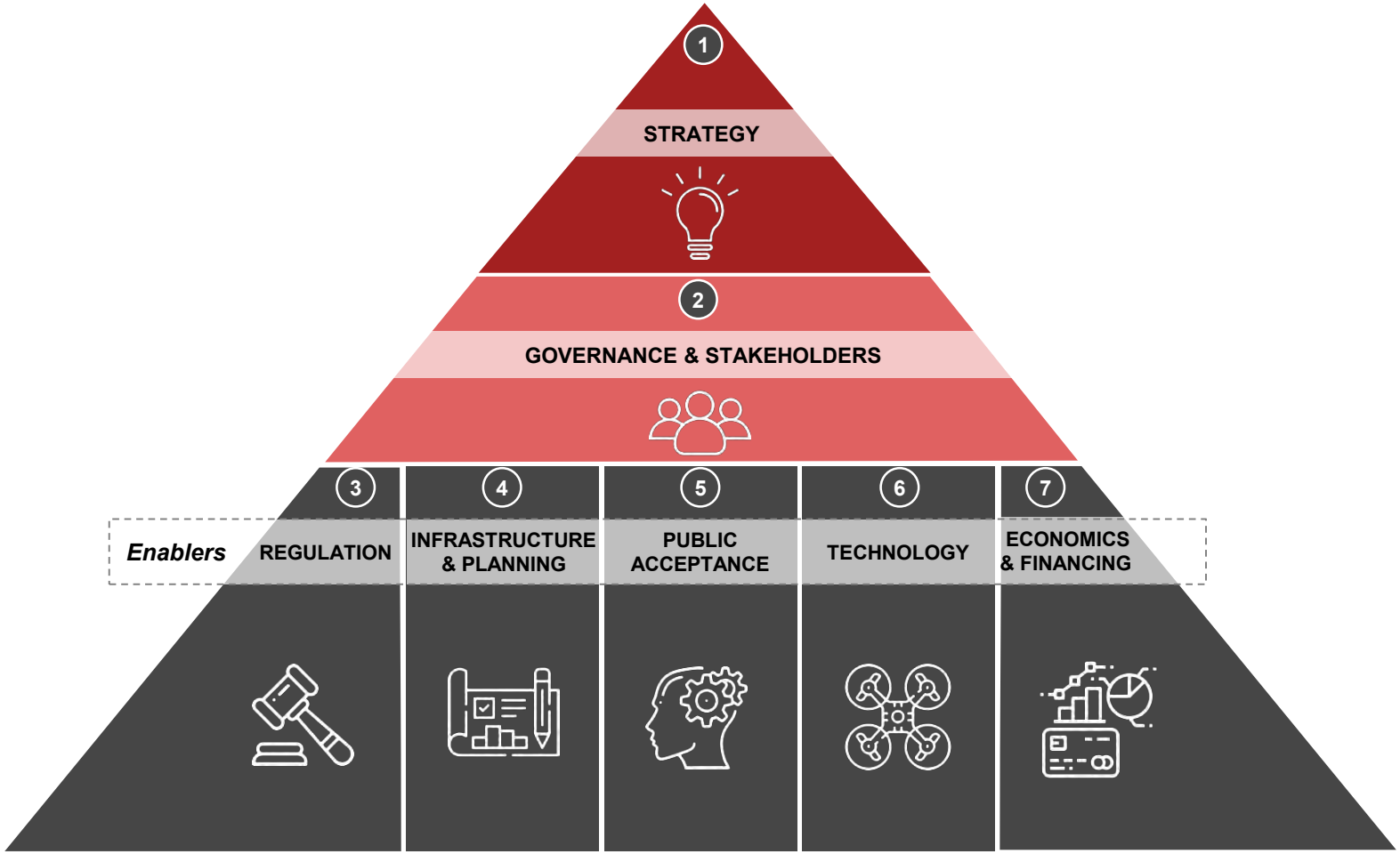
Notes: 1) Strategic importance and potential market;
2) Technical, Operational and Regulatory complexity
Source: Working Group insights

Movement of goods | Passenger transportation | Aerial work | Visual and data application

Some key recommendations for the Italian AAM ecosystem can be derived from international experiences

Benchmark lessons learned



- **Recognizing that local / city sponsorship is a key enabler**
- **Fostering cooperation outside of traditional aviation sector**
- **Adopting performance-based regulations**
- **Creating interfaces with public transport, multimodality and MaaS[1]**
- **Organizing initiatives with partners that focus on the deployment of the technology**
- **Adopting a more flexible approach to accelerate testing and demonstrations**
- **Developing Private Public Partnerships**

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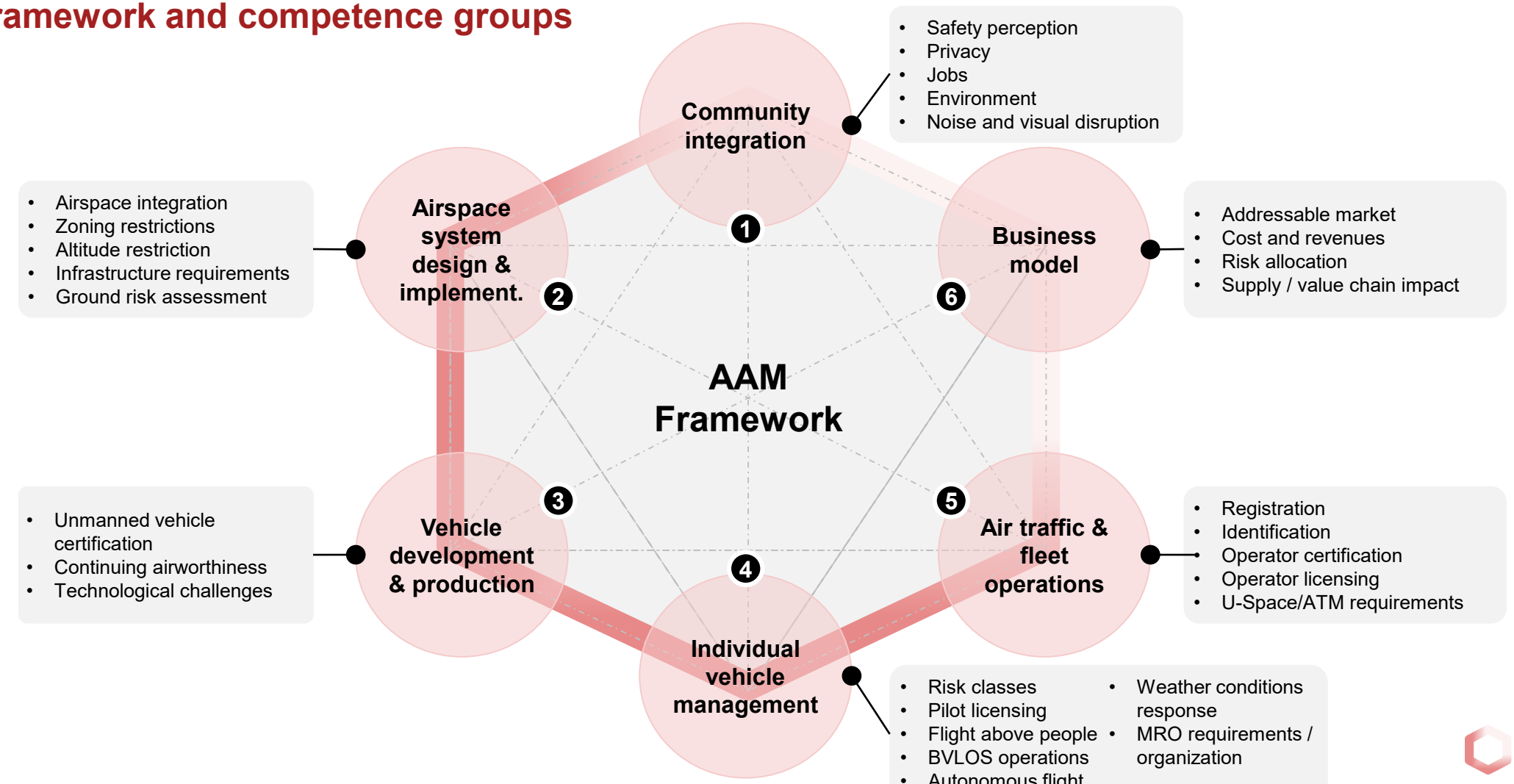
Notes: 1) Mobility as a Service (MaaS)
Source: Desk research, Experts interviews

In line with the AAM framework, six competence groups have been activated

AAM Framework and competence groups



Regulation

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Source: NASA Advanced Air Mobility National Campaign Framework; Working Group insights

With reference to the selected four CONUSEs, competence groups identified gaps / challenges and actions to address them

Competence groups input and output

ILLUSTRATIVE

Provided input

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2. Medical & Goods delivery
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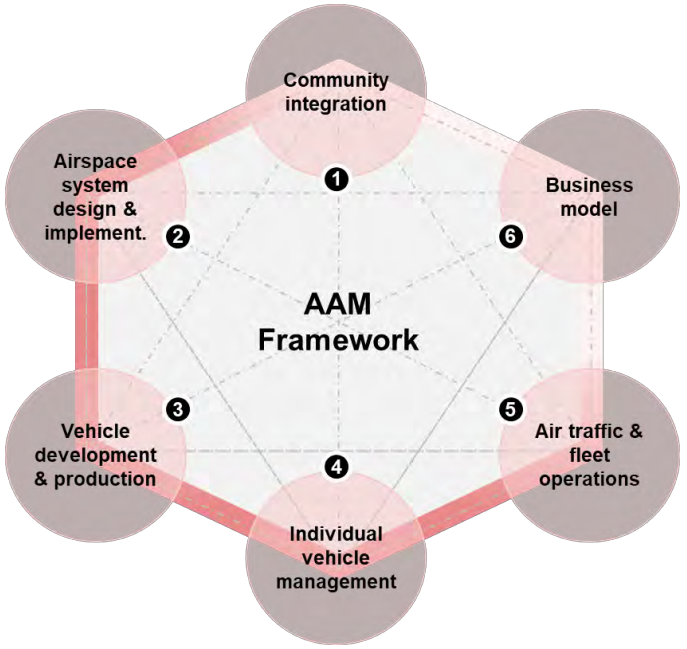
Competence Groups



Output

Gaps / challenges identification

Activities, owners and timeline to bridge gaps and overcome challenges

Roadmap

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Resources are available, however intervention of relevant institutions is paramount to unlock them

Funding takeaways

Stakeholders' resources	• Stakeholders' resources **exist but are limited** • These resources **would only cover initial stages of phase 2**
Ministries funds	• **2014-2020 resources are scarce** as we are approaching the **end of the current programming period**; however, if **Operational Programmes would have residual resources**, the ministries **can reallocate them by introduction of new measures** (or coherent projects) in line with the Operational Programmes' strategic objectives. Commitment and spending of such resources must end in 2023[1]. • To support MSs hit by the COVID-19 pandemic, the European Council has designed the Next Generation EU that includes – among others - **the Covid19 Recovery and Resilience Facility** (RRF) and **ReactEU.** • **The completion of 2021-2027 Operational Programmes design is expected in Q4 '21 or Q1 '22**, when also the first group of resources will be available. This ongoing process envisages consulting the public and private stakeholders regarding their ideas concerning the policies. • The **InvestEU programme** (successor of Junker plan) will channel a considerable amount of **resources through commercial banks** (e.g. EIB, CDP) in **the '21-'27 period.**
EU resources	• There are **very few open EU calls since we are between programming periods** • **AAM topics have gained wide recognition from the EU Commission** (as reflected in the Sustainable and Smart Mobility Strategy); thus, more resources are expected to become available in the next programming period
Private investors	• Private infrastructure investment funds usually cover **specific areas** (i.e. transport infrastructures, energy infrastructures, real estate, other) and could support the deployment of AAM infrastructure in the long run.

Notes: 1) According to Article 25 bis of the EU Regulation 1303, managing authorities could insert by 30 June 2021 new measures (or coherent projects) in compliance with the Legge di Bilancio which can be financed only by EU resources (i.e. without national co-financing) 2) (most relevant: innovation and research, the digital agenda, SMEs and low-carbon economy)

There are two suitable options to create a structured governance for the ecosystem to guide phase II

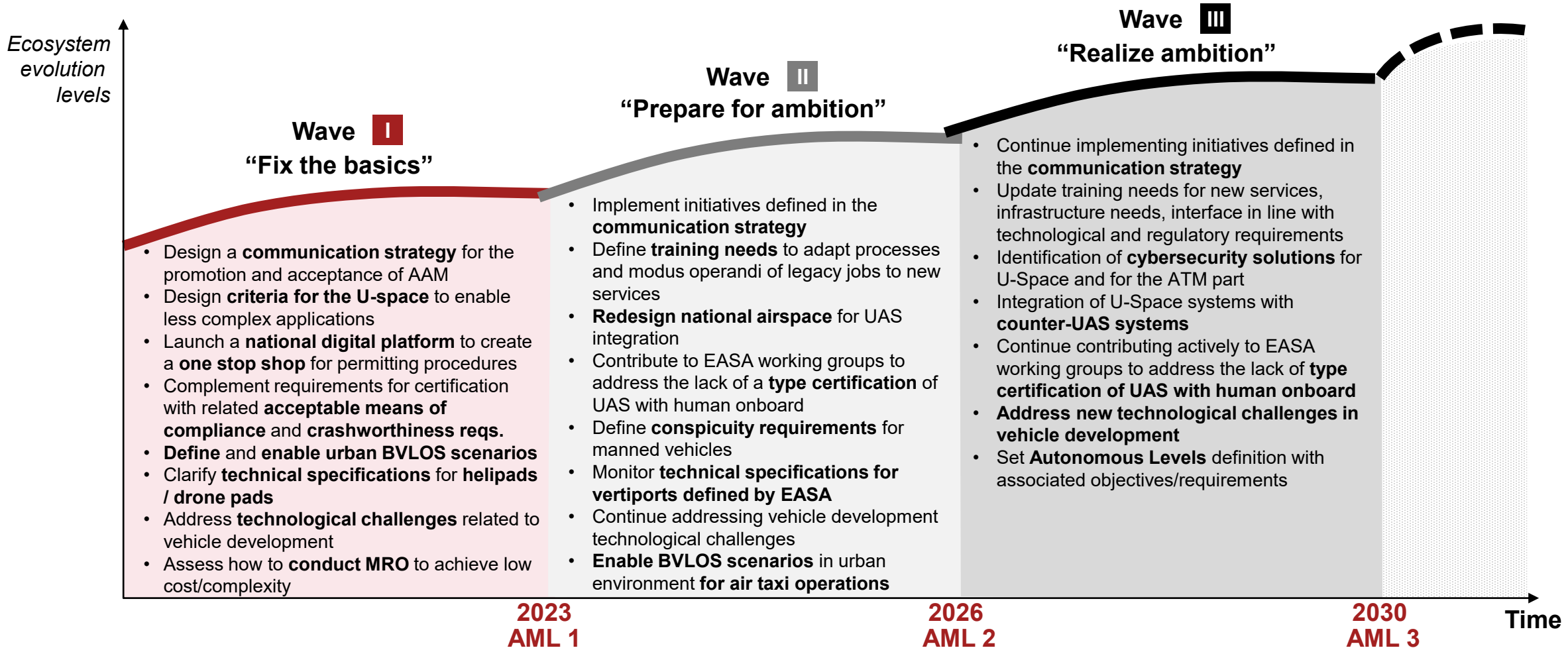
Governance options and characteristics

	Fondazione	Public-private partnership (PPP)
Applicable juridical entity	**"Fondazione di Partecipazione"**	**"Partenariato per l'innovazione"[1]**
Purpose	• Solution adopted by p**ublic entities in collaboration with private entities** to support activities aimed at achieving **social and public benefits**	• Created to **support the development of innovative products and services not yet available on the market** and to achieve their sale
Financing	• Financed through **shares of the participating subjects** with **single or recurrent contributions** • Follows the rules of **no profit organizations regarding distribution of profits**	• The **contract defines financing options**, including private and public economic participation • **Intermediate goals are set** and **compensation has to be defined accordingly**
Composition	• **Multiple funding entities both public and private** • Possibility to include **additional participants at any moment in time**	• Public entities can **launch tenders to identify suitable private partners** that will be chosen based on their proposition
Governance	• Defined by members that can **form different committees with different functions**	• **Defined in contract conditions** • The partnership **can be resolved or split in single contracts** among participating entities only at selected points in time defined in the funding contract

Notes: 1) Defined under Art. 65 of Codice Contratti Pubblici
Source: Desktop research

The roadmap foresees three waves with an increasing degree of complexity

Roadmap waves overview



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Source: Working Group insights

To support the roadmap, we developed business cases for each CONUSE with four key goals in mind

Goals of the model

Investigate market opportunity

- Scenario based **estimation of demand** for CONUSEs in 2030 and 2040
- Number of **circulating vehicles** for different applications in Italy in 2030 and 2040 based on forecasted demand for each CONUSE

Evaluate value chain impact

- **Forecasted revenues and profitability** for key actors along the value chain (i.e. OEM, service operators and MRO providers)

Calibrate infrastructure requirements

- **Quantity and density of key AAM infrastructures and investment required** relative to the calculated demand

Support to decision makers

- Support decisions of institutional stakeholders with further **ad-hoc analysis on specific geographies and use cases**

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Five business cases have been preliminary developed based on a defined geography with possibilities to extend the perimeter

Business cases overview

	Air Taxi	Goods delivery	Medical delivery	Inspection and mapping	Agriculture support
GEOGRAPHY	**City based case** (based on preliminary data provided by Rome)	**City based case** (based on Rome case study)	**City based case** (based on Rome case study)		
USE CASE	• Airport shuttle until 2030 • Air taxi and airport shuttle from 2030 onwards	• Parcel delivery to pick-up hubs (e.g. PuntoPoste) • # of neighborhoods[1] in scope: – 2030: 5 - 7 – 2040: 11 - 13	• Biomedical transportation across 17 selected hospitals	• Stationary (VLOS) and long range (BVLOS) inspection of energy infrastructures (e.g. power plants, wind farms)	• Surveying and spraying applications on agricultural fields based on size classes
EXTENSION AND SCALABILITY	• Additional cities with available traffic data and needs	• Additional cities based on population density per area and volumes of parcels delivered	• Additional hospital hubs and heath centres (e.g. laboratory analysis)	• Additional types of infrastructures (i.e. highways and other critical infrastructures) on the Italian territory	• Extension to other countries

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The roadmap has some key attributes which we should keep in mind when reading it

Roadmap attributes

Objective

- *Unlock **ecosystem complexity** to **enable testing activities***

Perimeter

- ***Advanced Air Mobility (AAM)** incorporating Urban Air Mobility (UAM) and including non-specific applications of urban operations such as interurban commercial transport, freight transport, public services and private and / or recreational transport*
- *Focus on four main applications: **air taxi, medical & goods delivery, inspection and mapping and agricultural support***

External consistency

- *Coherence **with European Union** regulatory milestones*
- ***Inclusion of benchmark results** (e.g. US, Europe, Canada, etc.) and lessons learned from international experiences*
- *Coherence with **national legal framework***

Living document

- ***Living document:** additional activities to be included as regulation, technology and testing advance*
- *Combination of **competences** expected to **be expanded** with input from other players*
- *Requiring continuous engagement of **local communities** for testing activities*

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Source: Working Group insights

Starting from the analysis of gaps and challenges across each area of the AAM framework…

Key gaps and challenges

AAM Competence Groups

Community integration	Airspace system design & implementation	Air traffic & fleet operations	Vehicle development & production	Individual vehicle management	Business Model
• **Mitigate risks** related to collection, management and storage of third parties' **data and images** • Need to **develop new types of capabilities** and integrate **new procedures and ways of working** • Communicate **benefits and address concerns** related to **environmental impact, noise and visual impact and flight safety**	• Need to **review airspace corridors design** to enable less complex AAM applications • **Need to re-design the airspace** in order to enable integrated operations of more advanced AAM applications • Need to **develop U-space-type services** and required AAM airspace services to enable operations • Lack of **air and ground infrastructure specifications**	• To enable mixed operations two elements are required: a **tactical separation algorithm; a common conspicuity technology** • **Integration of U-Space and ATM** requires the definition of standardized SWIM[1] interfaces between U-Space and ATM but also between other stakeholders • **Permitting authority** is shared among different institutional actors making the overall process lengthy and not allowing for coordinated action • Development of autonomous **sense and avoid technologies**	• Need to define **Acceptable Means of Compliance** that allow quality requirements and testing evidence to be produced by subcomponents providers instead of UAS operator/designer • There is currently no specific **Airworthiness Certification** standard for sUAS • Need to develop **onboard and ground safety and security systems** exchanging data for communication/navigation • Need to address technological challenges such as **long distance operations battery capacities**	• Uncertainty on the **role of the remote pilot** in case of operating multiple UAS simultaneously • Need for **performance-based requirements for BVLOS** and **enabling technologies for BVLOS navigation** • Need for **integration of UAS Autonomy Level**, Functions and related OR within the UAM/AAM ecosystem • Need for ConOps targeting **low cost, low burden, operational flexibility and safety MRO**	• Need to identify **adequate sustainable models** for the implementation of AAM applications in Italy • Need to define **specific timelines for the implementation of AAM applications** based on the **waves of studies, trials and regulations developed**

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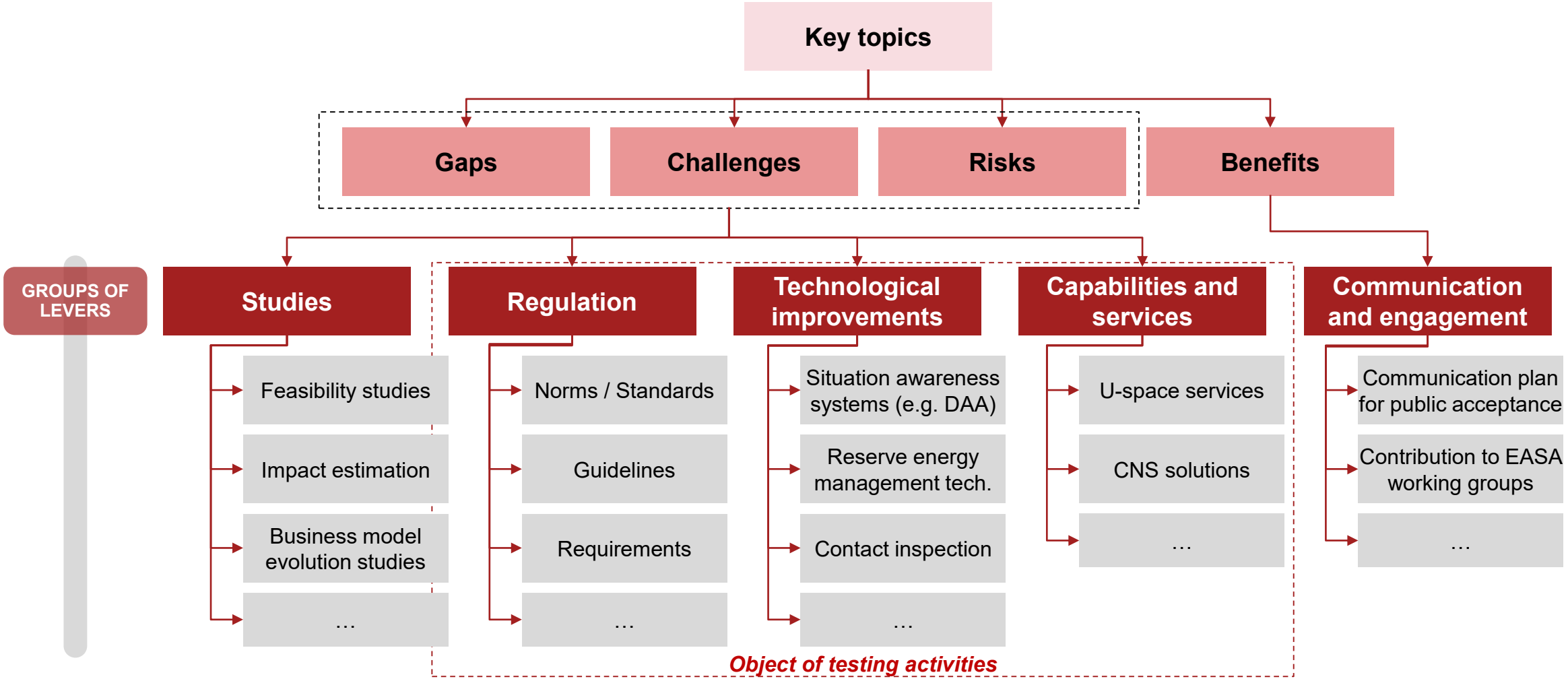
1) SWIM: System Wide Information Management
Source: Working Group insights

...five groups of levers were identified in the roadmap to enable implementation of CONUSEs

From key topics to levers

NON EXAUSTIVE



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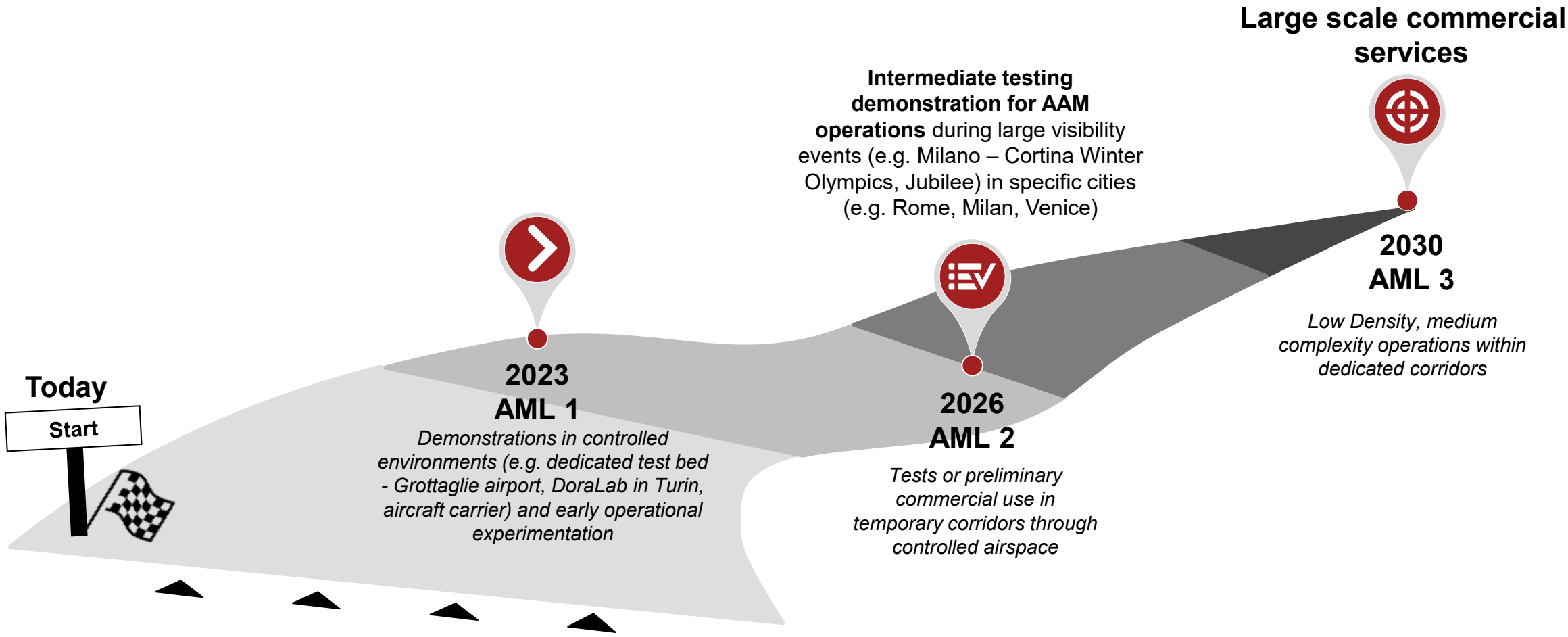
Source: Working Group insights

The agreed-upon roadmap to achieve Italian competitiveness at global level foresees the achievement of AML 3 by 2030

The Italian Advanced Air Mobility roadmap



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Notes: AML = Advanced Air Mobility Maturity Level
Source: Working Group insights

AMLs are characterized by three main dimensions: operational density, complexity and automation

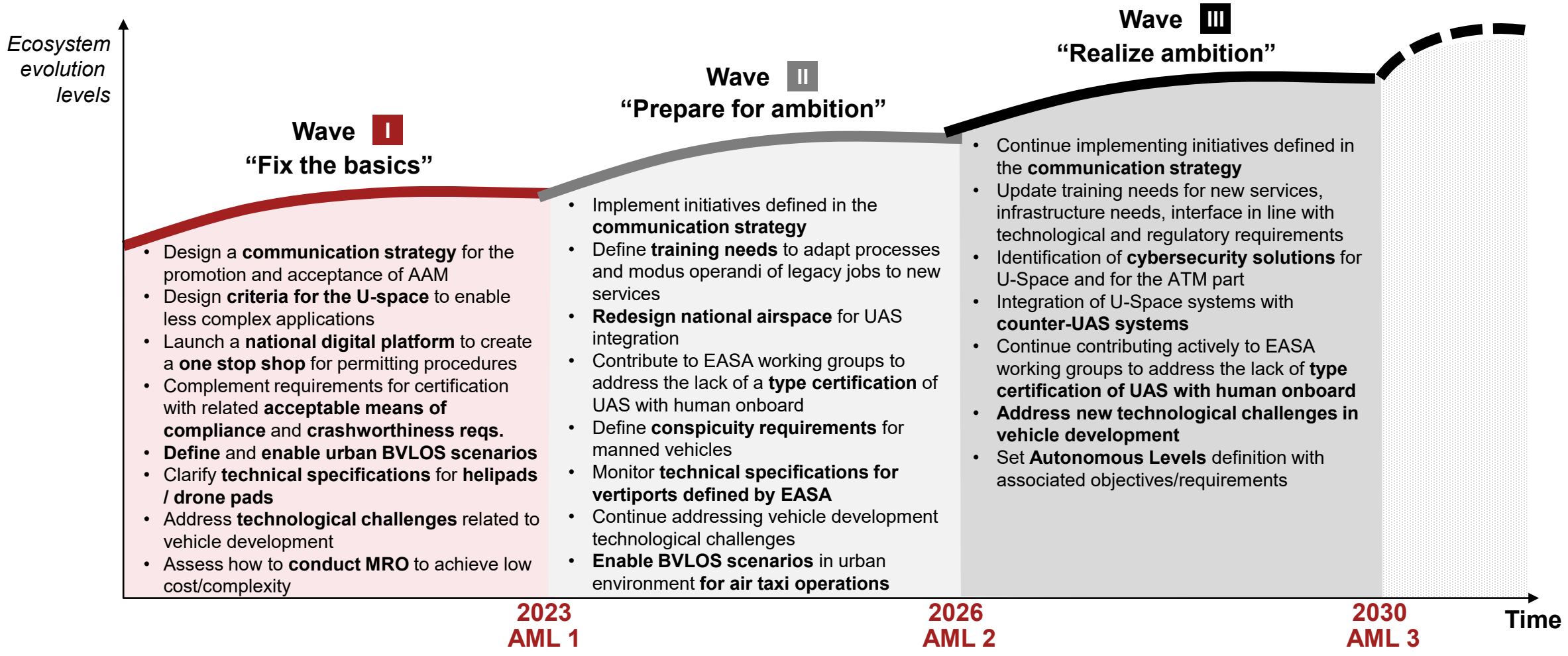
AML underlying dimensions

AML	Operation density	Complexity				Automation
		Airspace	Weather	Manufacturing scale	Infrastructure	
AML 1	Single test	Exceptions in the traditional airspace	No weather resilience	One-offs and demos	Shared with other VTOL solutions	No automation (pilot on board and fly-by-wire)
AML 2	Tests or preliminary commercial usage	UAM temporary corridors through controlled airspace	Very limited weather resilience	Custom orders, limited market with favorable regulation		Pilot assistance
AML 3	Few operations, U-Space enabled	Dedicated corridors	Weather-tolerant operations		Preliminary dedicated landing sites	Partial automation
AML 4	100s of simultaneous operations, many U-Space inspired ATM services available	Dynamic & on demand flying paths	Low visibility operations	Small volume series manufacturing	Dedicated low capacity landing sites and vertiports	Conditional automation
AML 5	1.000s of simultaneous operations, very dense U-Space/ATM	Perpetual dedicated flying zones	High weather tolerance, including icing	High volume manufacturing	Dedicated high capacity landing sites and vertiports	High automation
AML 6	10.000s of simultaneous operations, scaled ATM				Infrastructure fully integrated in the urban core	Full automation

Source: NASA

The roadmap foresees three waves with an increasing degree of complexity

Roadmap waves overview



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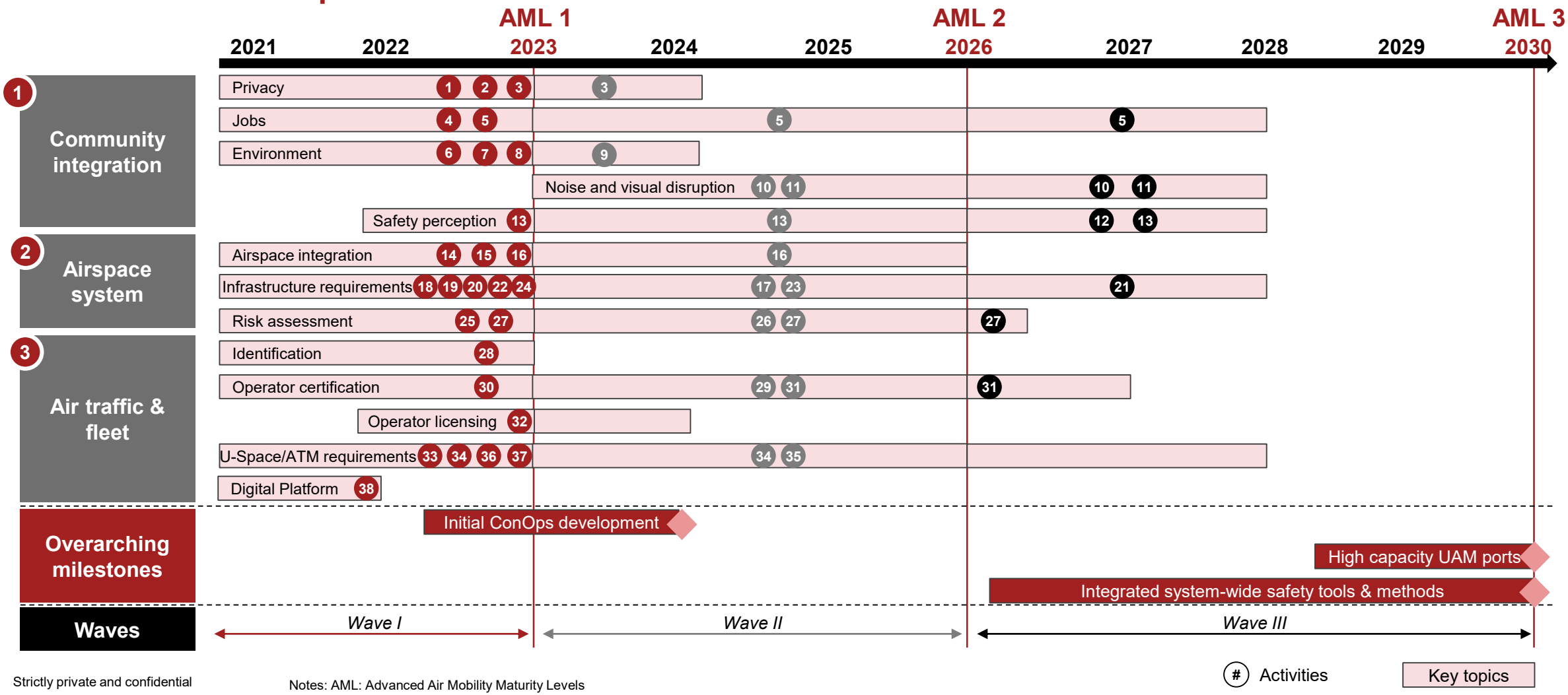
Source: Working Group insights

The Italian AAM Roadmap combines short / medium term elements with longer term ones (1/2)

Italian AAM Roadmap



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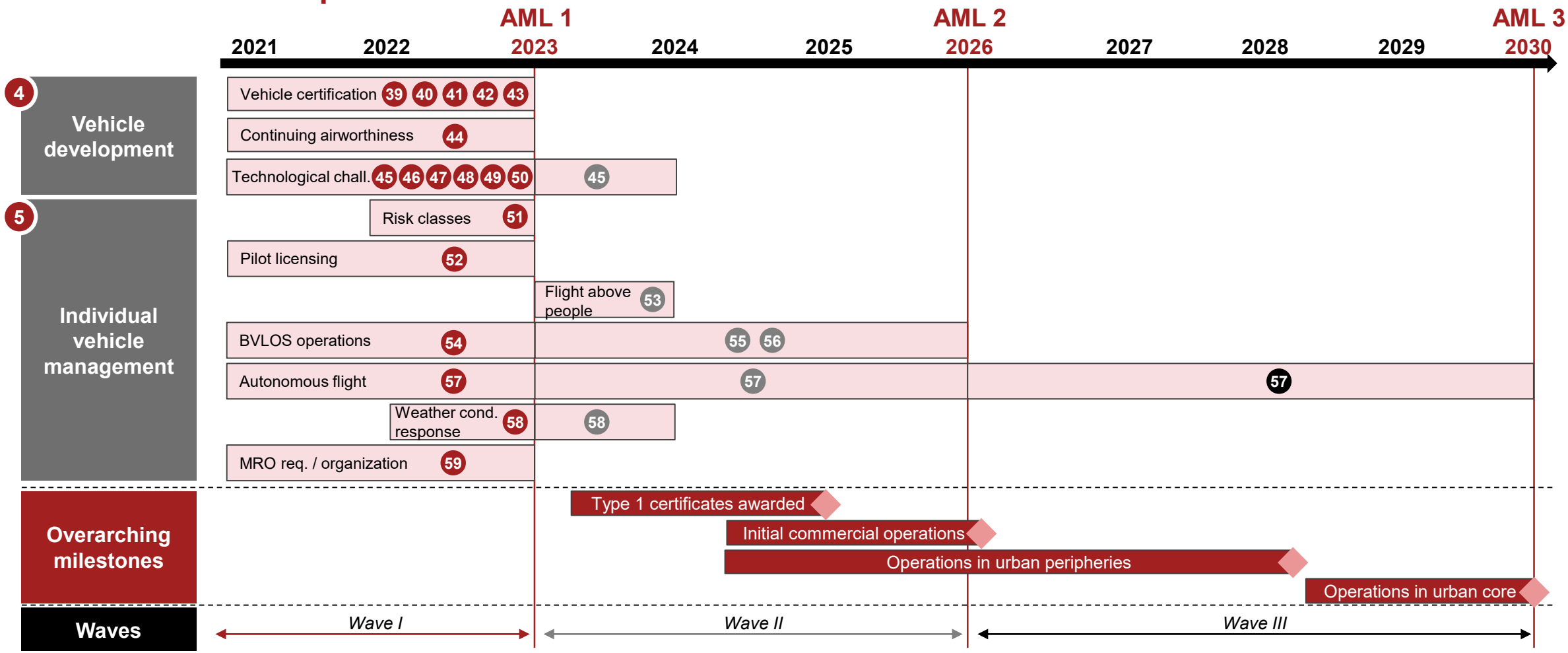
Notes: AML: Advanced Air Mobility Maturity Levels
Source: Working Group insights

The Italian AAM Roadmap combines short / medium term elements with longer term ones (2/2)

Italian AAM Roadmap



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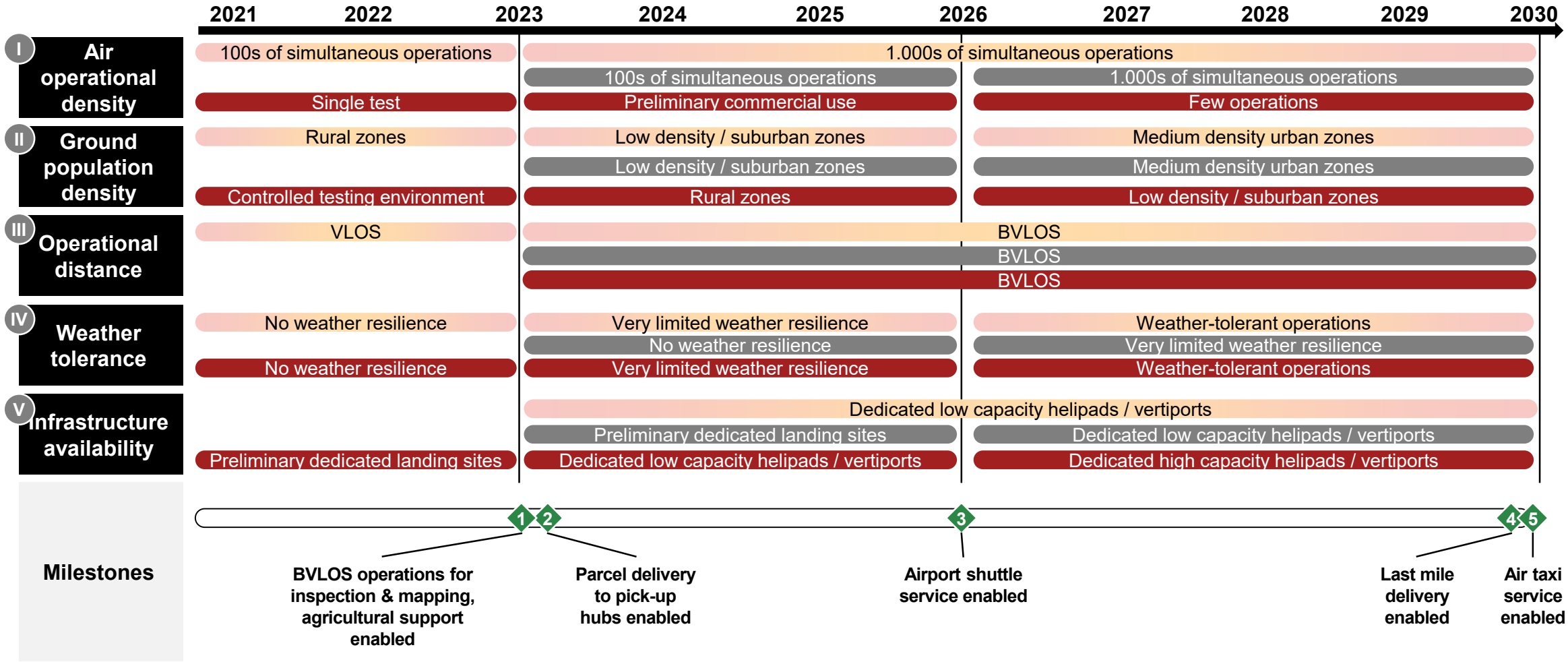
Notes: AML: Advanced Air Mobility Maturity Levels
Source: Working Group insights

Each CONUSE will have specific milestones to guide evolution of operations

CONUSEs evolution milestones



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Five key topics need to be addressed when dealing with community integration

Key topics – Community integration

Privacy

- IP protection and privacy concerns related to widespread UAM adoption (e.g. actual usage of camera technology)

Jobs

- Concern that autonomous technology will make jobs obsolete across multiple industries
- Concerns related to the integration of new procedures and ways of working (e.g. acceptance of new modus operandi by ATM & service providers)

Environment

- Concerns related to waste build-up from batteries and impact on wildlife and energy usage

Noise, visual and space disruption

- Concerns related to auditory and visual disturbances in residential neighborhoods
- Concerns related to integration of eVTOL infrastructure in cities and potential space disruptions generated

Safety perception

- Safety concerns related to consumers' distrust of autonomous technology
- Safety concerns related to vulnerability to cyber attacks

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Source: NASA; Working Group insights

For airspace design and implementation five areas need to be explored to enable operations

Key topics – Airspace systems design & implementation

Airspace integration

- Integration of eVTOLs in airspace with manned and unmanned and autonomous traffic
- Interoperability in terms of operations

Zoning restrictions

- Restrictions of access and operational regulations related to UAVs, and under which conditions (both related to the drone and the surroundings)

Altitude restriction

- Altitude flight restrictions according to size, task and overall operational / cruising nature

Infrastructure / system requirements

- Connectivity and infrastructure requirements to provide the necessary coverage for UAM operations
- Cybersecurity standards for the vehicles and the overall system to protect against jamming, spoofing, and other forms of interference

Risk assessment

- Methodologies and processes to assess both air and ground risk for UAS operations, as well as defining necessary mitigations and robustness levels

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Source: NASA; Working Group insights

With the implementation of more and more AAM applications new safe ATM / U-Space systems will be required

Key topics – Air traffic & fleet operations

Identification

- Requirements for remote identification of the aircraft required for law enforcement and ATC to ensure accountability

Operator certification

- Requirements for operator certification (these operator requirements will likely be an evolution of existing manned operator certifications)

Operator licensing

- Requirements for operator licensing in order to ensure economic robustness of the business

U-Space/ATM requirements

- Automated system for UAM traffic management needed to manage and de-conflict the traffic

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Source: NASA; Working Group insights

The definition of standards for vehicle development is paramount to the implementation to AAM services

Key topics – Vehicle development & production

Vehicle certification

- Vehicle standards will need to be evolved to encompass electric propulsion, autonomy, and its related technologies and subsystems and new mission typologies

Continuing airworthiness

- The set of processes by which a drone remains in a condition for safe operation throughout its operating life

Technological challenges

- Technological challenges to be faced to implement AAM services (e.g. sub-systems development, energy management, etc.)

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Source: NASA; Working Group insights

Several key topics have to be addressed to define standards for individual vehicle management

Key topics – Individual vehicle management

Risk classes

- Evaluation of gaps in current SORA risk assessment methodology for complex operations related to selected CONUSEs (e.g. long range BVLOS scenarios)

Pilot licensing

- Guidelines and standards for pilot licensing

Flight above people

- Regulations related to fly-by people and crowds of people, in urban or sub-urban areas to balance land safety and vehicle safety

BVLOS operations

- Requirements for Beyond Visual line of Sight (BVLOS) operations

Autonomous flight

- Regulations for autonomous flight operations
- (required for full integration into automated U-Space system)

Weather requirements

- Weather conditions and requirements to be considered in vehicle management to ensure safety whole not jeopardizing effective AAM operations

MRO requirements / organization

- Management repair and operations or overhaul requirements for vehicles used in AAM operations

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Source: NASA; Working Group insights

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Community integration gaps and challenges can be summarized as follows

Gaps and challenges – Community integration

NON-EXHAUSTIVE

Privacy	• Protection and handling of **passengers' data** • **Treatment of third parties' data and images** collected during flight • Mitigation of **risk of flying above sensitive areas and critical infrastructures**
Jobs	• **Need to develop new types of services and capabilities** along the value chain (e.g. vertiport operators) • Address **increase in competition for traditional transportation** services
Environment	• Assessment of actual **traffic and CO2 emissions reduction** brought by these new means of transportation • Need to **improve battery technology** with a positive impact on other transportation methods and need to address challenges due to **batteries disposal** • Improvement in **response to environmental emergencies**
Noise and visual disruption	• **Need to define maximum noise levels** based on different parameters (e.g. traffic volume, time of the day, area of operation) • **Rules for visual impact assessment** of drones and infrastructures
Safety perception	• Rules and characteristics for **emergency landing spots** • Authorities, detection methods, penalty system to **regulate crash cases**

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Source: Working Group insights

Airspace systems design and implementation gaps and challenges identified can be summarized as follows

Gaps and challenges – Airspace systems design & implementation

NON-EXHAUSTIVE

Airspace integration zoning and altitude restrictions

- Need to review **airspace corridors design** to enable less complex AAM applications (e.g. inspection and mapping)
- Need to **re-design the airspace** in order to manage manned, unmanned, aircraft, UAS, eVTOL and enable integrated operations of more advanced AAM applications (e.g. passenger transportation)

Infrastructure / systems requirements

- Need to develop U-space-type services in advance to the issuance of EU regulation, in order to minimize delays when the relevant regulation will be in place
- Lack of **air and ground infrastructure specifications**
- Lack of **required AAM airspace services** to enable operations (e.g. CNS infrastructure)
- Need for an **intrusion detection system** capable to detect a malicious attack and appropriate actions to manage it

Risk assessment

- Lack of clarity in the way the **airport risk assessment** legislation interfaces with SORA / MEDUSA
- Lack of ground **risk mitigation strategies** in relation to ground infrastructures (e.g. helipads and vertiports)
- Lack of mitigation strategies to address **security / cybersecurity risks**

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Source: Working Group insights

Air Traffic and fleet gaps and challenges identified can be summarized as follows

Gaps and challenges – Air traffic & fleet operations

NON-EXHAUSTIVE

Identification	• No gaps identified except for ATC/rules of the air (see U-Space/ATM section)
Operator certification and licensing	• Type **certification with human on board** is under development by EASA, need to follow regulatory evolution at EU level participating to dedicated working groups • The need for **operator / business licensing** has recently been taken on-board by the revision of the regulatory authority, but it is to be further investigated and a review of the specific regulation must be conducted in order to **check if the requirements developed for manned operations are suited for unmanned aviation**
U-Space / ATM requirements	• Draft regulation is based on a **substantial segregation between manned and unmanned**. To enable mixed operations two elements are required: a **tactical separation algorithm**; a common **conspicuity technology** • Integration of U-Space and ATM requires the definition of **standardized SWIM[1] interfaces** between U-Space and ATM but also between other stakeholders as data service providers, aeronautical data providers and authorities
Other	• **Permitting authority** is currently shared among different institutional actors making the overall process lengthy and not allowing for coordinated action

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1) SWIM: System Wide Information Management
Source: Working Group insights

Vehicle development and production gaps and challenges identified can be summarized as follows

Gaps and challenges – Vehicle development & production

NON-EXHAUSTIVE

Vehicle certification

- Need to **define AMC (acceptable means of compliance)** that allow quality requirements and testing evidence to be produced by subcomponents providers instead of UAS operator/designer in order to support failure rates computations and reliability.
- Need to identify **requirements for flight termination** in case of total propulsion power loss
- Need to define **vehicle visibility requirements** during day and night during low altitude operations
- Need to develop an **High Energy Fragment Risk Analysis**

Continuing airworthiness

- There is currently no specific **Airworthiness Certification standard** for sUAS, but aircraft could potentially be certified under existing standards for airplanes or rotorcraft
- **Continuing airworthiness may be delegated to different entities** (e.g. UAS operator, end user) according to specific items/functions (e.g. aircraft, batteries, take off and landing support equipment) - less applicable to Air Taxi, but relevant for other CONUSEs)
- Need to define **predictive maintenance** (condition-based maintenance) requirements

Technological challenges

- Need to **develop onboard and ground safety and security systems** exchanging data for communication/navigation with U-Space, 5G networks and GNSS (e.g. PNT (position-navigation-timing)
- Need to **address challenges related to innovative production processes** as additive manufacturing and the challenges posed in terms of a reliability in producing sound and repeatable structures
- Need to develop requirements for dedicated **flight simulators to be used for training**

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Source: Working Group insights

Individual vehicle management gaps and challenges identified can be summarized as follows

Gaps and challenges – Individual vehicle management

NON-EXHAUSTIVE

Flight above people	• Availability of reference **Scenarios & ConOps** • Methodologies uncertainty
Pilot licensing	• Uncertainty on the **role of the remote pilot** in case of operating more than one UAS simultaneously • Need for **harmonization with existing standards**
BVLOS operations	• Need for **performance-based requirements** for BVLOS and enabling technologies for BVLOS navigation • Need to adapt **Global Navigation Satellite Systems** (GNSS) **/ Position Navigation and Timing** (PNT) to the urban environment & datalink • Need for **supporting ground infrastructures** and network services • Need for **integration with the smart-city paradigm** and to address **cybersecurity issues**
Autonomous flight	• Need for **Performance-based regulation (PBR) Regulation** and **Airworthiness Directives (ADs) developed** and adopted/recognized by EASA • Need for integration of **UAS Autonomy Level**, Functions and related OR within the UAM/AAM ecosystem (e.g. external supporting systems, infrastructure and U-Space) that may feature in turn autonomous functions
Weather requirements	• Availability of suitable **weather status within Urban area** vs. reference Scenarios vs. ConOps • **Enabling Technologies and standards definition** • Availability of **enabling technologies and scale of the investment**
MRO	• Need for **ConOps targeting low cost, low burden, operational flexibility and safety** • Need to **define logistics framework, licensing and technologies**

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Source: Working Group insights

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Activities related to community integration need to continue across waves in order to follow technological and regulatory evolution

Key messages

Privacy	• In the short-medium term, **tailoring applicable legislation** aimed at collection, management and storage of data and transfer of information to all impacted actors
Jobs	• Each CONUSE will require specific **skills and competences** for which it will be necessary to identify **training needs** • Competences development and training activities need to continue across waves in line with technological and regulatory evolution
Environment noise and visual	• Development of a framework for **environmental sustainability analysis** (i.e. tools, studies and methodologies to verify environmental impact, for the selection of most sustainable transport modes and life cycle assessment)
Safety perception	• Design of a **communication strategy** for the promotion and acceptance of advanced air mobility through initiatives that disseminate benefits and advantages of AAM solutions (i.e. reduce pollution, reduce traffic congestion, economic advantages) • Communication needs to continue across waves to monitor and measure changes in public perception in relation to AAM

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Source: Working Group insights

Community Integration: activities required to overcome highlighted gaps and challenges

Key topic		Activities	Applicability	Timing	Wave	Criticality[1]
Privacy	1	Definition of an approach to **collect, store and manage passenger data and acquired images**	Air taxi	2021-2022	I	!
	2	Definition of an approach to allow consent and to **inform third parties about the data acquisition**	All CONUSEs	2021-2022	I	!
	3	Definition of rules for **overflight over critical infrastructures**	Inspection & mapping	2022-2024	I II	!!
Jobs	4	Definition of involved **actors along the prospective value chain** for all four CONUSEs	All CONUSEs	2021-2022	I	!
	5	Design and definition of **training needs for new services, infrastructure needs, interface versus legacy services**	All CONUSEs	2021-2028	I II III	!
Environment	6	Development of a study to estimate the **environmental impact of innovative transport modes** based on current volumes	Air taxi, goods / medical delivery	2021-2022	I	!!
	7	Design and definition of a **tool for transport system simulation and impact assessment**	Air taxi	2022-2023	I	!!
	8	**Communication of eco-design initiatives** for vehicles and systems	Air taxi	2022-2023	I	!
	9	**LCA (Life-cycle assessment) tool** development and application	All CONUSEs	2022-2024	II	!
Noise and visual disruption	10	Develop a study to **estimate the noise and visual impact** arising from forecasted traffic scenarios	All CONUSEs	2023-2028	II III	!!
	11	Design and implementation of **numerical and experimental framework to assess noise and visual impact** for single and hybrid fleet (air vehicles, ground vehicles)	All CONUSEs	2025-2027	II III	!
Safety perception	12	Design of a set of **guidelines to inform passengers and people on the ground** about safety related issues (i.e. safety, security, resilience and survivability)	All CONUSEs	2024-2027	III	!
	13	Design of **communication strategies to increase public acceptance** (tailored to target stakeholders involved)	All CONUSEs	2022-2028	I II III	!

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Notes: 1) Based on benchmark analysis, impact on challenges and gaps and competence group's member evaluation
Source: Working Group insights

Wave: I II III **Criticality:** ! Important !! Show stopper

To enable airspace accessibility and operations of all CONUSEs a stepwise airspace integration is required

Key messages

Airspace integration, zoning and altitude restrictions

- In the **short term,** current regulation and airspace corridors design should be challenged to enable the **accommodation** of some initial/less complex AAM applications (e.g. inspection/mapping, medical/goods delivery etc.) with **minimal/very limited adaptations to the current set of legacy rules, procedures and operations allowed in the managed airspace/U-space**
- In the meantime an **airspace assessment** analysis should be conducted for the definition of necessary steps to evolve from short term solutions to long term ones aiming at the **integration** of more complex and dense AAM type of operations
- Based on the airspace assessment results a step-wise **redesign of the reference airspace should be performed** to enable the integrated operations of more advanced and innovative AAM applications.

Infrastructure / system requirements

- Definition of requirements for **fundamental U-Space services and capabilities** (e.g. separation management, AAM specific CNS infrastructures)
- Identification of required **specifications for air/ground systems/capabilities** and definition of **compatibility** between existing infrastructures and AAM operations within the current legal framework
- Development of necessary **AAM airspace services** to enable operations (e.g. ad-hoc CNS infrastructure)
- Identification of relevant **cybersecurity solutions**

Risk assessment

- Identification of risks and possible mitigation strategies in relation to:
  - **Air risks** mainly looking at the interaction between manned and unmanned aviation in proximity of airports also with respect to security related issues (i.e. counter-UAS solutions)
  - **Ground risks mainly** related to ground infrastructures (e.g. helipads and vertiports)
  - **Security/Cybersecurit**y relevant risks

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Source: Working Group insights

Airspace systems design: activities required to overcome highlighted gaps and challenges

Key topic	#	Activities	Applicability	Timing	Wave	Criticality[1]
Airspace integration, zoning and altitude restrictions	14	Design **rules for the U-space** to enable medical and goods transportation, inspection & mapping and agricultural support	All CONUSE except Air taxi	2021-2022	I	!
	15	Conduct ad-hoc **Airspace Assessment** for an adequate airspace design	All CONUSE	2021-2022	I	!
	16	**National airspace redesign** for UAS integration	All CONUSE	2022-2024/2026	I II	!
Infrastructure / system requirements	17	Evolution of current strategic **conflict resolution services** (vs manned traffic)	Air Taxi and Goods delivery	2021-2025	II	!
	18	Definition of tools in relation to **basic U-space services** and ground infrastructures according to the type of airspace and to the relevant type of operations	All CONUSE	2021-2023	I	!
	19	Mapping of **technological solutions** and **CNS** to support each type of area	All CONUSE	2021-2023	I	!
	20	Exploration for the definition of a **tactical separation management / tactical conflict resolution service**	All CONUSE	2021-2022	I	!
	21	Identification of **cybersecurity solutions** for U-Space and for the ATM part	All CONUSE	2026-2028	III	!
	22	Clarification of **technical specifications** for **helipads / drone pads**	All CONUSE except Air taxi	2021-2022	I	!
	23	Monitoring of **technical specifications for vertiports defined by EASA**	Air Taxi	2023-2024	II	!
	24	Verify the compatibility of **existing infrastructures with AAM services** within the context of the **existing legal framework**	Air Taxi	2022-2023	I	!
Risk assessment	25	Integration of helipads / drone pads operations with respect to urban facilities to mitigate risk	All CONUSE except Air taxi	2021-2022	I	!
	26	Integration of **vertiport operations with respect to airport operations** (manned vs unmanned) to mitigate air risk	Air Taxi	2024-2026	II	!
	27	Integration of U-Space systems with **counter-UAS systems**	All CONUSE	2023-2025	I II III	!

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Notes: 1) Based on benchmark analysis, impact on challenges and gaps and competence group's member evaluation
Source: Working Group insights

Wave: I II III **Criticality:** ! Important ! Show stopper

Research on ATM and U-Space integration are ongoing at EU and intl. level, however a specific national assessment is required

Key messages

Identification	• In the short term, need to perform a **feasibility study** to identify the **level of interoperability** between ATM and U-Space systems and services also including **specific demonstration activities** and involving all needed stakeholders to tailor requirements
Operator certification and licensing	• Contribute to EASA working groups to address type certification for UAS with human on board and follow **EASA** work in relation to the **adaptation of the 965/2012 regulation** for passenger transport operations to include eVTOLs operations • Address **operator licensing** to ensure **financial robustness** of operators
U-Space/ATM requirements	• Address **organization of airspace in terms of U-Space / ATM domains** for air traffic control keeping in mind the need to address quick wins to open the Italian airspace for routine agricultural support, inspection and mapping and goods and medical delivery operations in the short term and passenger transportation in the medium to long term
National digital platform	• Launch a **national digital platform** to create a **one stop shop** for permitting procedures • The platform will solve the problem of strategic access to the airspace however operational flight authorization will still be provided by single U-space providers

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Source: Working Group insights

Air Traffic and Fleet: activities required to overcome highlighted gaps and challenges

Key topic	#	Activities	Applicability	Timing	Wave	Criticality[1]
Identification	28	Conduct **feasibility study** to understand U-Space/ATM integration levels	All CONUSE	2021-2023	I	!
Operator certification	29	Develop a list of **performance requirements** for UAS (which in the first instance can be allocated in the category of rotorcraft within the 965/2012 regulation for passenger transport operations)	Air taxi	2024-2026	II	!
	30	Develop a list of **performance requirements for UAS operator** to guarantee a safe, secure and reliable urban air service	All CONUSE	2021-2023	I	!
	31	Contribute actively to **EASA working groups** to address the lack of a type certification of UAS with human onboard	Air taxi	2022-2027	II III	!
Operator licensing	32	Verify **applicability of regulation 1008-2008** to passenger transportation drones operations and review operator requirements	Air taxi	2022-2024	I	!
U-Space/ATM requirements	33	Define a **protocol to address**: organization, rules, procedures and fees for the supply of required enabling services	All CONUSE	2021-2022	I	!
	34	Create **situation awareness systems** (e.g. Detect and Avoid) for tactical separation for UAS	All CONUSE	2021-2026	I II	!
	35	Define **conspicuity requirements** for manned vehicles	All CONUSE	2022-2024	II	!
	36	Structure future-proof standards for the implementation of **"one-to-many" control dynamics** in the urban airspace	All CONUSE	2021-2022	I	!
	37	Define a system to coordinate **emergency services** (118, COAU, Protezione Civile) for temporary segregation of the airspace	All CONUSE except Agri.	2021-2022	I	!
Cross topics	38	Creation of a **National Digital platform** to simplify permitting procedures	All CONUSE	2021-2022	I	!

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Notes: 1) Based on benchmark analysis, impact on challenges and gaps and competence group's member evaluation
Source: Working Group insights

Wave: I II III **Criticality:** ! Important ! Show stopper

To enable vehicle development some regulatory and technological challenges need to be addressed in the short to medium term

Key messages

Vehicle certification

In the **short term:**
- performance based regulatory requirements for drones certification need to be complemented with the related **acceptable means of compliance** to enable industrial vehicle development.
- Current traditional aviation **crashworthiness requirements** need to be complemented to consider also eVTOLs unique design to ensure occupant protection in case of crash.

- In the **short/medium term**, in line with **EASA AI roadmap,** which foresees the first Artificial Intelligence component to be certified by 2025, new criteria for qualification of **software supporting AI techniques** should be developed

Continuing airworthiness

In the **short term:**
- eVTOLs may pose new and unique **maintenance challenges** (e.g. high speed bearings, high power batteries etc.), the **continuing airworthiness regulation** should be updated to address these new challenges.
- Maintenance Task **to be developed from the early stages in close coordination** with AAM end users/Operators
- Flexible AMM Maintenance Environment **which should take credit of the benefits derived by predictive maintenance** based on advance monitoring system

Technological challenges

In the short to medium term several **technological challenges have to be faced,** below the ones with higher priority**:**
- **Sub-systems development** for the integration of new technologies in the frame of Aircraft Safety and Security systems, with proper allocation of functional assurance levels to airborne and ground sub-systems designed for exchanging data for communication/navigation with U-Space, 5G networks and GNSS
- **Reserve Energy Management and Planning :** development of propulsions systems based on high efficiency electrical engines, new battery concepts (e.g. graphene based), reliability of battery level monitoring
- **Flight Simulators** to develop requirements for flight simulators for eVTOLs to be used for training

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Source: Working Group insights

Vehicle development: activities required to overcome highlighted gaps and challenges

Key topic	#	Activities	Applicability	Timeframe	Wave	Criticality[1]
Vehicle certification	39	Definition of **acceptable means of compliance** for subsystems and equipment supplied by third parties to support the transition from aviation standard to industry	ALL CONUSEs	2021-2023	I	!
	40	Definition of **standards for qualification** to support AI applications	ALL CONUSEs	2022-2023	I	!
	41	Development of a comprehensive **structural study on crashworthiness**, high energy fragment risk and handling quality characteristics	Air Taxi	2021-2023	I	!
	42	Goods protection in case of **crash and integrity assurance** in case of dangerous goods	Medical and Goods Delivery	2021-2022	I	!
	43	Update of **article 13 of Italian Law regulation DL n°150** that prohibits the use of any aircraft (including drone) for crop spraying (verify actions undertaken by ISO, working group 25)	Agricultural support	2021-2023	I	!
Continuing airworthiness	44	**Update of continuing airworthiness regulations** (current Regulations doe not include specific ratings for AM mechanics, current Regulations do not allow provisions for predictive maintenance)	Air Taxi	2021-2023	I	!
Technological challenges	45	**Sub systems development**. Safety and Security of vehicle onboard and ground subsystems exchanging data for communication/navigation with U-Space, 5G networks and GNSS , including fast navigation computers to host AI Functions	ALL CONUSEs	2022-2024	I II	!
	46	**Airframe additive manufacturing process**	Air Taxi and Medical and Goods Delivery	2021-2023	I	!
	47	**Reserve Energy Management and Planning**	Air Taxi and Medical and Goods Delivery	2021-2022	I	!
	48	**Contact Inspection**	Inspection & Mapping	2022-2023	I	!
	49	**Flight simulators for training**	ALL CONUSEs	2021-2023	I	!
	50	Propose **noise certification requirements** to facilitate OEM vehicle development process	ALL CONUSEs	2021-2023	I	!

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Notes: 1) Based on benchmark analysis, impact on challenges and gaps and competence group's member evaluation
Source: Working Group insights

Wave: I II III **Criticality:** ! Important ! Show stopper

For vehicle management three main areas should be addressed with highest importance: flight above people, pilot licensing and MRO

Key messages

Flight above people

- Creation of **archetypes** or types of urban areas with **defined reference parameters** to guarantee **safety of people fly-by and of passengers**
- Investigate the need for **certification specifications** and related **acceptable means of compliance** to be met also for flight above people

Pilot licensing

- In the **short term** analyze and define what is the **role of the pilot** in the various AAM applications and the skills he/she must possess to address his/her tasks
- Once the previous point is addressed, **training requirements** (i.e. syllabus) should be defined and the opportunity to open flight schools should be evaluated
- Finally, **validity and methods of recognition** of **pilot licensing** at an international level

MRO

- In the short term operators, manufacturers and developers of the technologies and the national aviation authority should set up a **discussion table to define the new MRO criteria** to make AAM sustainable from an operational and economic point of view
- Moreover, **type of qualifications and training** needs for personnel carrying out MRO should be defined
- Traditional CAMO standards must be modified and updated to include AAM activities, including the relative levels of qualification of the personnel
- Finally, **qualification criteria** to obtain **maintenance credits** in relation to the **vehicle design** should be defined

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Source: Working Group insights

Individual vehicle management: activities required to overcome highlighted gaps and challenges

Key topic	#	Activities	Applicability	Timeframe	Wave	Criticality[1]
Risk classes	51	Modify and improve existing **Risk classes**, to encompass expected CONUSEs' vehicle and functional characteristics	All CONUSEs	2021-2022	I	!
Pilot licensing	52	Set the Definitions, Standards, Training Criteria etc. regarding **Pilot Licensing**	All CONUSEs	2021-2023	I	!
Flight above people	53	Define the approach to **ensure safety of fly-by** people in conjunction with vehicle's occupant safety	Air Taxi	2023-2024	II	!
BVLOS operations	54	**Define** and **enable BVLOS scenarios** to urban environment	Delivery, Inspection, Agriculture	2021-2023	I	!
	55	**Enable BVLOS scenarios** in urban environment **for air taxi operations type #3 – manned**	Air Taxi	2023-2024	II	!
	56	**Enable BVLOS scenarios** in urban environment **for air taxi operations type #2 – unmanned**	Air Taxi	2024-2025	II	!
Autonomous flight	57	Set **Autonomous Levels** definition with associated objectives/requirements	All CONUSEs	2021-2030	I II III	!
Weather condition response	58	Definition of **Weather Conditions** affecting AAM in the different application scenarios (weather and environmental minimal conditions)	All CONUSEs	2022-2024	I II	!
MRO requirements / organization	59	Assess how to **conduct MRO** to achieve low cost/complexity	Air Taxi, Delivery	2021-2023	I	!

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Notes: 1) Based on benchmark analysis, impact on challenges and gaps and competence group's member evaluation
Source: Working Group insights

Wave: I II III **Criticality:** ! Important ! Show stopper

Content

Executive summary

Project overview

Roadmap

- Key topics
- Gaps and challenges
- Actions
- **Actions details**
  - **Community integration**
  - Airspace design
  - Air Traffic & Fleet
  - Vehicle development
  - Individual vehicle management

Appendix - Acronyms

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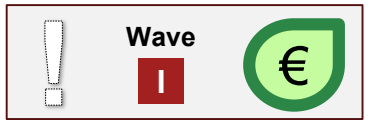
Activity 1: Definition of an approach to collect, store and manage passenger data and acquired images

Activity 1 – Overview



Activity description

- **Brief goal:** definition of an approach to collect, store and manage passenger data and acquired images
- **Description:** Data privacy is challenging since it attempts to use data while protecting an individual's privacy preferences and personally identifiable information. The fields of computer security, data security, and information security all design and use software, hardware, and human resources to address this issue. Regulation is already in place to support this activity; nevertheless, it is important to define the approach to collect, store and manage passenger data and acquired images. Depending on the outcome of the elicitation of requirements and cross check with the relevant regulations it is important to decide if it is useful to develop guidelines specific for AAM

Gap addressed

- Any use of a drone that captures images which identify an individual (such as a facial image) will fall within the scope of data protection legislations. But the same also applies if the drone collects any type of data (such as location, house fronts, phone number, vehicle registration plate, infrared image, etc.) that can be linked to an individual
- To facilitate drones operations it is necessary to clarify guidelines for the collection, processing and storage of personal data and images

Key tasks

	Task's description	Expected duration
T1	Determine data privacy requirements for passengers and what type of data are required	3 months
T2	Check suitability of relevant data privacy regulation in place	3 months
T3	Develop guidelines for collecting storing and managing passenger data and images	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Operator	Regulator
T2	Regulator	Operator
T3	Regulator	Operator

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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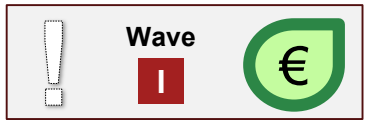
Activity 2: Definition of an approach to allow consent and to inform third parties about the data acquisition

Activity 2 – Overview



Activity description

- **Brief goal:** definition of an approach to allow consent and to inform third parties about the data acquisition
- **Description:** It is important to identify clear rules and guidelines that regulate how third parties should be informed about possible acquisition of personal data and how consents from third parties should be collected

Gap addressed

- Guidelines for collecting storing and managing consents (depending on outcome of T2)

Key tasks

	Task's description	Expected duration
T1	Determine data privacy requirements for consents	3 months
T2	Check suitability of relevant data privacy regulation in place	3 months
T3	Develop guidelines for managing consents relevant for AAM (depending on outcomes of T2)	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Operator	Regulator
T2	Regulator	Operator
T3	Regulator	Operator

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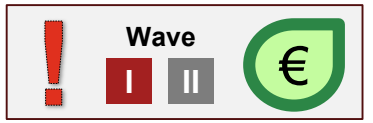
Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 3: Definition of rules for overflight over critical infrastructures

Activity 3 – Overview



Activity description

- **Brief goal:** identify regulatory gaps related to the overflight of critical infrastructures
- **Description:** overflight of critical infrastructures normally is not authorized unless appropriate risk assessments is produced and validated by the competent authority case by case. In a context of larger volumes and substantial increased number of flight operations, the development of an “ad hoc” regulation is deemed necessary.

Gap addressed

- Lack of a specific risk assessment methodology to support the possibility to overflight of critical infrastructures
- Lack of regulatory requirements to regulate collection of data on critical infrastructure

Key tasks

	Task’s description	Expected duration
T1	Definition of a regulation for overflight over critical infrastructures	2-3 Years
T2	Identification of a methodology to define risks of operations over critical infrastructures	2-3 Years
T3	Definition of guidelines related to privacy for data collected over critical infrastructures	2 Years

Responsibility assignment

Task	Agents’ role	
	Owner	*Informed*
T1	Government, Regulator	All concerned stakeholders
T2	Regulator	All concerned stakeholders
T3	Government	All concerned stakeholders

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 4: Definition of involved actors along the prospective value chain for all four CONUSEs

Activity 4 – Overview

Wave I

Activity description

- **Brief goal:** The activity aims at defining the actors whose job is somehow impacted by the value chain of CONUSEs
- **Description:** The activity addresses two type of issues:
  - Re-allocation of professionals whose job will be replaced by the development of the new services;
  - Identification of new professionals needed for the development of the new services

Gap addressed

- Lack of a strategy to manage the implications of possible job disruption

Key tasks

Task's description		Expected duration
T1	Identification of current services that will be replaced by AAM services	1 month
T2	Identification of the professionals involved in the current services and definition of their job description	2 month or more
T3	Identification of some alternative jobs / training session in order to re-allocate people	4-6 month
T4	Study of the characteristic of the new services in terms of infrastructure, new capabilities, etc.	2 month
T5	Definition of the job description for new professionals	4-6 month

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	AAM taskforce	
T2	AAM taskforce	Trade unions and social parties
T3	Trade unions and social parties	Competent Ministry
T4	AAM taskforce	
T5	Trade unions and social parties	Competent Ministry

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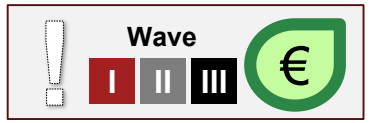
Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

Activity 5: Design and definition of training needs for new services, infrastructure needs, interface versus legacy services

Activity 5 – Overview



Activity description

- **Brief goal:** retrain existent workforce to limit negative effects of new AAM services on employment levels for legacy services
- **Description:** AAM services will required new set of competences and capabilities that workforce of current legacy services can't provide. This could result in a negative impact on employment level of current workforce that could be substituted by more trained workforce. This activity aims at identifying training programs to let existent workforce develop required skills and capabilities to be prepared to offer AAM services and limit negative effects

Gap addressed

- Need for a strategy to mitigate possible negative impacts on employment levels in legacy services

Key tasks

	Task's description	Expected duration
T1	Study to identify impact of AAM services on workforce along the value chain	6 months
T2	Identification of competences' gap on existent workforce	6 months
T3	Definition of training programs to retrain existent workforce	6 months
T4	Deployment of training programs available for employees willing to acquired required competencies	7 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Research institutes, Unions	Public Institutions
T2	Service operators, manufacturers	Public Institutions, unions
T3	Unions, operators, manufacturers	Public Institutions
T4	Public Institutions, Private companies	Unions

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 6: Development of a study to estimate the environmental impact of innovative transport modes

Activity 6 – Overview

Activity description

- **Brief goal:** Identify positive impact on environment of AAM
- **Description:** Design and development of a study to estimate the environmental footprint (e.g. air pollution, noise annoyance) of innovative transport modes.
  This study may refer only to some use cases (i.e. goods and medical delivery, agriculture support), others being specific of advanced air mobility cannot properly be compared (i.e. air taxi) or a proper set of assumptions need to be defined.

Gap addressed

- Communication of beneficial effects of AAM

Key tasks

Task's description		Expected duration
T1	Definition of applicable use cases (or sub use cases)	1 month
T2	Commissioning of the study	3 months
T3	Design and data collection	6 months
T4	Development	3 months
T5	Publication	1 month

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	AAM taskforce	Competent ministries
T2	Competent ministries	AAM taskforce
T3	University or research centre	AAM team
T4	University or research centre	AAM team
T5	Competent ministries	Community in general

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Activity 7: Design and definition of a tool for transport system simulation and impact assessment

Activity 7 – Overview

Activity description

- **Brief goal:** Development of a tool to support decisions about transport options
- **Description:** The activity allows to obtain a tool that is able to provide data on the impact of air taxis in urban environment for decision makers thanks to:
  - demand schemes
  - geographical and spatial coverage
  - energy consumption
  - time constraints
  - interfaces among different transport modes
  - environmental footprints

Gap addressed

- Communication of positive implications of UAM (i.e. reduction of CO2 emissions, reduction of traffic)

Key tasks

	Task's description	Expected duration
T1	Identification of end users of the decision support tool for transport modes (– e.g. investors, traffic operators, mobility service providers, passengers, etc.)	6 months
T2	Collection of requirements and analysis of demand	5 months
T3	Development life cycle (i.e. architecture and tool development)	12 months
T4	Validation in controlled environment	3 months
T5	Proof of concept demonstration	3 months (along with T4)

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Aviation research entities	End users
T2	Aviation research entities	End users
T3	Software development entity	
T4	Software development entity	
T5	Software development entity	

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Activity 8: Communication of eco-design initiatives for vehicles and systems

Activity 8 – Overview

Wave I

Activity description

- **Brief goal:** Increase public awareness on AAM green solutions
- **Description:** Communication campaign focused of main sensitive issues to share the advantages of AAM eco-design. Peculiar topics such as 5G, electric power generation, batteries dismantling shall be properly addressed to ease potential prejudices.
  Once defined the key topics, messages and the use of media shall be tailored in accordance with the audience (i.e. social networks for younger audience, newspapers/TV for elder audience)

Gap addressed

- Communication of positive implications of UAM

Key tasks

Task's description		Expected duration
T1	Identification of key concerns and definition of key messages	2 months
T2	Design of communication campaign	2 months
T3	Incentive plan definition	2 months
T4	Deployment of communication campaign	8 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	AAM taskforce	MITD
T2	Ministries	AAM taskforce
T3	MITD	Ministry of Economy
T4	Media, Ministries	

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Activity 9: LCA (life-cycle assessment) tool development and application

Activity 9 – Overview

Wave II

Activity description

- **Brief goal:** Evaluate costs and benefits on the environment of the whole ecosystem
- **Description:** LCA methodology will be applied on all elements. Starting from vehicle life-cycle (raw materials extraction, manufacturing, logistics, usage and final disposal) also other elements have to be analysed:
  - Batteries (production, usage, recharging systems and disposal)
  - Infrastructures
  - Special packaging for transportation of goods

Gap addressed

- Quantify environmental impact of new transportations modes on the whole ecosystem and during the life-cycle

Key tasks

	Task's description	Expected duration
T1	Definition of the object and perimeter	1 month
T2	LCI (Life Cycle Inventory)	6 months
T3	LCIA (Life Cycle Impact Assessment)	6 months
T4	Review of data and results	2 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Ministry of the Environment	ENAC
T2	Ministry of the Environment	ENAC
T3	Ministry of the Environment	ENAC

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

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Activity 10: Develop a study to estimate the noise and visual impact arising from forecasted traffic scenarios

Activity 10 – Overview

Activity description

- **Brief goal:** Conduct projects and studies to identify expected noise levels for different scenarios and applications
- **Description:** Noise and visual impact of AAM applications will be studied to identify critical issues that need to be addressed to completely implement AAM into urban environments in accordance with city plans

Gap addressed

- Evaluate impact of noise produced by AAM vehicles on the community
- Verify the feasibility of the creation of AAM infrastructure in accordance with noise standards

Key tasks

Task's description		Expected duration
T1	Conduct test to collect data on noise levels in different scenarios	1-2 years
T2	Identification of impact of noise on the surrounding environment	1-2 years
T3	Evaulation of feasibility of AAM infrastructures in accordance with city urban plans	2 years
T4	Evaluation of compatibility of AAM infrastructures with existing noise standards	2 years
T5	Communicate results obtained to the community	1 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Research centers, manufacturers	ENAC
T2	Research centers, manufacturers	ENAC
T3	Institutions (ministries, regions and cities)	ENAC
T4	Institutions (cities)	ENAC – Research centers
T5	Institutions (regions and cities)	

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Activity 11: Design and implementation of an experimental framework to assess noise and visual impact

Activity 11 – Overview

Activity description

- **Brief goal:** Develop test to measure noise and visual impact of AAM vehicles in different environments
- **Description:** Integration of AAM in urban environments needs an experimental phase for the CONUSEs with the aim of obtaining data and measurements to support research. Results will also set the basis for regulations

Gap addressed

- Lack of data on eVTOL performances in different scenarios and operations
- Lack of regulations on noise and visual pollution

Key tasks

	Task's description	Expected duration
T1	Definition of a joint program for trials among institutions, manufacturers and research centers	6 months
T2	Start trials to collect data on noise impact in different phases of the flight	2 years
T3	Define noise classes for vehicles based on their acoustic emission (i.e. Annex 16 ICAO_Noise Chapter) and give directions to manufacturers on new technologies to develop	2 years (in parallel with T2)
T4	Update of noise regulations to include AAM applications in existent regulatory framework (e.g. define suitable profiles, classes for infrastructures and overall noise limits)	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Institutions, ENAC, manufacturers, research centers	
T2	Research centers, manufacturers	ENAC
T3	EASA – ENAC	Manufacturer
T4	Institutions (ministries and regions)	ENAC

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 12: Design of a set of guidelines to inform passengers and people on the ground about safety related issues

Activity 12 – Overview

Wave III

Activity description

- **Brief goal:** increase safety perception of passenger and personnel
- **Description:** The activity aims at identifying all necessary measures to reduce risks and increase safety perception for all stakeholders impacted. It is composed of three main phases:
  - T1: Risk assessment including: risks identification, study of impacted actors, definition of mitigation strategies
  - T2: Development of guidelines including: Identification of the target of the guidelines; link possible risks to users impacted; identification of communication strategies (what, how and when) and necessaries training for personnel and emergency services; development of a remote assistance system in case of emergency
  - T3: Results monitoring

Gap addressed

- Address concerns related to safety perception
- Minimize damages to people and objects in case of accident

Key tasks

Task's description		Expected duration
T1	Risk assessment	6 months development 6 months for communication
T2	Development of guidelines	6 months development 6 months for communication
T3	Results monitoring	2 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Operators
T2	ENAC	Operators
T3	ENAC	Operators

Strictly private and confidential

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 13: Design of communication strategies to increase public acceptance

Activity 13 – Overview

Activity description

- **Brief goal:** foster public acceptance through a series of communication activities that address main concerns and obstacles to the adoption of AAM
- **Description:** The aim of this activity is to identify concerns and obstacles based on each geography peculiarities that can limit the acceptance of AAM applications. Identified concerns will be tackled through a series of communication activities that will aim at highlight advantages of AAM but also disprove concerns (e.g. Economic impact assessment studies to show the future benefits of AAM, showcase events across the region and Virtual Town Halls, public demos, council and board presentations to engage directly and timely with selected city and regional bodies)

Gap addressed

- Lack of a communication strategy to address public concerns specific for each geography and community

Key tasks

	Task's description	Expected duration
T1	Identification of geographies and their specific concerns through a social analysis	3 months
T2	Definition of tailored communication strategies for each type of concern	9 months
T3	Deployment of communication campaigns	6 years
T4	Periodical status update of public perception on AAM	6 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Public institutions	Local institutions
T2	Public Institutions	Local institutions
T3	Public Institutions	AAM ecosystem stakeholders
T4	Public / local institutions	AAM ecosystem stakeholders

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Activity 14: Design rules for the U-space to enable goods transportation, inspection & mapping and agricultural support

Activity 14 – Overview

Activity description

- **Brief goal:** The main purpose of this activity is to define the reference regulation enabling the EVLOS[1]/BVLOS UAS safe operations linked with goods transportation, inspection & mapping and agricultural support. The objective is to determine the rules required to enable safe UAS operations linked with the above mentioned use cases/applications
- **Description:** This activity should define a well balanced risk-based regulatory framework combining prescriptive and performance-based rules setting the requirements and conditions for UAS operations related to goods transportation, inspection & mapping and agricultural support services. The regulatory framework should enable UAS EVLOS/BVLOS operations in specific scenarios

Gap addressed

- Address the need for enabling the above mentioned UAS operations into the national airspace
- Definition of the requirements and conditions to enable safe EVLOS[1]/BVLOS operations for the UAS services in subject

Key tasks

	Task's description	Expected duration (# months/years)
T1	Define requirements and conditions for relevant EVLOS[1]/BVLOS UAS operations/services	6 months
T2	Develop a well balanced risk/performance-based regulatory framework for EVLOS[1]/BVLOS	12 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	
T2	ENAC	

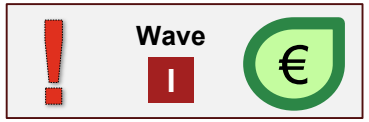
Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Strictly private and confidential

Notes: 1) Enhanced Line of Sight

Activity 15: Conduct ad-hoc Airspace Assessments for an adequate airspace design

Activity 15 – Overview



Activity description

- **Brief goal:** The main purpose of the airspace assessment is to build the full picture, which means taking a critical look at a certain airspace volume to identify the restrictions, operations, air and ground risks and collect sufficient data to determine what requirements are set to enable safe operations
  The objective is to determine which areas of the airspace are to be assigned to which airspace classes

- **Description:** This study is the first essential step on a journey from airspace assessment to airspace design and it can help in setting CNS requirements and establishing geo-fencing requirements.
  The study includes the analysis of: operations, infrastructure, restrictions, urban aspects, air and ground risks

Gap addressed

- Address the need for managed integration of UAS into the airspace
- Need to determine which zones of airspace are safe for a given UAS to fly in and which they should be excluded from

Key tasks

	Task's description	Expected duration (# months/years)
T1	Creation of a real time picture of current operations through interview of airspace users and analysis of data related to manned air operations	3 months
T2	Identification of airspace volumes to be avoided because of safety, security, privacy or environmental concerns	3 months
T3	Definition of requirements to enable safe UAS operations (i.e. requirements to give drone operators	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ANSP/USP with Eurocontrol support	ENAC
T2	ANSP/USP with Eurocontrol support	ENAC
T3	ANSP/USP with Eurocontrol support	ENAC

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 16: National airspace redesign for UAS integration

Activity 16 – Overview

Wave I II

Activity description

- **Brief goal:** Airspace structure redesign for accommodation/integration of UAS
- **Description:** Once completed airspace assessment the airspace redesign phase can start building on the airspace assessment outcomes/recommendations. This phase foresees the design of affected airspace based on the concept of Dynamic Allocation of corridors and the supporting traffic management infrastructure and capabilities.

Gap addressed

- At present, operation of autonomous vehicles is generally relegated to segregated airspace volumes and over the most rural areas
- Airspace classifications and structures need to evolve based on appropriate performance metrics, while new models and tools are needed to address U-Space operational requirements, with an increasing focus on the coexistence of manned and unmanned Urban Air Mobility (UAM) vehicles and associated Communication, Navigation and Surveillance (CNS) infrastructure Ultimately, routine “file and fly” access—the ability to operate “at will” without the need for one-off special approval for each operation—to all classes of airspace, subject to constraints of airspace design and airspace use by other traffic, is essential to the success of later applications of advanced aerial mobility

Key tasks

Task’s description	Expected duration (# months/years)
See next page	

Responsibility assignment

Task	Agents’ role	
	Owner	*Informed*
See next page		

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Strictly private and confidential

Activity 16: National airspace redesign for UAS integration

Activity 16 – Overview

Key tasks			Responsibility assignment	
Task's description		Expected duration (# months/years)	*Owner*	*Informed*
T1	Study/define the viable traffic management solutions given a range of expected traffic densities within the defined corridors. Solutions could require a centralized AAM automated traffic control system, or a more simple metering or Demand-Capacity Balancing solution	6 months + possible additional iterations/refinements	ANSP/USP	CAA & relevant Stakeholders
T2	Study/define the design of the Dynamic Allocation of Corridors to minimize interactions with existing manned VFR traffic flows and solutions to improve the situational awareness for conventional VFR traffic to be aware of the already allocated AAM corridors and/or operations	6 months	ANSP/USP	CAA & relevant stakeholders
T3	Definition of requirements for accessibility and usage of AAM airspace volumes	6 months	ENAC	ANSP/USP & relevant stakeholders
T4	Enable the "Geo-fencing provision" service as essential to avoid UAS flight in the "restricted areas"	3 months	ANSP/USP/Navigation database provider	CAA & relevant stakeholders
T5	Establish No Fly Zone to address interference with manned air traffic near airports and heliports	6 months	ANSP/USP/ENAC	Relevant stakeholders
T6	Identification of flight levels (e.g. min and max quotas) for UAS operations that limit the volume of airspace for flight	6 months	ANSP/USP/ENAC	Relevant stakeholders
T7	Development of "Tracking and Position reporting", "Surveillance data exchange" services necessary for BVLOS operations	1 year	ANSP/USP	CAA & relevant stakeholders
T8	Definition of specific methodologies that not only target the assessment of the ground risk but also of the air risk	1 year	ANSP/USP	CAA & relevant stakeholders

Strictly private and confidential

Activity 17: Evolution of current strategic conflict resolution services (vs manned traffic)

Activity 17 – Overview

Wave II

Activity description

- **Brief goal:** the main purpose of this activity is to define the required evolution of the relevant separation management service of unmanned vs unmanned as well as of unmanned vs manned aviation.
- **Description:** There are mainly two type of separation management service: strategic separation management service which occurs before take-off and resolves conflicts in the planned operations; and tactical separation management service, which resolves conflicts that are detected during the flight.
  The activity should define how we can evolve from a basic strategic separation management service to a more advanced and complex tactical separation management service.

Key tasks

	Task's description	Expected duration (# months/years)
T1	Testing activities to improve current strategic conflict resolution systems	1 year
T2	Define advanced ATM/U-Space functions and airborne capabilities to enable the tactical separation management service	2 years

Gap addressed

- Evolution from a regulation based on a substantial segregation between manned and unmanned

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ANSP/USP	CAA
T2	ANSP/USP/CAA	

Activity 18: Definition of tools in relation to basic U-space services and ground infrastructures

Activity 18 – Overview

Wave I

Activity description

- **Brief goal**: Manage UAM operations into mid-size urban and suburban areas
- **Description**: Definition of a controlled airspace to enable UAM operations, exploring new developed CORUS XUAM architectures, as well as the interrelation with manned aviation and other drone operations. This will be achieved with the focus on ATM-U-Space services/aspects. The scenario of operation will comprises:
  - Study UAM cargo operations (e.g. medical goods/vaccine) in urban and suburban airspace from controlled airspace to U-space
  - Strategic de-confliction and sequencing before take-off to accommodate UAM taking into account manned traffic and other drones operation
  - "Handshaking" between U-Space and ATM;
  - Involvement of Civil Airport Taranto Grottaglie for ATM component and D-Flight, the Italian USP
  - Involvement of large, fast UAM vehicle owned by PVS for cargo operations
  - Involvement of small drones for last mile operations (to the hospital)
  - Involvement of small drones for "other operations"
  - Safety pilot on board of PVS UAM Vehicle (also to mitigate and facilitate the permission to fly)

Gap addressed

- ATM/U-Space coordination

Key tasks

	Task's description	Expected duration
T1	Planning, Set-Up, Organization This is the management task for the demonstration. Development of demonstration scenarios, use cases, mission planning, setting-up of the ATM/U-Space interface, organization of demonstration fields, and briefing sessions for involved operational personnel (ATCOs and Pilots). The U-space system of D-Flight will be used for the demonstration.	20 months
T2	Safety-case, authorization This task interfaces with the authorities and clears the way for the demonstration to occur. An aeronautical safety study will be performed using the SORA methodology. With the output of this process, the flight authorization requests will be managed with the Italian NSA	10 months
T3	Execution This task will include cycles of demonstration. The Pipistrel UAM aircraft with remote pilot + safety pilot on board will be used for the real flight trials. Demonstrate the feasibility of integrated operation of manned and unmanned aviation following ATC and U-Space procedures. Involvement of Air Traffic Controllers, and small drone operators, provision of D-Flight U-space services. Observation, assessment of safety, human performance, cyber security, and access and equity through the involvement of dedicated KPA experts	9 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Service providers, UAM Operator	Airport operator
T2	Service providers, UAM Operator, small drone operators	ENAC, Airport operator, other airfields involved
T3	Service providers, UAM Operator, small drone operators	ENAC, Airport operator, other airfields involved

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Strictly private and confidential

Activity 19: Mapping of technological solutions and CNS to support each type of area

Activity 19 – Overview

Wave I

Activity description

- **Brief goal:** The overall goal of this activity is to map the AAM enabling technologies and CNS infrastructure supporting reference operations in managed and unmanaged airspace as well as in the various type of airspace
- **Description:** Communications, Navigation and Surveillance (CNS) and technological solutions requirements must be defined to develop an adequate ATM/U-Space architecture supporting AAM integration in the reference Airspace.

Gap addressed

- CNS requirements must be developed in order to develop and adequate ATM/U-Space architecture supporting AAM integration in the various classes of airspace. These requirements must also address cybersecurity, future communications, satellite-based
- navigation & APNT, and scalable surveillance and situational awareness requirements.
- CNS integration requirements should also consider the relevant AAM Command & Control (C2) systems.

Key tasks

	Task's description	Expected duration (# months/years)
T1	CNS and enabling technologies survey WRT to the various type of airspace potentially interested by AAM operations.	3 months
T2	Conduct a gap analysis of the required CNS infrastructure/architecture enabling AAM operations WRT current infrastructure	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ANSP/USP	CAA & relevant stakeholders
T2	ANSP/USP	CAA & relevant stakeholders

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

Strictly private and confidential

Activity 20: Exploration for the definition of a tactical separation management / tactical conflict resolution service

Activity 20 – Overview

Activity description

- **Brief goal:** U-space services and capabilities shall support a range of AAM operations ranging from sparsely populated areas with marginal manned aviation operations to urban operations with considerable manned aviation, terrain and surface obstacles. The corresponding requirements for tactical separation management/conflict resolution shall be explored and adequately defined to properly mitigate the risks for people in air and on the ground as well as properties
- **Description:** AAM operating in high-density areas or mixed types of traffic may be required to be equipped with DAA to meet the requirements. Tactical Separation Management will require further investigation to develop robust, and scalable separation management services

Gap addressed

- Draft regulation is based on a substantial segregation between manned and unmanned. To enable mixed operations two elements are required: a tactical separation algorithm; a common conspicuity technology

Key tasks

	Task's description	Expected duration (# months/years)
T1	Identification of conflict management principles and related algorithms;	3 months
T2	Conflict detection optimization and vertical separation implementation;	6 months
T3	Tactical Conflict resolution WRT manned aviation..	12 months
T4	Interactions between the tactical conflict resolution service and on-board DAA systems.	12 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ANSP/USP/CAA	Relevant Stakeholders
T2	ANSP/USP/CAA	Relevant Stakeholders
T3	ANSP/USP/CAA	Relevant Stakeholders
T4	ANSP/USP/CAA	Relevant Stakeholders

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 21: Identification of cybersecurity solutions for U-Space and for the ATM part (1/2)

Activity 21 – Overview

Wave III

Activity description

- **Brief goal:** Identification of cybersecurity solutions to ensure safe ATM/U-Space
- **Description:** definition of:
  - To define a security operational risk assessment approach
  - To define “cybersecurity -based" architectures
  - To develop an Intrusion Detection System
  - To define an approach to testing of Intrusion Detection systems (means of evidence)
  - To define Cybersecurity Observatory
  - To foster a cybersecurity culture among the stakeholder

Key tasks

Task’s description	Expected duration (# months/years)
See next page	

Gap addressed

- Cybersecurity Risk Assessment Approach
- Security by design architectures
- Cybersecurity Intrusion Detection Systems
- Update of ADS-B (Automatic Dependent Surveillance - Broadcast) systems
- Standardization and Regulations
- Cybersecurity culture

Responsibility assignment

Task	Agents’ role	
	Owner	*Informed*
See next page		

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Effort < Mln | Tenths Mln | Hundreds Mln

Criticality Important | Show stopper

Activity 21: Identification of cybersecurity solutions for U-Space and for the ATM part (2/2)

Activity 21 – Overview

Key tasks			Responsibility assignment	
	Task's description	Expected duration (# months/years)	*Owner*	*Informed*
T1	The task develops an approach to be followed by operators to perform a cyber security operational risk assessment, in parallel to SORA applied for safety purposes The main task outcome is a Preliminary Security Operational Risk Assessment Approach	1 year	ANSP/USP	CAA
T2	The task defines the cyber-security for assessment for the CONUSEs of interest The main task outcome is a the CONUSE xxx Cyber-Security Operational Risk Assessment Approach	0,5 year	ANSP/USP	CAA
T3	The task defines the main concepts of: public Key Infrastructure, digital certificates, and blockchain support for UAVs/U-Space operations, solutions for the validation of navigation and position data, recovery solutions for cyber-attacks, etc. The main task outcome are the system requirements for the reference concepts	2 years	ANSP/USP	CAA
T4	The task defines the main concepts or cyber-secure datalink for traffic control and CNS The main task outcome are the system requirements for the reference concepts	1 year	ANSP/USP	CAA
T5	The task aims to analyse the most suitable artificial intelligence techniques. Benchmark among different concepts are envisaged in order to analyse the most suitable ones	1 year	ANSP/USP	CAA
T6	This task defines the key performance indicators to evaluate the intrusion detection system	0,5 year	ANSP/USP	CAA
T7	This task defines at high level the methodology to test the intrusion detection system including the classes of test to be performed (are part of the methodology also the key performance indicators)	0,5 year	ANSP/USP/CAA	
T8	This task defines the approach to generate scenarios for the cyber-attacks including simulation guidelines	1 year	ANSP/USP/CAA	
T9	This task aims to define a possible approach to organize a Cyber-security observatory collecting data at national level and fostering the same approach at European level. The task includes also the definition of the "business model " underpinning such structure	2 year	CAA	ANSP/USP
T10	This task aims to address the main vulnerabilities from a social-culture perspective identifying the best approach to promote best-practices	2 years	ANSP/USP	CAA

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Activity 22: Clarification of technical specifications for helipads / drone pads

Activity 22 – Overview

Wave I

Activity description

- **Brief goal:** Individuation technical characteristics for ground infrastructures (i.e. helipads and drone pads)
- **Description:** The activity is aimed at establishing the reference technical criteria in order to adapt / design ground infrastructures and foresees three main tasks:
  - Review of international approach (i.e. ICAO/EASA)
  - Definition of a national approach to technical specification
  - Identification of National Technical specifications

Gap addressed

- Lack of a technical approach suitable to National needs

Key tasks

	Task's description	Expected duration (# months/years)
T1	Review of international approach (i.e. ICAO/EASA)	2 months
T2	Definition of a national approach to technical specification	4 months
T3	Identification of National Technical specifications	4 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Aerodrome Operator
T2	ENAC	Aerodrome Operator / COA
T3	ENAC	Stakeholders

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 23: Monitoring of technical specifications for vertiports defined by EASA

Activity 23 – Overview

Wave II

Activity description

- **Brief goal:** Get involved in EASA rulemaking process related to vertiports
- **Description:** The activity is aimed at identifying the EASA RMT (Rulemaking task) dedicated to vertiports technical specifications and at structuring the participation of Italian stakeholders in the working group. The activity can be broken down in three main tasks:
  - Identification of EASA dedicated Rulemaking Group
  - Structuring of National participation to EASA RMT (Rulemaking task)
  - Ensuring participation in EASA working groups dedicated to the EASA RMT

Gap addressed

- Individuation EASA idea on vertiports technical specifications

Key tasks

	Task's description	Expected duration (# months/years)
T1	Identification of EASA dedicated Rulemaking Group	1 months
T2	Structuring of National participation to EASA RMT	2 months
T3	Ensuring participation in EASA working groups dedicated to the EASA RMT	1,5 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Stakeholder
T2	Aerodrome Operator /ENAC	Stakeholder
T3	Aerodrome Operator /ENAC	Stakeholder

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 24: Definition of an approach to analyze the compatibility of vertiports with the existing legal framework

Activity 24 – Overview

Activity description

- **Brief goal:** Defining the compatibility of the technical specifications (TS) for vertiports within the existing national legal framework on urban, landscape and mobility planning
- **Description:** Definition of a proposal to amend national legal framework on urban, landscape and mobility planning. These proposals are defined considering aspects which are:
  - Compatibility with technical specifications for vertiports
  - Suitability of technical specifications for vertiports with small changes
  - Obstacles to develop vertiports infrastructure

Gap addressed

- Harmonization of technical specification for vertiports with the existing national legal framework on urban, landscape and mobility planning

Key tasks

	Task's description	Expected duration (# months/years)
T1	Individuation of existing national legal framework involved	3 months
T2	Definition integration of TS with national legal framework	7 months
T3	Definition of proposals to amend national legal framework	2 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC / Municipalities	Stakeholder
T2	ENAC / Municipalities	Stakeholder
T3	ENAC / Municipalities	Stakeholder

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 25: Integration of helipads / drone pads operations with respect to urban facilities to mitigate risk

Activity 25 – Overview

Wave I

Activity description

- **Brief goal:** Ensure the integration of helipads and drone pads operations with urban context
- **Description:** Definition of an approach to classify areas to be used for drones operations (i.e. helipads and operative corridors) according to these criteria:
  - Type of goods delivered
  - Type of operations (i.e. Air taxi, medical & goods delivery, inspection and mapping, agricultural support, etc.)
  - Number of operations allowed

Gap addressed

- Managing the risk associated to drone operations in urban context

Key tasks

Task's description		Expected duration (# months/years)
T1	Definition of a methodology to evaluate risk related to operations	5 months
T2	Definition of an approach to classify areas to be used for drone operations	8 months
T3	Application of a defined approach for the Winter Olympic Games scenario in 2026	7 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC / ATM stakeholders	Eurocontrol
T2	ENAC / Municipality / Eurocontrol	Stakeholder
T3	ENAC / Municipality / Eurocontrol	Stakeholder

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Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

Activity 26: Integration of vertiport operations with respect to airport operations (manned vs unmanned)

Activity 26 – Overview

Wave II

Activity description

- **Brief goal:** safe integration of vertiports and airports operations
- **Description:** enable VTOL operations (manned and unmanned) inside controlled airspace and integrate them with airports operations is one of the challenges to address for the development of AAM. New ground infrastructures (vertiports) used for take-off and landing and ground operations need to be developed to be integrated with airports activities ensuring safety, flight operations efficiency and passengers related processes

Gap addressed

- Identify solutions to manage UAS traffic (manned and unmanned) in proximity of vertiports limiting the interference with airport operations
- Identify key services to certify ground infrastructures (vertiports)
- Identify organizational and operational requirements for the integration of vertiport and airport operations and for contingencies management

Key tasks

	Task's description	Expected duration
T1	Verify interference of landing and take-off paths for VTOLs with landing and take-off paths for general aviation and identify solutions to reduce risks	1-2 years
T2	Conduct a study to identify essential services (safety/security/ground handling) for the certification of vertiports (e.g. security check, anti-icing service, etc.)	1-2 years
T3	Define regulations for vertiports in terms of organizational and operational requirements for the integration of vertiports and airports operations, for emergencies and contingencies management (e.g. low visibility procedures)	1-2 years
T4	Develop systems to coordinate airports operators, vertiports operators and ANSP in terms of operations and sharing of information among all stakeholders involved	1-2 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ANSP[1] - Airports operators	ENAC
T2	EASA-ENAC	Airports operators
T3	EASA-ENAC	Airports operators
T4	ANSP[1] - Airports operators	ENAC

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

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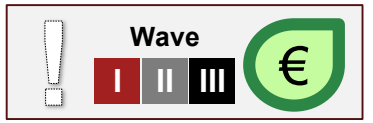
Notes: 1) Air Navigation Service Provider

Activity 27: Integration of U-Space systems with counter-UAS systems

Activity 27 – Overview



Activity description

- **Brief goal:** Perform a feasibility study to understand the smart integration of counter-UAS capabilities with U-Space ecosystem
- **Description:** To analyze and asses the level of interoperability needed between the U-Space ecosystem and the C-UAS[1] capabilities provided by a typical C-UAS[1] System (e.g. command and control, Recognized Air Picture Management, Threat Evaluation, Weapon Assignment). The level of interoperability and service integration depends on the needed security levels of the areas that may be permanent (e.g. vertiports or airports) or temporary (e.g. stadium, crisis management temporary locations etc.) according to the different CONUSEs. The study will assess which C-UAS[1] services needs to be integrated and the requirements that will be specific for the different CONUSE.

Gap addressed

- Integration of U-Space services and C-UAS services in complex U-Space ecosystems

Key tasks

	Task's description	Expected duration
T1	Assessment of different level of security needed for the U-Space typical CONUSEs	10 months
T2	Identification of requirements associated to the specific CONUSE	18 months
T3	Demonstration of the identified solution	18 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC/Service providers	All (including MoD)
T2	Industry players	All (including MoD)
T3	Industry players/Service providers	All (including MoD)

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

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Notes: 1) Counter-UAS

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Appendix - Acronyms

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Activity 28: Feasibility study to understand U-Space/ATM integration levels

Activity – Overview

Activity description

- **Brief goal:** Perform a feasibility study to identify the level of interoperability between ATM and U-Space systems and services
- **Description:** The ATM and U-Space interoperability can be achieved through the identification of the domain data to be exchanged, the operations to be performed, the interfaces to be implemented and the functional and non functional requirements to be fulfilled. The tailoring of the requirements and procedures can be reached with specific demonstration activities and involving of all the needed stakeholder, including final users and contingency/crisis management entities (e.g. Protezione Civile, Vigili del Fuoco etc). The final result of the feasibility study will be the fine tuning of the ATM/U-Space integration requirements and procedures that will enable the full concept implementation

Gap addressed

- Specific technical and operational requirements tailored for the Italian ecosystem for the interoperability between ATM and U-Space systems and services

Key tasks

	Task's description	Expected duration
T1	Identification of CONUSEs to be demonstrated	8 months
T2	Tailoring of requirements and procedures to support the demonstration activities	12 months
T3	ATM and U-Space systems preparation to support the demonstrations	18 months
T4	Demonstration activities and outcomes	4 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Service Providers	ENAC+ Industry + Final Users
T2	Industry + Service Providers	ENAC + Final Users
T3	Industry + Service Providers	ENAC + Final Users
T4	Service Providers + Final Users + Industries	All

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 29: Develop a list of performance requirements for UAS[1]

Activity 2 – Overview

Wave II

Activity description

- **Brief goal:** define a list of performance requirements for UAS for each kind of CONUSE
- **Description:** a set of minimum performance requirements has to be identified to allow the safe operations of UAS, especially in urban areas. The performance requirements should give, as an output, the maximum take-off mass for a specific flight in consideration of the environmental conditions, such as temperature, wind and obstacles to be cleared. performance requirements take into consideration the failure that cannot be ruled out by UAS design, as it happens with Commercial Air Transportation (CAT). Performance requirements are typical of each kind of aircraft (i.e. Airplanes, Helicopters) and kind of engine (piston, turbine). While for UAS replicating airplanes or helicopters there's no need of new elements, electric powered multicopter pose a challenge similar to that of tiltrotors

Gap addressed

- Current version of regulation 965/2012 does not include set of performance for electric-powered multicopters. EASA is actively working on this element with its Rule Making Task 230 (RMT.0230) aiming at type#3 operations and Type#2 Operations

Key tasks

Task's description		Expected duration (# months/years)
T1	Benchmark Performance of currently available UAS	3 months
T2	Derive failure modes that can affect UAS multicopter	8 months
T3	Monitor activity of EASA RMT.0230	2 years
T4	Review NPA for Type#3 Operations	4 months
T5	Review NPA for Type#2 Operations	4 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry	ENAC Airspace Users
T2	Industry	ENAC Airspace Users
T3	ENAC	Industry Airspace users
T4	ENAC	Industry Airspace users
T5	ENAC	Industry Airspace users

1) (which in the first instance can be allocated in the category of rotorcraft within the 965/2012 regulation for passenger transport operations)

Effort < Mln | Tenths Mln | Hundreds Mln

Criticality Important | Show stopper

Strictly private and confidential

Activity 30: Develop a list of performance requirements for UAS operator to guarantee safe, secure and reliable urban air service

Activity 2 – Overview

Activity description

- **Brief goal**: definition of a set of regulations to allow UAS operators deploy safe and reliable services
- **Description:** the activity aims at develop a list of performance requirements that will be used by UAS operators to define urban air services that are safe, secure and reliable.
  Currently Reg. 965/2012 does not set performance requirements that allow UAS operations in urban environments, therefore it is necessary a review of current regulations to identify elements to be updated and new requirements to be introduced to address all topics related to UAS operations.

Gap addressed

- Lack of UAS specific regulations that define performance requirements for UAS operators

Key tasks

	Task's description	Expected duration (# months/years)
T1	Benchmark Performance of currently available UAS	3 months
T2	Review of current regulation to identify key elements to be updated	6 months
T3	Definition of a set of performance requirements on which regulation should be based	6 months
T4	Presentation of results to EASA and development of a regulation at European level	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry, UAS operators	Regulator
T2	Regulator	UAS operators
T3	Regulator	UAS operators
T4	Regulator	UAS operators

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 31: Contribute actively to EASA working groups to address the lack of a type certification of UAS with human onboard

Activity – Overview

Wave II III

Activity description

- **Brief goal:** Identification of certification requirements for UAS with human onboard
- **Description:** Definition of requirements for production and operations of UAS with human onboard through five steps:
  - Safety Pilot onboard / remote documents necessary for the release of the permits to fly: EASA doc. “Flight Conditions”, ENAC doc. Operational authorization/Permit to Fly
  - Safety Pilot onboard / remote and passengers documents necessary for the release of the permits to fly: EASA doc. Special Condition/Certification specification + EASA doc. “Type Certificate” + ENAC doc. “Certificate of Airworthiness”
  - Remote Pilot and Passengers documents necessary for the release of permits to fly : EASA doc. Special Condition/Certification specification + EASA doc. “Type Certificate” + ENAC doc. “Certificate of Airworthiness”
  - Autonomous system no human on board documents necessary for the release of permits to fly: EASA doc. “Flight Conditions” + ENAC doc. Operational authorization/Permit to Fly
  - Autonomous system and passengers documents necessary for the release of the permits to fly: EASA doc. Special Condition/Certification Specification + EASA doc. “Type Certificate” + ENAC doc. “Certificate of Airworthiness”

Gap addressed

- Identification of standard Special Conditions + Issue of Certification Specification (EASA)
- Adaptation of current procedures for the issue of an UAS operative authorization, a Permit to Fly, a Certificate of Airworthiness to the case of drones with humans on board (ENAC)

Key tasks

	Task’s description	Expected duration (# months/years)
T1	To promote and Inform EASA of the strategic importance of a standard Special Conditions for UAS taxi	6 months
T2	To promote and Inform EASA of the strategic importance to issue a Certification Specifications for UAS taxi.	6 months
T3	To adapt ENAC current procedures for the issue of an UAS operative authorization, a Permit to Fly.	6 months after EASA release of a standard Special Conditions for UAS
T4	To adapt ENAC current procedures for the issue of an UAS Certificate of Airworthiness	6 months after EASA release of Certification Specification

Responsibility assignment

Task	Agents’ role	
	Owner	*Informed*
T1	ENAC	Manufacturers / Operators
T2	ENAC	Manufacturers / Operators
T3	ENAC	Manufacturers / Operators
T4	ENAC	Manufacturers / Operators

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

Strictly private and confidential

Activity 32: Verify applicability of regulation 1008-2008 to passenger transportation drones operations

Activity – Overview

Wave I

Activity description

- **Brief Goal:** definition of the requirements for the operation of air services in the European Union
- **Description:** The activity aims at verify applicability of regulation 1008-2008 to passenger transportation drones operations. Regulation 1008/2008 defines the requirements for the licensing of Community air carriers, the right of Community air carriers to operate intra-Community air services and the pricing of intra-Community air services. In the regulation air service means *a flight or a series of flights carrying passengers, cargo and/or mail for remuneration and/or hire.* Therefore it affects air services provided with UAVs also, while the real applicability of this regulation to the specific UAV environment has never been checked

Gap addressed

- Requirements currently included in the regulation 1008/2008 have been written for operators of manned aircraft, and therefore it is to be addressed if they are relevant, and in what measures, for air services provided with UAV

Key tasks

Task's description		Expected duration (# months/years)
T1	Check the applicability of the current version of the regulation to a UAV operator	6 months
T2	Prepare a draft modification of regulation 1008/2008 to be sent to the European Commission for testing	1 years
T3	Open a discussion with European Commission to prepare a modification of regulation 1008/2008	1 years
T4	Follow modification in the EU Council	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Industry Operators
T2	ENAC	Industry Operators
T3	ENAC	Industry Operators
T4	ENAC	Industry Operators

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Strictly private and confidential

Activity 33: Define a protocol to address: organization, rules, procedures and fees for required services

Activity – Overview

Wave I

Activity description

- **Brief Goal**: prepare a National Economic Regulation for those U-Space services which are not subject to market competition
- **Description:** although EU U-Space Commission Implementing Rule is aimed to define U-Space where competition will be a part of the structure, the levels of interoperability and technical specification are still far from reaching that point, and therefore it is likely that for some years from now, U-Space services shall be provided on a monopolistic basis and therefore economic regulation shall be needed. In addition many services will e provided outside U-Space, in a structure still to be defined. Commission Single European Sky Package (SES2+) proposal includes an article dedicated to CIS that could serve as the basis for the rest of services provided on a monopolistic basis

Gap addressed

- Lack of economic regulation for UAV services not provided

Key tasks

	Task's description	Expected duration (# months/years)
T1	Monitor progress in Single European Sky Package (SES2+) proposal	1 year
T2	Define a draft regulation on U-Space services organization	1 year
T3	Define a draft regulation on U-Space services provided outside U-Space Airspace	1 year

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Industry Operators
T2	ENAC	Industry Operators
T3	ENAC	Industry operators

Activity 34: Create situation awareness systems (e.g. Detect and Avoid) for tactical separation for UAS

Activity – Overview

Task's date are in line with SESAR's roadmap

Wave I II

Activity description

- **Brief goal**: Creation of a DAA system for tactical separation for UAS
- **Description**: Study, validation and **implementation** of Detect and Avoid function for RPAS/drone applied to AAM (class Certified) in airspace class D-G where very diverse airspace users are present ranging from other drones, to general aviation flights operating VFR. These segments of airspace also present different levels of ATC services to interact with. DAA systems comprise of two major provided functions; Remain Well Clear (RWC) and Collision Avoidance (CA). These functions support the remote pilots in her/his responsibilities with regards to the rules of the air in ICAO Annex II. DAA is an addition to Strategic Conflict Management Strategic process of keeping aircraft away from intruders and other conflict hazards based on:
  - Airspace organization and management (ATM/U-Space)
  - Demand and capacity balancing (ATM/U-Space)
  - Traffic synchronization components (ATM/U-Space)

  Regarding AAM operations in A-C airspace (controlled airspace) for RMC we have:
  - Traffic control (ATC responsibility)
  - Remain well clear (RP responsibility)

Gap addressed

- Interoperability with other UAS
- Certification process for products available on the market

Key tasks

	Task's description	Expected duration (# months/years)
T1	Exploratory and industrial research	Target 2024
T2	V4 (industrialization)	Target 2026
T3	V5 (deployment)	2027
T4	Operations	2027/2033

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industries, ANSP, USP, Research centers, AAM operators, standardisation/regulation bodies	Other Aus
T2	Industries, AAM operators standardisation/regulation bodies	Other Aus, ANSP
T3	Industries, AAM operators standardisation/regulation bodies	Other Aus, ANSP
T4	Industries, AAM operators standardisation/regulation bodies	Other Aus, ANSP

Strictly private and confidential

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

Activity 35: Define conspicuity requirements for manned vehicles

Activity – Overview

Wave II

Activity description

- **Brief goal**: Conspicuity definition for manned vehicles is a key enabler for building complete Traffic Information Services (TIS) within low level airspace
- **Description**: Traffic Information Services (TIS) is a core U-Space service which, together with strategic deconflicting, will support safe mixed UAS/manned operations without rigid segregation of airspace. While UAS operators will have to comply with remote networking e-ident (and positioning) through TBD standard, a clear mandate and the relevant enabling technologies for manned aviation are still to be defined. *For the time being, it is being proposed an amendment to 923/2012 with ref. to SERA 6005: "In order to allow manned aircraft which are not provided with an air traffic control service to safely operate alongside unmanned aircraft in U-space airspace, it is important that the position of manned aircraft is communicated to U-space service providers. This should be achieved by making manned aircraft electronically conspicuous, effectively signaling their presence by means of surveillance technologies.".*

Gap addressed

- Current surveillance infrastructure and technology for manned aviation can only be used to provide Traffic Information Service (TIS) for unmanned aviation in very limited parts of the airspace at the very low levels in question. At least that is the case in countries with a significant uncontrolled airspace. New surveillance and communication (C2) infrastructure and technology which would allow a significantly better coverage at very low level is hampered by the lack of European TIS performance requirements on infrastructure as well as on airborne equipment. Exemptions to 923/2012 may be granted to special operations (ref. art. 4 923/2012). Those include most of the manned activities at low altitude.
- N.B. The U-space AMC/GM working group will evaluate electronic conspicuity options which should be based on the specific surveillance coverage and specific technologic capabilities and performance in the foreseen operational scenarios (source EC answer to WAOS letter)

Key tasks

	Task's description	Expected duration (# months/years)
T1	Addressing the issue to EC within U-space reg. package revision	6 months
T2	Publish a manifest for soft launching a nationwide voluntary Network Remote ID	1 month
T3	Establish agreement with "special operation" managers (i.e. HEMS[1], FIRE, Civil Protection, Law Enforcement, etc.)	6 month
T4	Conspicuity Management for State and Air Force	1 year
T5	Liase with U-Space AMC/GM Working Group	1 year

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Stakeholders
T2	ENAC	Service providers
T3	Service providers	ENAC
T4	Air Force	ENAC
T5	Industry	Service providers

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

Strictly private and confidential

1) Helicopter Emergency Medical Service

Activity 36: Structure future-proof standards for the implementation of "one-to-many" control dynamics

Activity – Overview

Wave I

Activity description

- **Brief goal:** Enabling one to many operations

- **Description:** The purpose of this activity is to enable a scalable, safe, secure, affordable, and efficient fleet operations management services that ensure safe navigation and efficiently handle aircraft operations through the following steps:
  - definition of the ConOps based on the market needs
  - definition of the requirements for the acceptable level of safety and security
  - definition of the requirements for operational procedures that describe the stakeholders and their roles in the ConOps
  - definition of the business constraints (a balance between drone operators needs and business sustainability) to enable a wide-scale adoption
  - definition of a technological roadmap based on a system management via automation layers (therefore with predictable behavior) with progressive maturity.

Gap addressed

- Identification of regulation requirements
- Technological gaps

Key tasks

Task's description		Expected duration (# months/years)
T1	Define the ConOps on the market needs	3 months
T2	Define the safety and security requirements to enable 1:n operations with an acceptable risk level	12 months
T3	Define procedures (roles and standard) and system services requirements	24 months
T4	Define the index 1:n (pilot:drones) to grant the business sustainability	3 months
T5	Define the experimental and technology roadmap	24 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	End users/Drone services provider/workgroup AAM	All AAM stakeholder
T2	Regulatory authority	All AAM stakeholder
T3	Regulatory authority	All AAM stakeholder
T4	Business model workgroup AAM/drone operators	Regulatory authority, U-Space authority
T5	Industrial stakeholders	Regulatory authority, U-Space authority

Strictly private and confidential

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 37: Define a system to coordinate emergency services for temporary segregation

Activity – Overview

Wave I

Activity description

- **Brief goal**: coordination of emergency services with ATM/U-Space services
- **Description**: Definition of a system for coordination of emergency services (118, COAU, Protezione Civile) for temporary segregation of airspace to intervene in critical situations.
  In view of the eventual regulatory framework, the activity itself could be rearranged; rather than applying temporary segregation, the provision of U-space services might allow some kind of shared use of an airspace volume.

Gap addressed

- Regulatory (ongoing)
- Technological (potentially low, depends on adopted solution)

Key tasks

Task's description		Expected duration (# months/years)
T1	Definition of stakeholder requirements	1 month
T2	Development of ConOps (procedural and technical solutions)	1 month
T3	Validation of ConOps	1 month
T4	Implementation	3 to 6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	USSP / Emergency Services	CAA
T2	USSP / Emergency Services	CAA
T3	USSP / Emergency Services	CAA
T4	USSP / Emergency Services	CAA

Strictly private and confidential

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 38: Creation of a National Digital platform to simplify permitting procedures

Activity – Overview

Wave I

Activity description

- **Brief goal:** Create a national digital platform to simplify and harmonize permitting procedures for drone operations
- **Description:**The objective of the measure is the digitalization of the procedures of the Public Administrations involved in order to have a single-entry point to enable drone services and the creation of innovative u-space services to enable operations. The measure is aimed at easing and harmonizing permitting procedures for drone operations. Moreover, the creation of a national digital platform will improve communication and facilitate procedures for drone service providers / public and private operators and permitting / regulatory authorities. The platform will become a one stop shop for businesses and citizens allowing for safety, security and local administrative authorization procedures to be completed online.

Gap addressed

- Complexity of combined regulations regarding entry-level AAM applications

Key tasks

	Task's description	Expected duration (# months/years)
T1	The creation of a national interoperable digital public platform to simplify and harmonize permitting procedures for drone operations	12 months
T2	The inclusion of other services and infrastructures to enable the U-space in urban environment	12 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Service providers
T2	ENAC	Service providers

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Strictly private and confidential

Activity 39: Definition of acceptable means of compliance for subsystems and equipment supplied by third parties

Activity – Overview

Activity description

- **Brief goal:** Definition of acceptable means of compliance for subsystems and equipment supplied by third parties to support the transition from aviation standard to industry
- **Description:** The traditional aircraft type certification makes extensively use of industries standard as an acceptable means of compliance to comply with the applicable certification specification. These standard are some time recalled in the applicable advisory materials or European Technical Standard Order (ETSO). In the contrary, drones makes extensively use of COTS often not comply with any specific standard. This gap is lowered up to zero when drones reach dimension and operation typical of manned aircrafts. Current regulation is moving towards an objective-based, operation centric and proportional approach to UAS certification. This means that the certification basis is built by industries by identification of Airworthiness Design Standards and Acceptable Means of Compliance (AMC) to comply with objective requirements

Key tasks

	Task's description	Expected duration (# months/years)
T1	Identification of all available aviation standards potentially applicable to drones (air taxi design as target reference).	12 months
T2	Starting from T1, assessment on the applicability based on the objective-based, operation centric and proportional approach.	12 months

Gap addressed

- Need to identify all potential aviation standard starting with the Air Taxi application that represent the most complex design. Simple and less complex systems, will use standards "lowered" based on the objective requirements evaluation result.
- Definition of standard for sense and avoid system

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industries	ENAC/EASA
T2	Industries/ENAC	EASA

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Strictly private and confidential

Activity 40: Definition of standards for qualification to support AI applications

Activity – Overview

Wave I

Activity description

- **Brief goal:** To develop new Software Certification Process supporting AI techniques (machine learning)
- **Description:** Today available regulations do not provide consolidated standards for the qualification of software supporting Artificial Intelligence (machine learning) used for fast navigation computers. To tackle this problem, a new joint international committee, SAE G-34/Eurocae WG-114 has been appointed in 2019. This committee is working to create a strong and well-supported Means of Compliance (MoC) for AI certification by the autumn of 2022. This is in line with the EASA AI road map (February 2020) which foresees the first AI component to be certified by 2025

Key tasks

	Task's description	Expected duration (# months/years)
T1	Gap analysis of existing standards for the development of AI certification	10 months
T2	Definition of the possible approaches to certification of AI-ML based SW (including definition of AI SW properties, like explainability, trustability, etc.) → guidelines and recommendation	14 months

Gap addressed

- Current regulations do not address the process for Artificial Intelligence Machine Learning based SW certification. This is clearly an issue because such a disruptive technology is needed to allow operations of drones, implementation of U-Space and operations in urban environment

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	Industries/Research Institutions/Universities
T2	ENAC	Industries/Research Institutions/Universities

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 41: Development of a structural study on crashworthiness, high energy fragment risks and handling

Activity – Overview

Wave I

Activity description

- **Brief goal:** Development of a comprehensive structural study on crashworthiness, high energy fragment risk and handling qualities
- **Description:**
  - Due to the specific design of the AAM vehicle, especially for Taxi CONUSE, current aviation crashworthiness requirements may be insufficient to ensure occupant protection in case of a potential otherwise survivable crash
  - Assessment of handling qualities and dynamics of AAM vehicle should be tailored to the specific AAM mission and control modes (manned, remote, automatic, etc.)
  - Specific regulations and AMC should address safety of passengers and third parties in case of blade failures on any Multirotor design
  - Similarly protection systems should be developed to minimize the risk of fire due of Lithium battery due to impact loads in case of crash

Gap addressed

- Need of specific standards for AAM may result in a combination of automotive passenger accommodations and protections versus traditional aircraft airframes. This should complement Special Conditions for VTOL (SC-VTOL) toward CS.
- Handling qualities and passenger perceived dynamics should be improved for both safety and comfort of flight, considering the specific issues related to remoted pilot HMI and highly automated systems. Coordination with EASA CS-UAS developments and works from JARUS and EUROCAE

Key tasks

	Task's description	Expected duration (# months/years)
T1	Crashworthiness requirements to protect passengers in case of crash conditions similar to cars (moderate impact energy, unforeseen direction) rather than aeronautics	1 years
T2	Development of handling qualities criteria for AAM ConOps	3 years
T3	Safety requirements development for blade protection	1 years
T4	Research in the fields of simulations and test for airframe crashworthiness based on new materials, airframe/seating integrated resilience, automotive/aeronautical methods	2 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Research centers	ENAC
T2	Universities	Industry players
T3	ENAC	Industry players
T4	CIRA/Universities	Industry players/ENAC

Effort < Mln | Tenths Mln | Hundreds Mln

Criticality Important | Show stopper

Strictly private and confidential

Activity 42: Goods protection in case of crash and integrity assurance in case of dangerous goods

Activity – Overview

Wave I

Activity description

- **Brief goal:** definition of standards for goods protection in case of crash and integrity assurance for dangerous goods
- **Description:** currently, there are several different cargo drone use cases, in varying states of implementation: automation of intralogistics, covering factories and warehouses; parcel delivery (first/last mile), catering to dense urban areas; supply of medical goods, normally to hard-to-reach places; and transportation of air freight, usually in rural areas. Technical standards should apply in order to maintain the quality of goods and the safety of operations: temperature, pressure, vibration levels, bio-chemical contamination (active and passive), corrosion, crash proof containment, ease of onboard installation (docking or suspension mechanism), digital interfacing with ground stations and aerial vehicle for payload control and monitoring (incl. mobile network and companion computers)

Gap addressed

- There is a need to develop dedicated Acceptable Methods of Compliance to address the issues posed by underslung transport of sensitive goods (e.g. human organs) or dangerous items. To develop containers capable to protect the payload or prevent its dispersion into the environment in case of crash or inadvertent release. Level of protection ensured should be proportionate to the importance/danger of payload (accountability of operators)

Key tasks

	Task's description	Expected duration (# months/years)
T1	State of art and background	3 months
T2	Definition of technical specifications (based on simulations and experiments)	6-9 months
T3	Guidelines for certification	3 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Universities and/or Research Centers and/or Companies	ENAC / EASA
T2	Universities and/or Research Centers (incl. Private Entities)	ENAC / EASA
T3	ENAC / EASA	Universities and/or Research Centers and/or Companies

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

Strictly private and confidential

Activity 43: Update of article 13 of Italian Law regulation DL n°150

Activity – Overview

Wave I

Activity description

- **Brief goal:** Work to update of article 13 of Italian Law regulation DL n°150/2012 to enable the use of aircrafts (including drone) for crop spraying
- **Description:** The article 13 of DL 150/2012 related also to Directive 2009/128/EC states that the aerial spraying is prohibited. There is a need to update current law in order to allow and promote the use of UAS multicopters for crop spraying. Current UAS multicopter technology allows crop spraying to be accomplished with great precision minimizing the risk of dispersion into environment or adjacent areas. In parallel to lift the restriction for the aerial spraying system, some specific standards should be developed and the experience gained should be used as justification for the regulatory amendment. In this respect a link with ISO WG 25 – ISO/TC 23/SC 6/WG 25 ref. to ISO/CD 23117-1

Gap addressed

- Current article 13 of DL 150/2012 and article 9 of 2009/128/CE prohibit aerial spraying system based on the potential risk to human health and adjacent environment. Evidence should be found on the minimization of the risk based on the high precision system now potential available using drones.

Key tasks

Task's description		Expected duration (# months/years)
T1	Current National and European regulation framework.	3 months
T2	Proposal for amendment with related justification based on evidence that operation with drones minimized the risk.	6 months
T3	New European regulation framework	2 year
T4	New National regulation framework	2 year

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC legal department/Ministry of the Environment.	
T2	Industries/ENAC	ENAC legal department
T3	ENAC legal department/Ministry of the Environment.	
T4	ENAC legal department/Ministry of the Environment.	

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

Strictly private and confidential

Activity 44: Update of continuing airworthiness regulations

Activity – Overview

Wave I

Activity description

- **Brief goal:** Update of the Continuing Airworthiness regulations to address the challenges posed by the technology and operational models of AAM vehicle

- **Description:** The introduction of electrically powered aircraft and AAM vehicle may introduce new and unique potential maintenance challenges such as high speed bearings, wear and contamination of windings, thermal damages to insulating components, high power batteries inspections and handling. AAM operational models may change how aircraft maintenance is conducted and the standards to which maintenance technicians are trained.

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Gap addressed

- Development of dedicate ratings for maintenance staff operating on AAM vehicles
- A more flexible AMM Maintenance Environment which should take credit of the benefits derived by predictive maintenance based on advance monitoring system

Key tasks

Task's description		Expected duration (# months/years)
T1	Identification of the main technical issues associated to the maintenance of the current AAM vehicle design	6 months
T2	Maturity assessment of predictive maintenance technique applied to AAM Vehicle System and identification of those task which could take the most benefit from application of predictive maintenance.	12 months
T3	Definition based on the outcome of Task 1 and 2 of agreed standards for certification and training of mechanics operating on AAM vehicles.	6 months
T4	To propose changes into Part 66 for introducing a licence category for AAM Certifying Staff.	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry	ENAC
T2	Industry , Research Centres, Academies	ENAC
T3	Industry	ENAC
T4	ENAC, Industry	EASA

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Strictly private and confidential

Activity 45: Sub systems development

Activity – Overview

Wave I II

Activity description

- **Brief goal:** Allow for integration of new technologies in the frame of Aircraft Safety and Security systems, considering proper allocation of functional assurance levels to all sub-systems, airborne and ground.
- **Description:** All UAS CONUSE, at different levels, imply relevant Safety and Security requirements. New technologies are based on non-traditional development approaches, often not compatible with current assessment methods that functional components and sub-systems need to deal with. Objective-based development methods should be improved to match the safety objectives of the normative, that are being adapted as well. This applies to the whole AAM ecosystem, based on distributed safety/security related functions across UAS airborne and ground (control unit, fleet manager, U-Space/USSP, etc.).

Gap addressed

- Improve reliability of new technologies towards airworthy safety and security requirements
- Address AAM ecosystem complexity with a holistic safety assessment which is not strictly aircraft centric but affects vehicle development

Key tasks

	Task's description	Expected duration (# months/years)
T1	Improvement of Objective-oriented development methods to address safety and security objectives (e.g. Artificial Intelligence)	2 years
T2	Guidelines for functional hazard assessment throughout the whole UAS ecosystem including airborne-ground-USSP-CIS (e.g. geoawareness/ geofencing/ geocaging)	2 years
T3	Technological development in the fields of Autonomous Flight, Detect And Avoid, Proximity Warning Systems, U-Space, 5G networks, GNSS, fast computers, Artificial Intelligence	6 years
T4	Cybersecurity threats and vulnerabilities management	2 years
T5	Ground infrastructures and obstacles information and geofencing	3 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Research centers/Industry players	Industry players/ENAC
T2	Industry players	ENAC
T3	Universities/Research centers	Industry players
T4	Industry players	ENAC
T5	Universities	Service providers/Research centers

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 46: Airframe additive Manufacturing Process

Activity – Overview

Wave I

Activity description

- **Brief goal:** Identification of the challenges related to innovative production processes as additive manufacturing posed in terms of a reliability in producing sound and repeatable structures
- **Description:** In the additive manufacturing process the material is deposited in the machine by various methods and fused using lasers, electron beams, plasma or electrical arc into a near final shape component. Consequently, these methods can produce complex AM parts with 'engineering properties' which are highly material, process, and configuration dependent and which may generate significant variability if production is not governed by strict process control documentation. It is recommended to use a 'step by step' approach to product criticality evolution, i.e. initially develop experience with applications of no, or very limited criticality identification of the Key Parameters and demonstration of understanding of the sensitivity of the engineering properties important to the safety of the final parts and products to these Key Parameters.

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Gap addressed

- Incomplete material engineering Key Parameters
- Missing manufacturing process standardization

Key tasks

	Task's description	Expected duration (# months/years)
T1	Identification of the Key Parameters governing the engineering properties and failure modes for different materials	18 months
T2	Identification of the requirements for manufacturing process stability	12 months
T4	Identification of ongoing standardization activities in other industries	3 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry	Aviation Safety Agency
T2	Industry	Aviation Safety Agency
T3	Aviation Safety Agency	
T4	Aviation Safety Agency	Industry

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

Strictly private and confidential

Activity 47: Reserve Energy Management and Planning

Activity – Overview

Wave I

Activity description

- **Brief goal:** To address the technology gap related to Reserve Energy management and planning
- **Description:** The need for Mission planning to cater for extra time needed for an alternate landing site, is a significative challenge for the AAM utilization based on Lithium battery technology. To address this issue there is a need to have propulsions systems based on:
  - High Efficiency Electrical Engines
  - New Battery Concept (e.g. Graphene based)
  - Reliability of Battery Level Monitoring

Gap addressed

- Current electrical propulsion systems are a limiting factor for a widespread deployment of eVTOL systems to be used for passenger transportation (as air taxis), for emergency response (medical delivery) and also for transportation of goods.

Key tasks

	Task's description	Expected duration (# months/years)
T1	Increasing Electrical engine efficiency: improving in design and in power electronic converters as well as employing new materials (for advanced magnetic and thermal properties) and advanced manufacturing techniques (3D printing for example)	18 months
T2	Battery: Trade-off analysis between new possible proof of concepts and high-performance lithium-metal batteries	10 months
T3	To follow a rigorous process for health monitoring system development according to safety assessment	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industries	Research Institutes/Universities
T2	Research Institutes/Universities	Industries
T3	Research Institutes/Universities	Industries

Strictly private and confidential

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 48: Contact Inspection

Activity – Overview

Wave I

Activity description

- **Brief goal:** develop and demonstration of a drone service for remote inspection by physical contact
- **Description:** close inspection of large structures (buildings, dams, bridges) is expensive and dangerous for human operators. This Activity aims at enabling remote tasks, using drones capable to hover in close vicinity to a vertical surface and to dock with it, in order to perform sensing tasks (e.g. high resolution imaging). The drone must be capable of both tele-operated and autonomous operations, depending on the scenario. It is assumed that such a system can be built by integrating/adapting off-the-shelf components (hardware and software). The final target is to demonstrate the capability in a real environment and to present a sound business plan for offering it as a service

Gap addressed

- Make available on the market a faster, cheaper and safer service for close inspection of large structures both in routine (monitoring and maintenance) and extraordinary conditions (post-incident investigations, earthquakes).

Key tasks

	Task's description	Expected duration (# months/years)
T1	Aircraft design with lightweight protection of moving parts	1 year
T2	Control algorithms (measure and stabilize contact forces)	1.5 year
T3	Navigation algorithms in loosely structured and densely cluttered environments	1.5 year
T4	User interface (including fleet control)	1 year
T5	Business plan	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Research centers	Industry players
T2	Universities, Research centers	Industry players
T3	Universities, Research centers	Industry players
T4	Industry players	ENAC
T5	Industry players	ENAC

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 49: Flight simulators training

Activity – Overview

Wave I

Activity description

- **Brief goal:** develop requirements for flight simulators for AAM application to be used for training
- **Description:** Currently EASA regulation for flight simulators does not include requirements and standards for AAM flight simulators. Hence, it is necessary to extend regulation to define requirements for simulators for AAM applications

Gap addressed

- No specific requirements and standard available for AAM flight simulators to be used for training

Key tasks

	Task's description	Expected duration (# months/years)
T1	Review of current EASA regulation for flight simulators and identification of those requirements which will be more feasible for AAM application	6 months
T2	Based on the identified requirements, identification of the most suitable type of flight simulators which would fit the AAM application	6 months
T3	Select for each class of CONUSE an AAM model candidate for the development of a dedicated flight simulators based on the requirements	3 months
T4	Development and certification of the identified flight simulator	2 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry players / ENAC	EASA
T2	Industry players/ ENAC	EASA
T3	Industry players	ENAC
T4	Industry players/ ENAC	EASA

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 50: Propose noise certification requirements to facilitate OEM vehicle development process

Activity – Overview

Activity description

- **Brief goal:** set noise requirements for airworthiness and certification purpose; in addition considerations to certification standards, ensure that noise requirements are compatible with acceptable noise limits in terms of perceived noise with AAM context and environment.
- **Description:** as part of the certification of AAM aircraft, the noise certification standards (specifications) shall be defined. These are expected to be specific to AAM vehicles/VTOL they have specific features and operational aspects which differ from existing airplanes/helicopters. Hence, specific noise limits should be set, as well as the criteria for the demonstration of compliance to certification rules and limits. This process of noise rules/limits definition must be done ensuring that the operational environment is thoroughly mapped and studied and that the specific element of individual's noise perception within the environment is understood to ensure that suitable "noise requirements and standards" are defined

Gap addressed

- Noise characterization of a multitude of VTOL aircraft
- mapping of a suitable envelope of "noise environments" to encompass "all the possibilities"
- Noise impact depending on operational rules (U-space corridor vs. urban environment not yet defined)
- Hardware/software for adequate testing
- Need to establish clear means of compliance (including tests vs. simulation)

Key tasks

Task's description		Expected duration (# months/years)
T1	Description of noise for typical AAM environment	10-15 months
T2	Develop Noise certification limits and acceptable MOC	12-18 months
T3	Validation of limits and MOC (through validation tests)	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	City Stakeholder/Academia	ENAC/Industry/Airports
T2	ENAC	Industry/Airports/Academia
T3	ENAC/Industry	Airports/Academia

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Appendix - Acronyms

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Activity 51: Modify and improve existing Risk classes, to encompass expected CONUSEs' characteristics

Activity – Overview

Wave I

Activity description

- **Brief goal:** Identification of SORA risk classes implementation standards and gaps identification in relation to complex ConOps involving long range BVLOS flight operation in intra-urban and urban scenarios
- **Description:** The SORA methodology is based on the definition of air and ground risk classes which are the basis for ConOps risk assessment. However, complex scenarios like long range BVLOS flights in urban and intra-urban areas implies traversing airspace and ground areas with non-homogeneous properties.

In this activity will be proposed the application of the SORA risk assessment methodology to a long range BVLOS goods delivery ConOps in urban and intra-urban scenario for platforms with MTOM > 100kg. In particular, the challenge of the identification of the overall air and ground risk and the relative mitigations will be addressed.

Gap addressed

- Evaluation of gaps in SORA risk assessment methodology for complex long range BVLOS scenarios
- Standardization in the SORA methodology of the use of natural risk mitigation features such as rivers in urban environment operations

Key tasks

	Task's description	Expected duration
T1	Evaluation of the SORA risk assessment methodology and risk classes definition for complex long range BVLOS flight traversing non-homogeneous Air and Ground risk areas.	6 months
T2	Assessment of the impact of the natural mitigation elements (such as rivers) on the Ground risk in urban area	3 months
T3	Assessment of the supporting ad-hoc infrastructure e.g. beacons and emergency landing areas on the mission	3 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry	Regulatory body
T2	Industry	Regulatory body
T3	Industry	Regulatory body

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Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

Activity 52: Set the Definitions, Standards, Training Criteria etc. regarding Pilot Licensing

Activity – Overview

Activity description

- **Brief goal:** Identification of clear guidelines and standards for pilot licensing
- **Description:** The role of Pilot in AAM has to be clarified: AAM may span from fully piloted aircraft to fully autonomous; a pilot capabilities/roles with a variable role in between these two extreme requires further investigation. This will very much depend on type of aircraft/airborne/ground technologies, operational scenarios, type of CONUSE.
  It is necessary to analyze and define what is the pilot's role in the various AAM development path in future, what are the differences with existing (airplane, rotorcraft) pilots' licensing, training and overall role.
  In addition, CONUSE related with goods delivery will probably be economically viable only if the operation activities can be scaled up keeping a limited numbers of operators. It is necessary to define to what extent the role of the pilot can be scaled to multiple UAS flying simultaneously.

Gap addressed

- T1: Availability of Scenarios & ConOps and technological options
- T2: Role of the remote pilot in case of operating more than one UAS simultaneously
- T3: Harmonization with existing standards

Key tasks

Task's description		Expected duration
T1	Scenario Definition & Role of Pilot (per CONUSE)	8 months
T2	Extension of the Role of Pilot in the case of conducting the remote flight operations for more than one UAS simultaneously	8 months
T3	Define Pilots qualification standards and training (per CONUSE)	12 months
T4	Discussion with Authorities	3 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry	Regulatory body
T2	Industry	Regulatory body
T3	Regulatory body	Industry
T4	Industry/Regulatory body	

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Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 53: Define the approach to ensure safety of fly-by people in conjunction with vehicle's occupant safety

Activity – Overview

Activity description

- **Brief goal:** Identification of the required approach to ensure safety of fly-by operations and of vehicle's occupant
- **Description:** Stakeholders agree that for an AAM to be successful, the safety of people on ground is ensured as the safety of vehicles' occupants. An analysis about how to achieve that is required. It appears that this goal shall be achieved as a combination of aircraft characteristic/technologies, Certification/Operation standards, operational analysis, role of the context. A sound methodological approach is necessary to ensure accuracy and reliability of specific safety analysis with regard safety of fly-by people.

Gap addressed

- T1: Availability of reference Scenarios & ConOps
- T2: Uncertainty of the methodologies

Key tasks

	Task's description	Expected duration
T1	Scenario Definition	3 months
T2	Methodological Approach and Solution definitions	6 months
T3	Validation of the Approach; discussion and approval with Authorities	1 year
T4	Implementation in regulation	6 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	regulator	AAM industries
T2	regulator	AAM industries
T3	AAM industries	Regulator
T4	regulator	AAM industries

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Effort < Mln | Tenths Mln | Hundreds Mln

Criticality Important | Show stopper

Activity 54: Define and enable BVLOS scenarios to urban environment

Activity – Overview

Wave I

Activity description

- **Brief goal:** identify performance requirements and technical solutions for real time BVLOS navigation in accordance to the regulatory framework foreseen for AAM
- **Description:** The activity should focus on the identification of performance-based requirements for BVLOS navigation in urban and intra-urban environment related to each identified CONUSE, coherent with the present and foreseen regulatory framework. The activity should then aim to identify and test innovative solutions able to fill the technological gaps to achieve the said performance-based navigation requirements. Depending on the CONUSE, BVLOS navigation may be either fully centralized and based solely on on-board systems or it could also rely on: network services that allow information exchange between airspace users, ground and smart-city infrastructures, proximity sensors, weather data, detailed mapping, space-based services, etc.

Gap addressed

- Performance-based requirements for BVLOS real time / all weather navigation in urban and intra-urban environment
- Enabling technologies for BVLOS navigation
- Adapt PNT GNSS-based services to the urban environment & Datalink
- Supporting ground infrastructures and network services
- Integration with the smart-city paradigm
- Cybersecurity issues

Key tasks

Task's description		Expected duration
T1	Define performance-based requirements for BVLOS navigation	12 months
T2	Refine PNT/GNSS as enabling technology in the urban env.	12 months
T3	Define a detailed technological roadmap to identify innovative enabling (airborne) technologies for BVLOS navigation	24 months
T4	Define a detailed technological roadmap to identify ground- and space- based technologies, infrastructures and data network specifications in support of BVLOS navigation	24 months
T5	Identify and tackle cybersecurity issues	24 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Regulatory Authority	Industry
T2	Research centers / Universities	Industry
T3	Industry	Research
T4	Research / Industry	
T5	Research / Industry	

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

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Activity 55: Enable BVLOS scenarios in urban environment for air taxi operations type #3 - manned

Activity – Overview

Wave II

Activity description

- **Brief goal:** enable deployment of BVLOS air taxi operations (type #3, manned) in urban environment through navigation services an systems
- **Description:** Enabling BVLOS scenario in an urban environment for manned air-taxi operations means to allow carrying of people operations with safety pilot on-board (OPV) who must have the capability to supervise the operations ("man on the loop"), initiate and manage contingency and/or emergency procedures without increasing risks for third parties on the ground. In this regards the BVLOS navigation services and technologies are analogous to those applicable to unmanned vehicles. To enable such a scenario it will be essential to define from a regulatory point of view the role of the safety pilot on-board in relation with the PIC and/or the level of automation of the system and U-Space. Moreover from a technical point of view it will be important to define the level of autonomy shared between the vehicle and the external supporting systems in relation with the duties of the safety pilot on-board.

Gap addressed

- Requirements and responsibility of the safety pilot on-board
- Management and control of the risk for third parties on ground in relation of emergency procedures in urban environment
- Definition of the sharing of autonomy between vehicle and external supporting systems in relation with the human-on-the-loop function.

Key tasks

	Task's description	Expected duration
T1	Definition of the requirements and responsibility of the safety pilot on-board	12 months
T2	Definition of management and control methods of the risk for third parties on ground in relation of emergency procedures in urban environment	24 month
T3	Definition of the sharing of autonomy levels between vehicle and external supporting systems in relation with the human-on-the-loop function.	24 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC	All
T2	ENAC / Cities	All
T3	Research centers / Industry	All

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 56: Enable BVLOS scenarios in urban environment for air taxi operations type #2 - unmanned

Activity – Overview

Wave II

Activity description

- **Brief goal:** enable deployment of BVLOS air taxi operations (type #2, unmanned) in urban environment through navigation services an systems
- **Description:** In order to enable BVLOS scenarios in urban environment for unmanned air taxy it will be essential to develop innovative real time BVLOS navigation service that may be ground-, air- and space-based, able to allow the navigation in the urban environment. To this aim both GIS and GNSS technologies will be important to provide a precise geo-referenced description of the environment and allow efficient and reliable communication and remission channels, technologies and band wide spectrum. Moreover the sharing of autonomy levels between the vehicle and the external supporting systems (like the U-Space) will have to be clearly defined in relation with the "human-on-the-loop" function (on resident on-board but on the ground). In the future even autonomous BVLOS operations with the "human-off-the-loop" function may be envisaged, where the safety monitoring of the vehicle autonomous operations will in turn (partially or fully) rely on external autonomous systems (e.g. autonomous U-Space functions).

Gap addressed

- air-, ground- and space-based services and technologies for BVLOS autonomous real-time navigation in urban environment, including the spectrum
- GIS models for dynamically describing the urban environment
- high complex systems provided with AI technologies able to provide adaptive behavior of the vehicle to react to the environment in emergency situations
- sharing of autonomy functions between the vehicle and the external supporting system

Key tasks

	Task's description	Expected duration
T1	air-, ground- and space-based services and technologies	24 months
T2	GIS models	24 months
T3	high complex systems provided with AI technologies able to provide adaptive behavior	36 months
T4	sharing of autonomy functions vehicle vs external systems	24 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry	All
T2	Industry/Research centers/Cities	All
T3	ENAC/Industry	All
T4	Industry	All

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important !! Show stopper

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Activity 57: Set Autonomous Levels definition with associated objectives/requirements

Activity – Overview

Activity description

- **Brief goal:** Set UAS Autonomy Levels suitable for UAB/AAM along with associated objective requirements for UAS and related supporting system, and U-Space.
- **Description:** EASA Autonomy Level & Artificial Intelligence (AI), PBR Requirements (Jarus), etc. may need harmonization to guarantee that framework, definitions, requirements, functional & operational objectives are coherent. An analysis and review of such objectives/requirements shall ensure that coherence is achieved and will let stakeholders (industry, regulators) to provided input for regulation update. JARUS is developing airworthiness objective requirements (OR) for UAS with autonomous functions that are performed by High Complex Systems (HCS) including AI technologies, such as ML and DL. These OR will be included in the future version on the performance based JARUS CS-UAS airworthiness standard that may be adopted by EASA and other NAAs in all, in part or with modifications. In order to practically comply with OR industry and standardization bodies may develop detailed Airworthiness Design Standards (ADS) that will have to specify the OR for specific UAS architectures, designs and operations. A validation effort is required to verify the adequacy and completeness of the OR derived so far and also to test the possibility of their actual breakdown into ADS suitable to support interesting UAM/AAM use cases. The JARUS CS-UAS HCS OR shall be validated against identified UAM/AAM used cases by developing consistent ADS, that should encompass at least the following three functions (identified by the joint committee SAE G34 / EUROCAE WG-114 as representative of UAS autonomy application): (1) Object classification for Sense & Avoid, (2) Structural health monitoring, and (3) UAM Route planning/optimization. The output of this activity will be: 1) validation of the CS-UAS HCS OR, possibly complemented with additional (presently missing) requirements, and 2) definition of ADS(s) for identified UAM/AAM use cases. The later output will support type certification of future UAS for UAM/AAM, provided CS-UAS OR and related ADS will be recognized and adoped by EASA.

Gap addressed

T1: Availability of reference Scenarios & ConOps for UAM/AAM with UAS featuring HCS with AI
T2: PBR Regulation and ADS developed and adopted/recognised by EASA
T3: Integration of UAS Autonomy Level, Functions and related OR within the UAM/AAM ecosystem (e.g. external supporting systems, infrastructure and U-Space) that may feature in turn autonomous functions

Key tasks

Task's description		Expected duration
T1	Identify UAM/AAM operative scenarios within the 4 CONUSE, that use UAS with HCS that feature at least one of the identified autonomous functions (1), (2) and (3)	6 months
T2	Develop ADS(s) for each of UAS identified in the operative scenarios, against the JARUS CS-UAS HCS OR and identity possible additional HCS OR needed to complement the CS-UAS.	2 years
T3	Identify Level of Autonomy and related OR for the entire UAM/AAM ecosystem of UAS + external supporting system + U-Space services (at U4 level).	2 years
T4	Validation by Demo	3 years

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	Industry players	All
T2	ENAC	All
T3	ENAC	All
T4	Industry players	All

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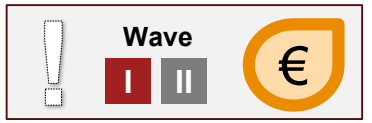
Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

Activity 58: Definition of Weather Conditions affecting AAM in the different application scenarios

Activity – Overview



Activity description

- **Brief goal:** Assess how the Weather Conditions may influence AAM, how WX information are collected, distributed and used.
- **Description:** Weather conditions are an important factors to consider for ensuring safety of operations and its fundamental to identify how to address weather conditions for AAM operations. A few topics may be listed here:
  - what are the suitable Weather Minima to ensure safety while not jeopardizing an effective AAM (flight cancellation, diversions during trips?)
  - How to cope with WX that may quickly change in few hours/minutes and within a flight? How to handle Ice formation?
  - How to ensure that reliable and prompt WX information are provided on ground/in flight?
  - How to acquire WX conditions and provide WX forecast at small scale of an urban area, on a continuous basis to ensure safety of flight?

Gap addressed

- T1: Availability of suitable WX status within Urban area vs. reference Scenarios vs. ConOps
- T2: Enabling Technologies and standards definition
- T4: Availability of enabling technologies and scale of the investment

Key tasks

	Task's description	Expected duration
T1	Set the operating scenario and WX issues within Urban area	3 months
T2	Define a set of Requirements for a WX Information Service at Urban scale, integrated with existing (Macro-scale) WX information system	6 months
T3	Define a Roadmap to implement a WX INFO System; map the technologies, including the Gaps	4 months
T4	Implement the Roadmap – Stepped Approach with Pilot Projects and Concept Validation; full implementation afterwards	24 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	.Service providers / ENAC	Service providers / Industry players/ Airports
T2	Service providers / ENAC	Service providers / Industry players/ Airports
T3	Service providers / ENAC	Service providers / Industry players/ Airports
T4	Service providers / ENAC	Service providers / Industry players/ Airports

Effort € < Mln € Tenths Mln € Hundreds Mln **Criticality** ! Important ! Show stopper

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Activity 59: Assess how to conduct MRO to achieve low cost/complexity

Activity – Overview

Wave I

Activity description

- **Brief goal:** Design MRO operations and requirements to achieve low costs and complexity
- **Description:** The MRO framework in Aviation is well established, and it is aimed to comply with Continued Airworthiness rules. This framework is characterized by certain costs, organization, etc. This may not fit with a sustainable business case for a mass transportation case like AAM, which requires flexibility of operations (e.g., no-downtime for maintenance) and very low cost to sustain a different business case.
  Within this change of approach, it is therefore necessary to develop a new MRO approach. This requires a joint analysis between the Systems/Aircraft manufactures, Aircraft Operators, MRO organizations (either they are three distinct organization or one only).
  Different approach vs. CONUSE to be explored. Specifically, the possibility to have a "low cost/complexity" MRO approach/tools for "less critical" CONUSE (e.g., agriculture) vs. a "high level" MRO for others (e.g., pax transport).

Gap addressed

- T2: ConOps targeting low cost, low burden, operational flexibility and safety
- T3: Logistics framework, licensing and technologies

Key tasks

	Task's description	Expected duration
T1	Map current MRO features and KPI	2 months
T2	Define key requirements for a new MRO	6 months
T3	Issue a proposal for an AAM/MRO	12 months

Responsibility assignment

Task	Agents' role	
	Owner	*Informed*
T1	ENAC / Industry players	External MRO providers
T2	ENAC	Industry players/External MRO providers
T3	ENAC	Industry players/ External MRO providers

Effort < Mln | Tenths Mln | Hundreds Mln **Criticality** Important | Show stopper

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Acronyms (1/2)

Term	Definition	Term	Definition
AAM	Advanced Air Mobility	**COTS**	Cargo Offload and Transfer System
AI	Artificial Intelligence	**DAA**	Detect and Avoid
ANSP	Air Navigation Service Provider	**EASA**	European Aviation Safety Agency
ATC	Air Traffic Control	**ENAC**	Ente Nazionale Aviazione Civile
ATM	Air Traffic Management	**EVLOS**	Enhanced Visual Line Of Sight,
BVLOS	Beyond Visual Line of Sight	**eVTOL**	Electrical vertical take-off and landing
CAA	Civil Aviation Authority	**FAA**	Federal Aviation Administration
CAMO	Continuing Airworthiness Management Organization	**GA**	General Aviation
CNS	Communications, Navigation, Surveillance	**GIS**	Geographic Information System
COAU	Centro operativo aereo unificato	**GNSS**	Global Navigation Satellite Systems
ConOps	Concept of Operations	**ICAO**	International Civil Aviation Organization
CONUSE	Concept of Use	**ISO**	International Organization for Standardization

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Acronyms (2/2)

Term	Definition	Term	Definition
JARUS	Joint Authorities for Rulemaking on Unmanned Systems	**UAM**	Urban Air Mobility
LCA	Life cycle assessment	**UAV**	Unmanned Aerial Vehicle
MRO	Maintenance, Repair and Overhaul	**UML**	Urban Air Mobility Maturity Level
MTOM	Maximum Take-off Mass	**USS**	UAS Service Supplier
NASA	National Aeronautics and Space Administration	**USSP**	U-space Service Provider
OEM	Original Equipment Manufacturer	**U-space**	Set of services relying on a high level of digitalization and automation of functions and specific procedures designed to support safe, efficient and secure access to airspace for large numbers of drones
OPV	Optionally Piloted Vehicle	**UTM**	Unmanned aerial systems traffic management
PNT	Position Navigation and timing	**SWIM**	System Wide Information Management
RF	Radio Frequency	**Vertiports**	VTOL hubs with multiple take-off and landing pads, as well as charging infrastructure
RID	Remote Identification	**VLOS**	Visual line of sight
RPAS	Remotely Piloted Aircraft System	**VTOL**	Vertical take-off and landing
sUAS	Small Unmanned Aircraft Systems	**WG**	Working Group

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