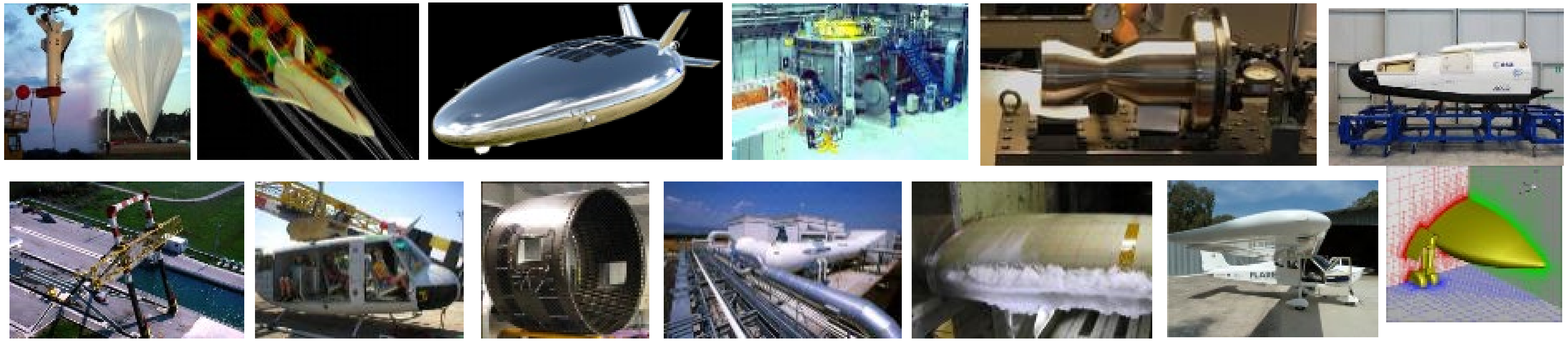
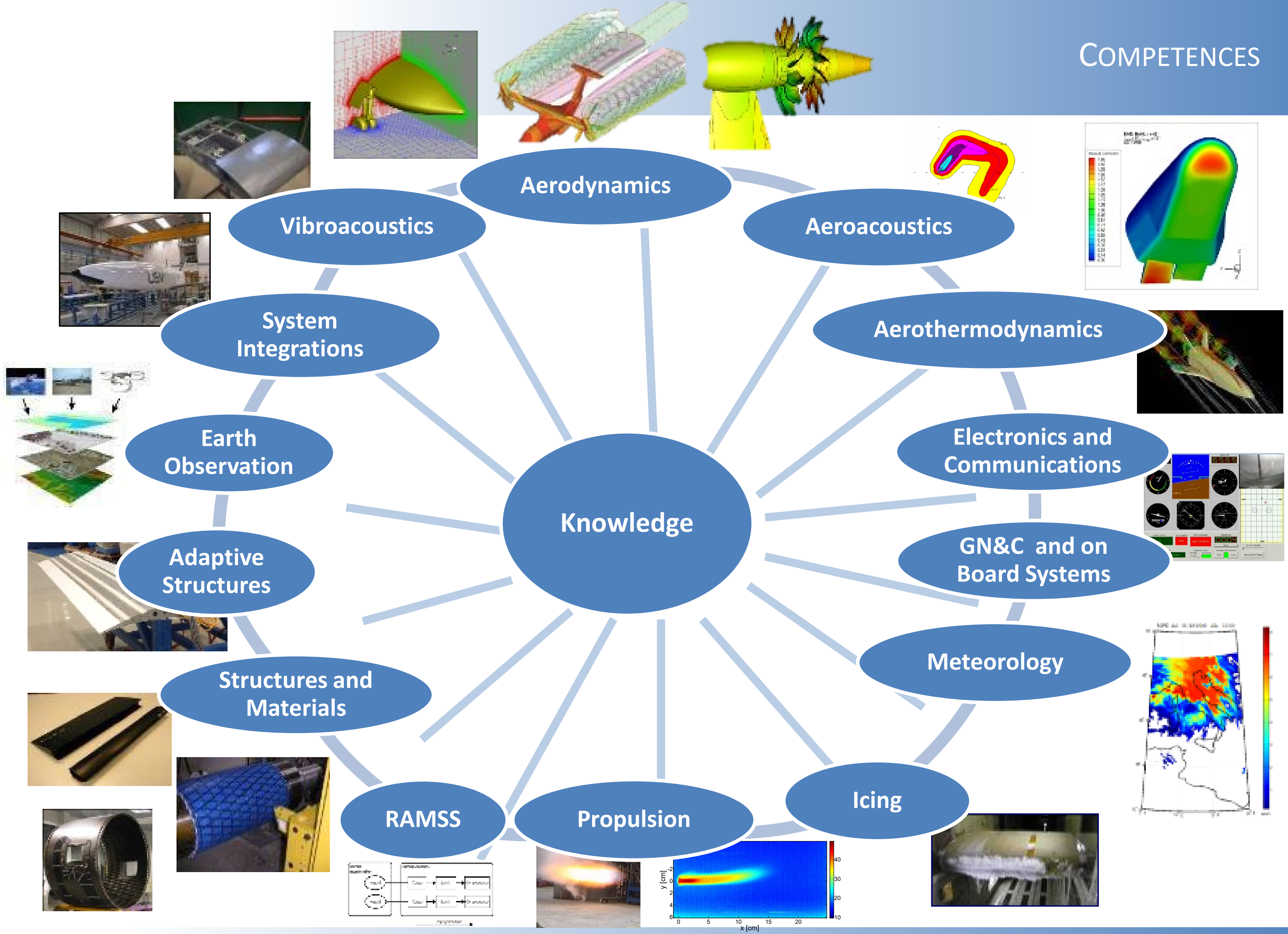
CIRA
Centro Italiano Ricerche Aerospaziali

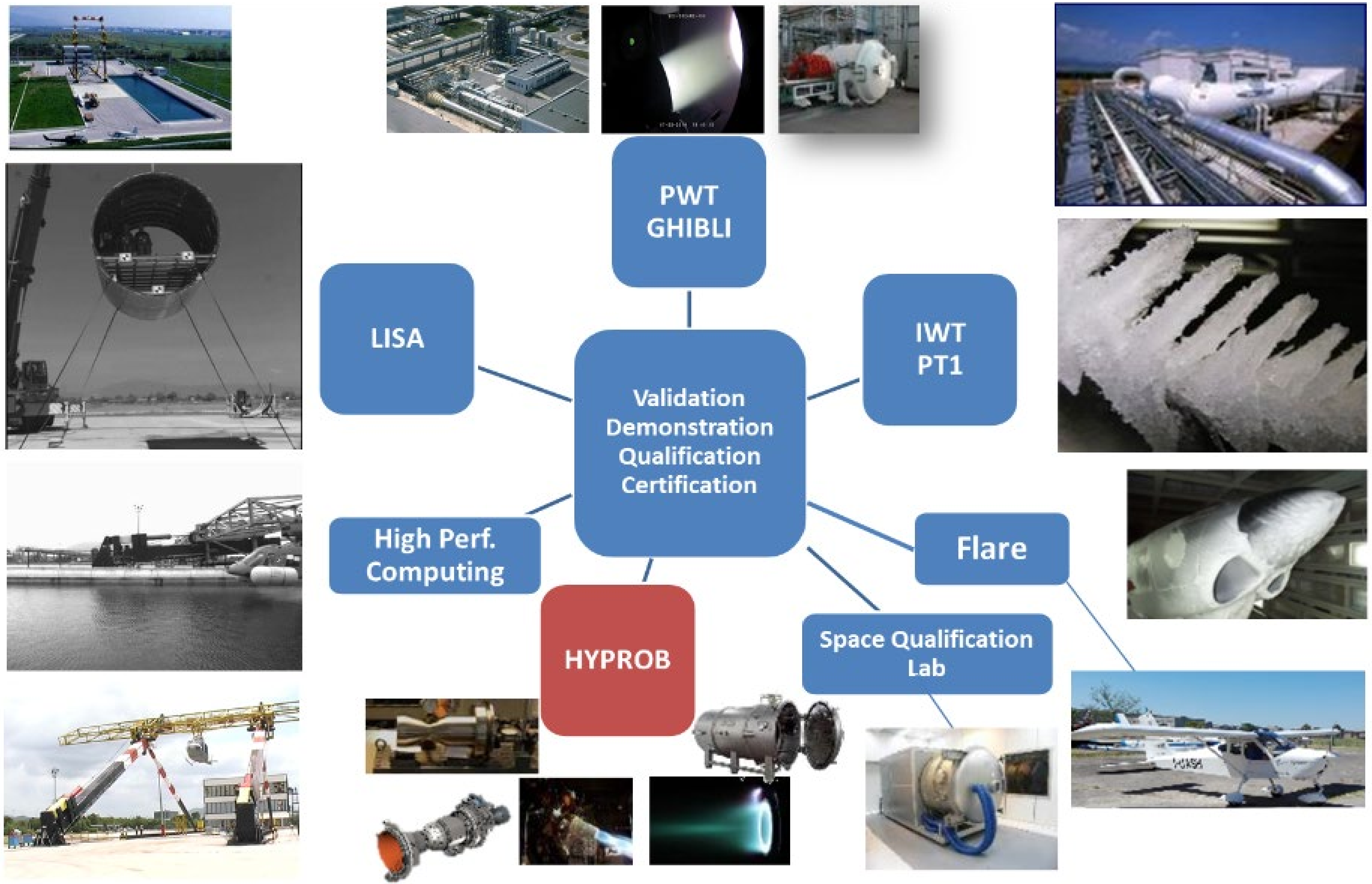


160 HECTARES

1	Entrance
2	Offices
3	Cantina
4	Main Offices
5	Offices and Technological Labs
6	Crash Facilities
7	Transonic WT
8	Cooling towers – Compressed Air
9	IWT – Icing Wind Tunnel
10	PWT – Plasma Wind Tunnel
11	Airfield (external)


Knowledge
Aerodynamics
Aeroacoustics
Aerothermodynamics
Electronics and Communications
GN&C and on Board Systems
Meteorology
Icing
Propulsion
RAMSS
Structures and Materials
Adaptive Structures
Earth Observation
System Integrations
Vibroacoustics

RESEARCH INFRASTRUCTURES
PRORA



CIRA

- is member of National, European, International Associations
- is representing ITALY in the European and International context
- Has signed MoUs at National, European, International level

Ministries of the Italian Government

Italian Universities

Italian PMI

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GARTEUR

esa

ACARE

EASA

ESRE
ASSOCIATION OF EUROPEAN SPACE RESEARCH ESTABLISHMENTS

Alliance for Zero-Emission Aviation
PREPARING EUROPE FOR HYDROGEN & ELECTRIC FLIGHT

SAGAS
Stakeholders' Advisory Group on Aviation Security

EREA
Association of European Research Establishments in Aeronautics

NASA

IAF
AD ASTRONAUTICA PACEM HOMINUMQUE PROGRESSUM

SAE INTERNATIONAL

IFAR
International Forum for Aviation Research

National Research Council
NRC·CNRC Canada

Environment and Climate Change Canada
Environnement et Changement climatique Canada

NATO OTAN

UF UNIVERSITY of FLORIDA

GARTEUR is an intergovernmental agreement signed in 1973 dedicated to cooperation of Dual (civil and military) R&TD projects among 7 NATO countries (France, Germany, Italy, The Netherlands,Spain, Sweden, UK).

Organisation

Italy is involved in the
- Executive Committee
- 5 GoRs

CIRA is involved in the
- Executive Committee
- 5 GoR

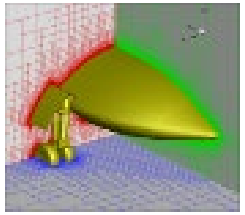
10 Action Groups
- 4 in Aerodynamics,
- 5 in Helicopters,
- 1 in Structures & Materials

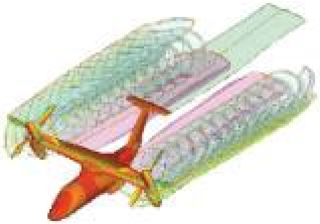
7 Action Groups
- 4 in Aerodynamics
- 3 in Helicopters

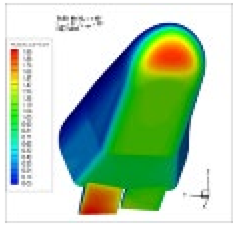
Each GoR coordinates:
- Action Groups performing R&TD well focused projects
- Exploratory Group to prepared new AG and related projects..

R/TD PROJECTS ARE SELF FUNDED BY EACH NATION

- **Strategic Research Lines for the development of cutting edge knowledge and technology**
    - ***Medium-Long Term R&TD Projects*** *(2<TRL<5)*
    - ***Medium-Short Term R&TD Projects*** *(e.g.* ***Investments Programmes****, 4<TRL<6)*
    - ***Education and Workforce Training***
- the upgrade of RI extending the testing envelope and renewing measuring systems
- the definition and realisation of new world wide RI
- **Engineering, Qualification, Certification and Integration**



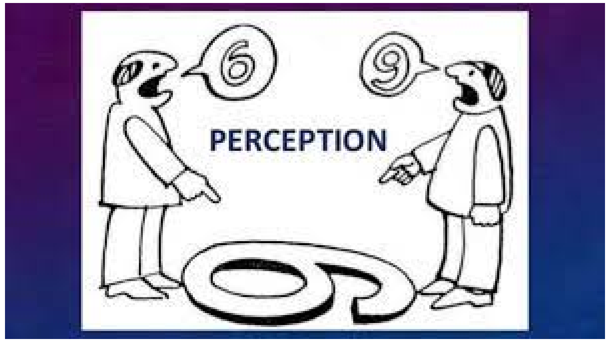




- Community Engagement → as an enabler for acceptance.
- Which Community For UAM? → Specific of conuses
- Perception → Risks/costs and benefits
- SORA and its application → Uncertainties for safety and consequently its perception
- References → EASA and IFAR Views
- Engagement → Smart Cities

The problem of acceptance for new technologies (difference between safety and perception of safety) how to work on both of them.

Perception of safety, perception of benefits and actual safety and actual benefits



Benefits -> how to exploit and disseminate benefits

Risk for sudden lack of trust (strongly depends on safety degradation) quantification of safety uncertainty provides information on acceptance stability.

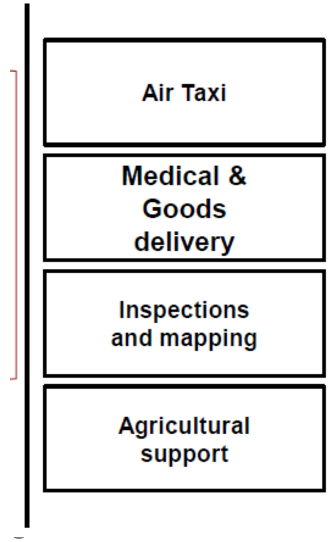
1. **UAM industry**
   - Manufacturers, UAM operators, maintenance services, airport operators,
   - Service providers, vertiports, communication providers, suppliers, UAM operators,

2. **Potential users**
   - Urban residents, travellers, commuters, high wealth individuals, car users,
   - Emergency services, public transport users, critical infrastructure managers,

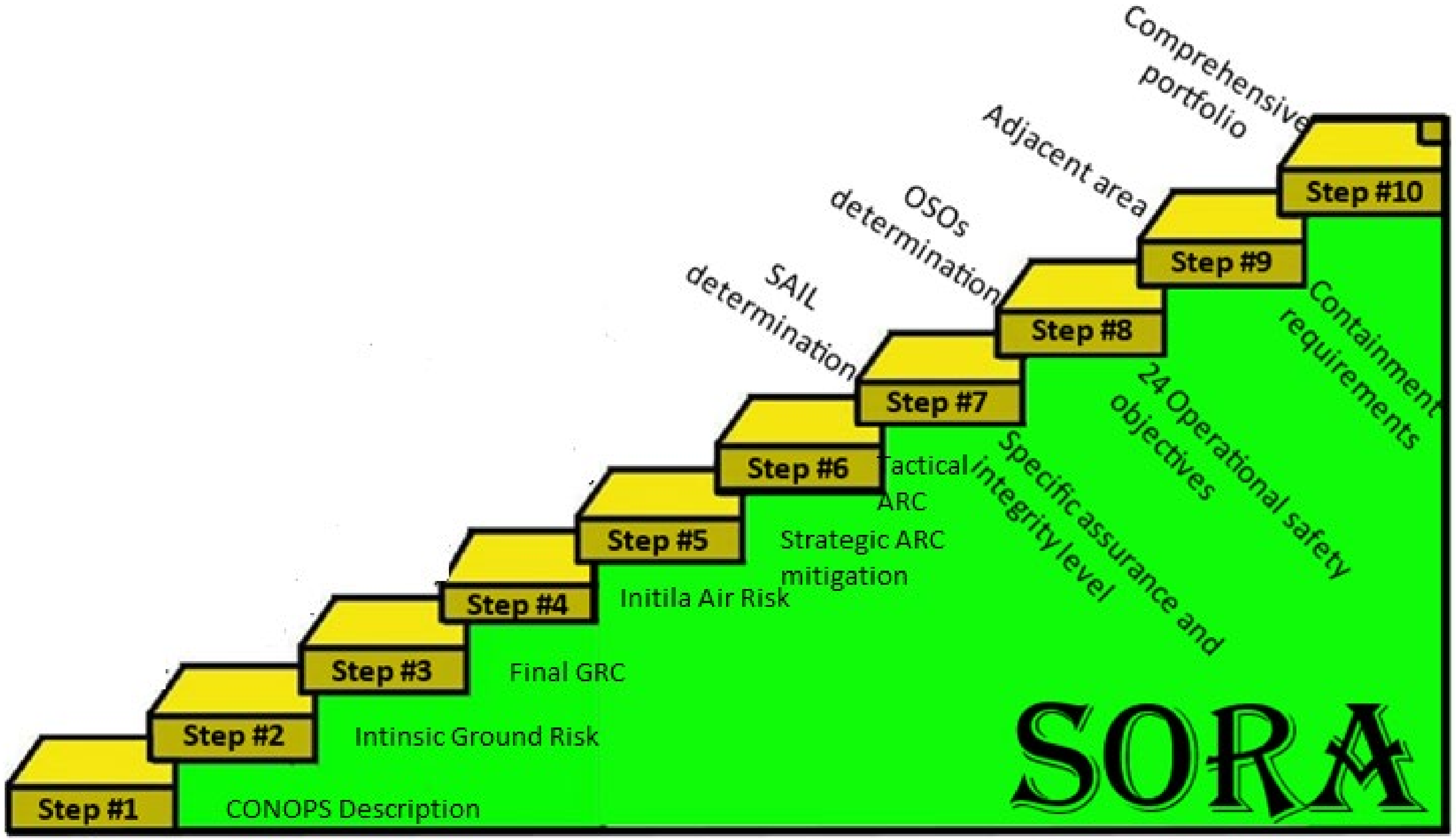
2. **Governments, public institutions & regulators**
   - Supranational & national: EU institutions and bodies, EASA, air traffic control organizations, EU member state authorities, military & police
   - Local: Local authorities, municipalities, city officials, urban and city planners, public institutions and organizations

2. **Indirectly affected third parties**
   - Private individuals: Residents, communities, real-estate owners, citizens
   - Professionals: Pilots, academia, innovators
   - Associations: Local environmental protection associations, local traveller's’
   - associations, unions, lobbies, associations, environmental groups

5. **Extended industry:**
   - Airports, aerospace & automotive industry, energy providers, public transport providers, insurance providers, ticket brokers,businesses in other industries potentially interested in entering UAM space



- SORA: Specific Operation Risk Assessment, supports evaluation of risks for the expert's point of view



EASA performed a study on the societal acceptance of Urban Air Mobility in Europe in 2021. Based on research, literature review, local market analysis, surveys and interviews, the study examined the attitudes, expectations and concerns of EU citizens with respect to UAM and revealed interesting insights, some unexpected. The survey results were very homogeneous among all those surveyed across the EU and in all socio-economic categories.

They have been clustered into specific take-aways 3 of them impacting public acceptance:

- The main benefits expected from UAM are faster, cleaner and extended connectivity;
- However, when encouraged to reflect upon the concrete consequences of potential UAM operations in their city, EU citizens want to limit their own exposure to risks, in particular when related to safety, noise, security and environmental impact;
- Safety concerns come first, but the study also shows that citizens seem to trust the current aviation safety levels and would be reassured if these levels were applied for UAM;
- The results also demonstrate a limited trust in the security and cyber security of UAM, requiring threat-prevention measures

#	**Priority Technology Assessment Area** (at minimum, one template slide per technology area identified by IFAR/ICAO Task Force)	**IFAR Member Org Assessment**
OAO	Societal Acceptance area priorities	**Safety:** • Different dimensions have to be addressed between safety for experts and perceived safety by the external stakeholders • Need to identify and promote the right cost benefit ratio for all the impacted stakeholders (also citizens, besides UAM workers) • Need to train people to handle possible off nominal scenarios
OAA	State of the Art Assessment	• All the previous items in the Societal Acceptance area are to be collected
OAG	Gap analysis	• Program definition and training for all the impacted stakeholders • Measurement of environmental and safety impact starting from current baseline of existing transport modes and identifying UAM as an enabler of environmental, social and business benefits
OAQ	Open research questions	• Systems and approaches able to assess the environmental and social impact on a periodic basis of UAM (locally and globally) choices and also on demand and as forecasting capability to drive strategic decisions
…	…	…

Quantifying uncertainty in safety for advanced air mobility (AAM) involves assessing the potential risks and uncertainties associated with their operations considering the previous Conuses.

- **Risk Identification:**
  - Identify and list potential hazards, risks, and uncertainties associated with AAM operations. These could include technical failures, adverse weather conditions, human error, infrastructure challenges, regulatory changes, and more.
- **Risk Assessment:**
  - Evaluate each identified risk in terms of its likelihood of occurrence and potential consequences. Use methods like risk matrices or risk assessment scales to assign quantitative values to these factors.
- **Scenario Analysis:**
  - Develop realistic scenarios that combine various hazards and risks to understand how they might interact and impact safety.
  - Consider different operational conditions, urban environments, and system failures that could lead to safety incidents.

- **Probabilistic Modeling:**
  - Utilize probabilistic modeling techniques to quantify the likelihood of different safety outcomes.
  - Bayesian networks, Monte Carlo simulations, and fault trees are tools that can help model complex relationships among variables and assess potential safety events.
- **Data Analysis:**
  - Gather historical safety data from similar industries or technologies, if available.
  - Analyze this data to identify trends, patterns, and lessons learned that can inform your assessment of safety uncertainties.
- **Expert Opinions:**
  - Engage with experts in AAM technology, aviation safety, and relevant domains to gather their insights on potential safety uncertainties.
  - Use expert opinions to validate and refine your risk assessments.

- **Sensitivity Analysis:**
  - Conduct sensitivity analysis to understand which factors have the most significant impact on safety uncertainties.
  - Identify critical variables that could lead to major changes in safety outcomes.
- **Regulatory Compliance:**
  - Evaluate the impact of regulatory requirements and changes on safety uncertainties.
  - Consider how adherence to regulations can mitigate or exacerbate safety risks.
- **Validation and Verification:**
  - Ensure that the safety measures, systems, and technologies implemented in AAM operations are thoroughly validated and verified through testing and simulations.
  - Use validation and verification processes to reduce uncertainties related to safety.

- **Continuous Monitoring and Improvement:**
  - Implement mechanisms for continuous monitoring of safety metrics and incident data.
  - Use this data to refine your risk assessments, models, and strategies over time.
- **Communication:**
  - Communicate the results of your safety uncertainty quantification to stakeholders, regulatory bodies, and the public.
  - Provide clear and transparent information about the identified risks, mitigation strategies, and ongoing safety efforts.
- **Adaptive Strategies:**
  - Develop strategies to adapt to changing safety uncertainties over time.
  - Consider scenarios where new risks emerge or existing risks evolve due to technological advancements or changing operational environments.

To reduce the uncertainty related to risks and thus increase safety and also its perception.

Community integration

- **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**

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

Key topics – Community integration

Privacy	Jobs	Environment
• IP protection and privacy concerns related to widespread UAM adoption (e.g. actual usage of camera technology)	• 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)	• Concerns related to waste build-up from batteries and impact on wildlife and energy usage

Noise, visual and space disruption	Safety perception
• 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 concerns related to consumers' distrust of autonomous technology • Safety concerns related to vulnerability to cyber attacks

Barriers and enablers

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**

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

Smart cities are increasingly exploring the integration of Urban Air Mobility (UAM) as a solution to alleviate traffic congestion, reduce emissions, and enhance transportation efficiency

UAM Infrastructure, Integrated Transportation Regulation and Safety, Environmental Considerations.

Data Management: Utilize data analytics and IoT (Internet of Things) sensors to manage UAM traffic efficiently. Data on passenger demand, vehicle location, weather conditions, and traffic patterns can be used to optimize UAM routes and schedules.

Accessibility: Ensure that UAM services are accessible to a wide range of users, including those with disabilities and people from diverse socio-economic backgrounds. Consider pricing models that are inclusive and affordable.

Public Engagement: Engage the public in the planning and implementation of UAM services. Address concerns related to noise, safety, and privacy to build public trust and support.

Public-Private Partnerships: Collaborate with private companies to develop and operate UAM services. Public-private partnerships can help leverage private sector expertise and resources while ensuring public interests are protected.

Education and Training: Develop programs to educate and train UAM pilots and maintenance personnel. Building a skilled workforce is crucial for the safe and efficient operation of UAM services.

Security: Implement robust cybersecurity measures to protect UAM systems from potential cyber threats. Ensuring the security of UAM networks is critical for public safety.

Scalability: Plan for scalability. As UAM services grow and evolve, the city should have a flexible infrastructure that can adapt to changing demands and technologies.

Environmental Impact Assessment: Conduct thorough environmental impact assessments before implementing UAM services. This includes evaluating the potential effects on local ecosystems, air quality, and noise pollution.

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