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AirTN Catalogue of the European Aeronautical Research Facilities – Facts & Figures

A useful basis for next challenges

11 October 2016, Bratislava

Outlines

- AirTN NextGen: Research Infrastructures (RI) Catalogue
- AirTN NextGen points of view regarding the next steps to the Key RI identification and AirTN NextGen suggested actions towards identification of new RI needs.
- Other AirTN NextGen actions concerning RI : Seminar and Workshop on the topic "Towards virtual certification":
- "Towards virtual certification" → Key recommendations
- Conclusion

Aims of the AirTN Task on Research Infrastructures with a focus on experimental test facilities (Partners : CIRA, DLR, NLR, ONERA) **:**

- To contribute to the improvement of the optimal use, major upgrade and development of aeronautical research infrastructures in Europe.
- To support the identification of needs for new Research Infrastructures in Europe.

Catalogue of **Strategic, Key** and Common facilities:

- Taking into account the ACARE typology:
  - Strategic facilities : > 100 M€ investments; operating budget as high as 10M€/year and less than 10 in Europe.
  - Key facilities : > 10 M€ investments; tariffs on full operating costs – unique character and less than 100 in Europe. (Catalogue:]10;30],]30;60],]60;100])
  - Common facilities : < 10 M€ investments; medium or small size capabilities and basic tools.
- Available in the AirTN website as a tool for the stakeholders.

The catalogue (last updated version : September 2016):

- 8 Infrastructure types* : *Wind Tunnel*, *Propulsion Bench*, Others, Structures, Flight test bed, Materials, Simulator, Supercomputers.

- From the questionnaire responses:

→ Number of answers: **246**

→ Number of countries: 14

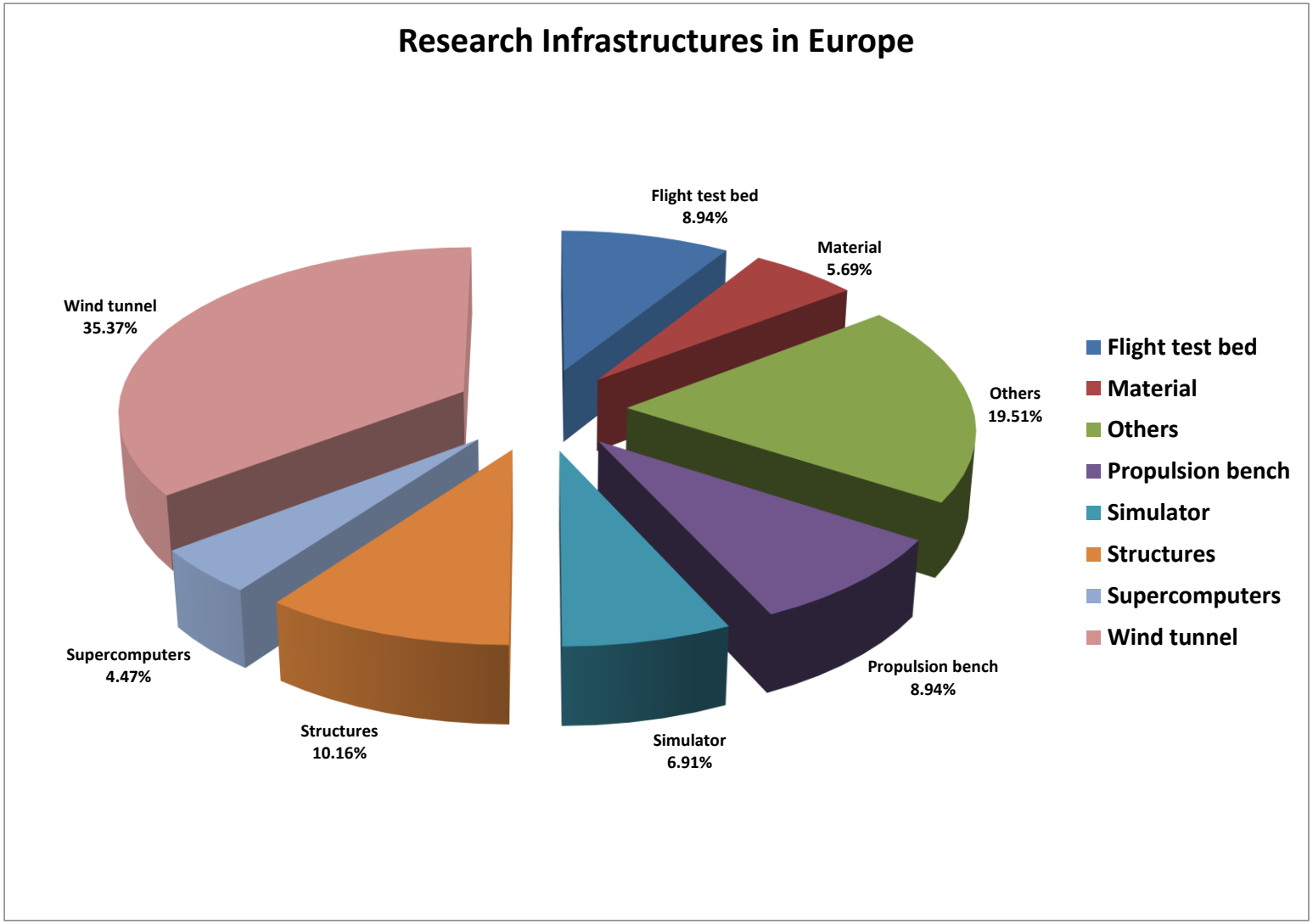
→ Number of Strategic facilities: **13** (Wind Tunnel: 7, Propulsion: 4, Structures: 2)

→ Number of Key facilities: **73**

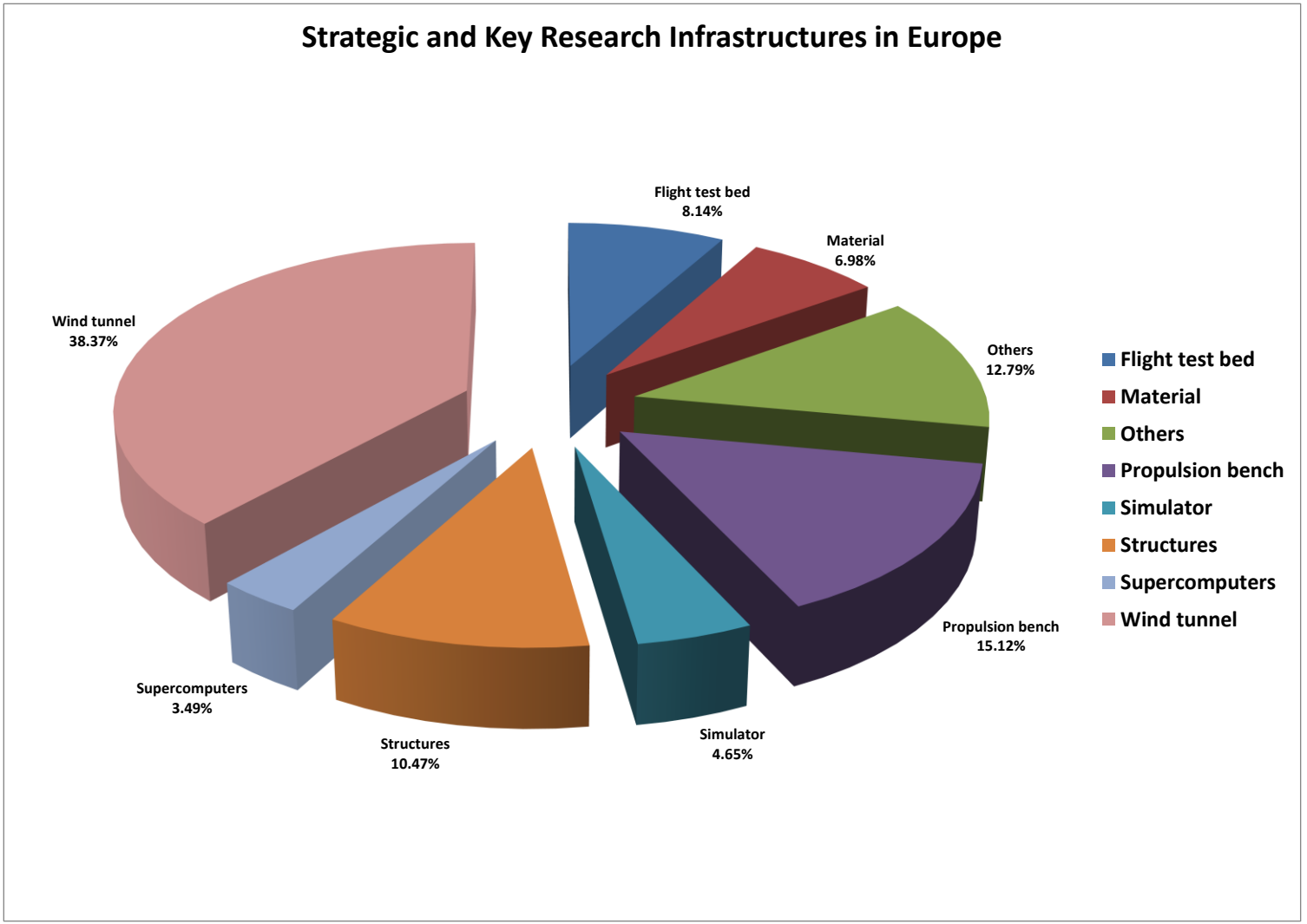
- Some research infrastructures are not sorted following the ACARE typology because of a lack of financial information (**especially in the case of UK**).

Strategic and Key RIs → http://airtn.eu/catalogues/research-facilities/

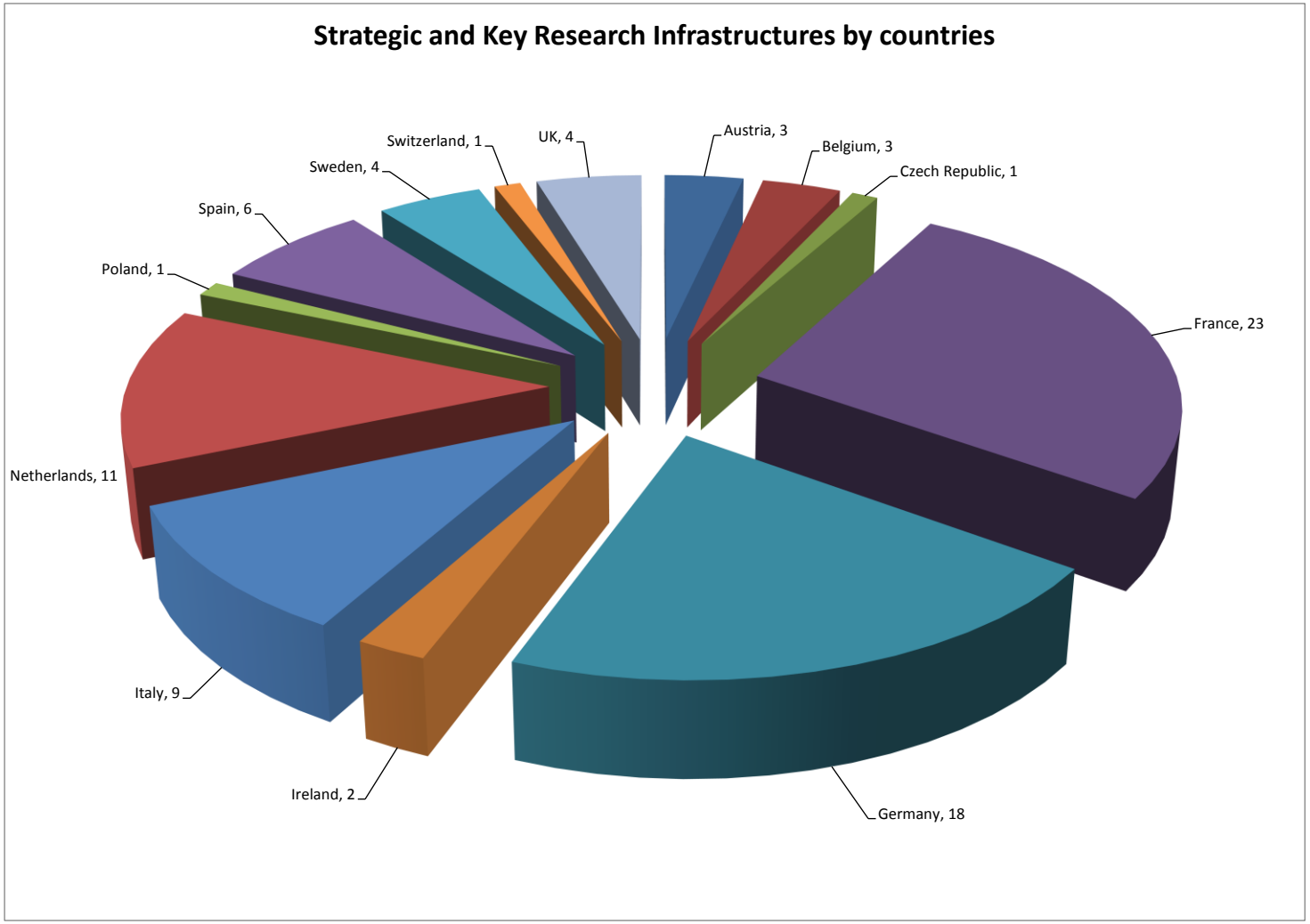
* Strategic and Key RI rank



246 facilities



86 facilities → 78 facilities on the public part of the website



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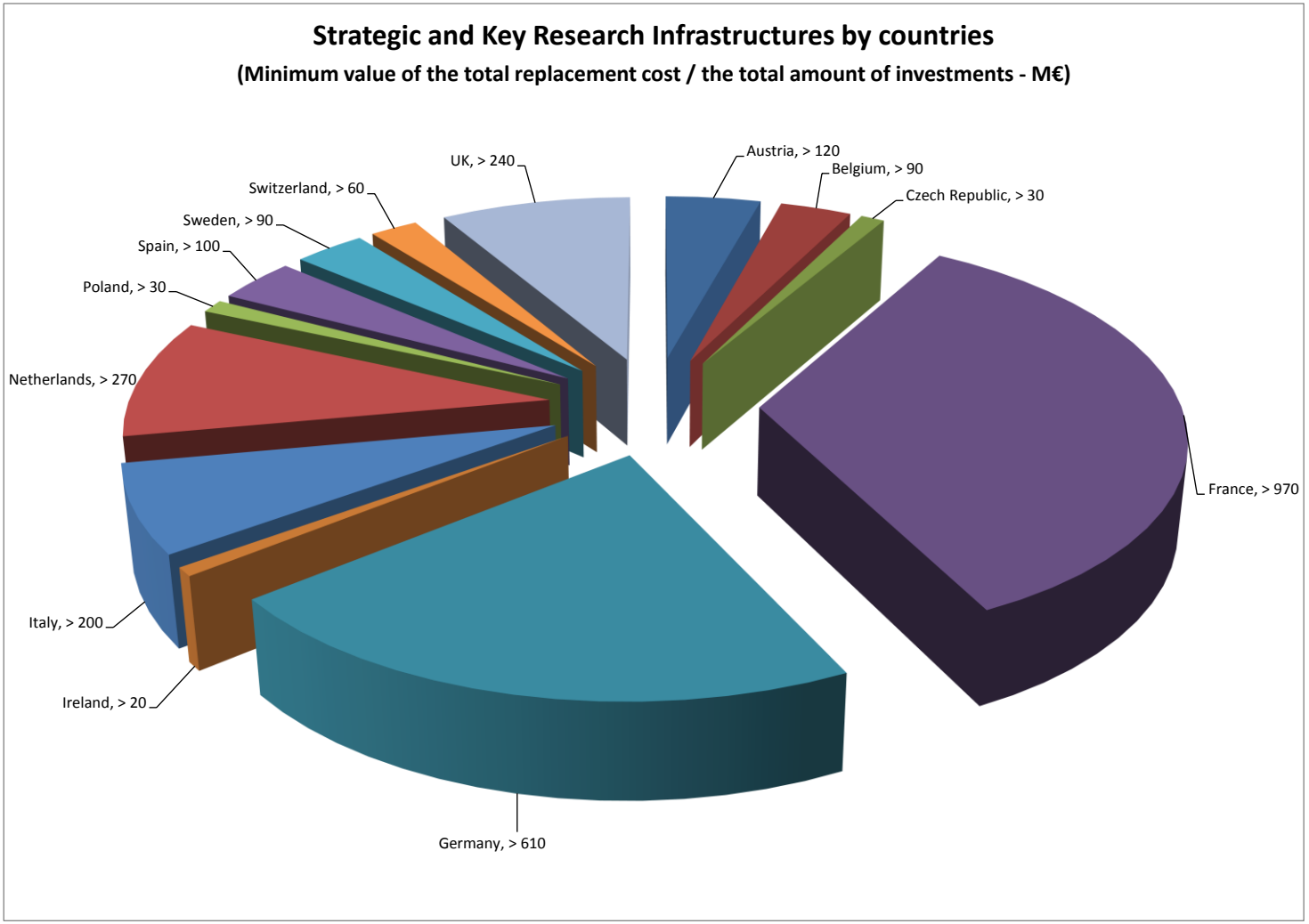
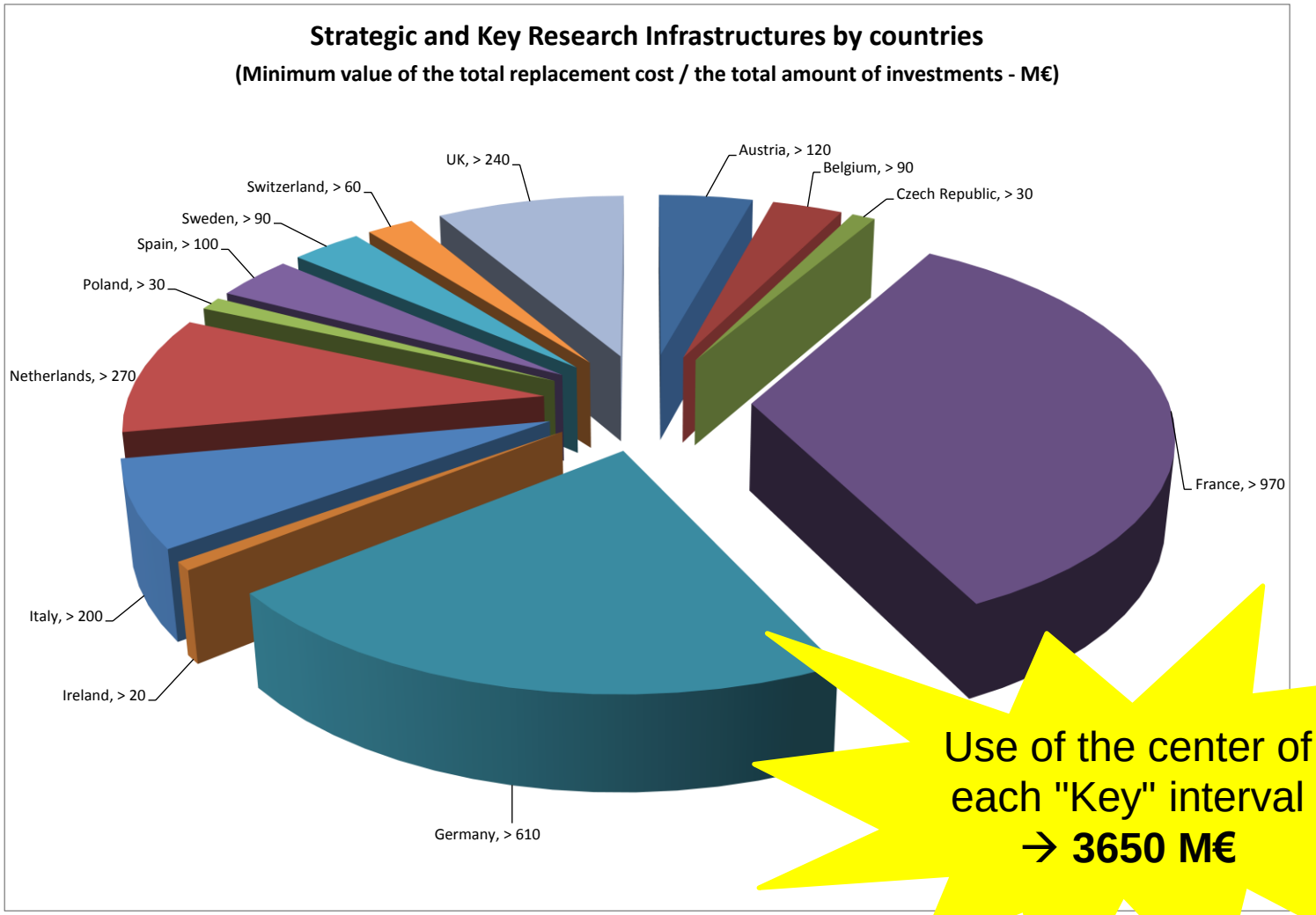


86 facilities (78 facilities on the public part of the website): Minimum value > 2830 M€



Use of the center of each "Key" interval
→ **3650 M€**

86 facilities (78 facilities on the public part of the website): Minimum value > 2 30 M€

AirTN NextGen points of view regarding the next steps to the Key RI identification:

There were a lot of discussions about the criteria (IEG report, response of AirTN, etc…) which could be used to identify **Key** infrastructures (instead of the financial criterion) → a specific task is then necessary to improve the criteria and their thresholds.

The following points should be covered:

- **Review the WG-5 RI-vs FP2050 table - RI needs**
- **Complete the WG-5 RI-vs FP2050 table mapping the RI catalogue onto the table** - The table at the moment is incomplete in fact it is not clear what is really available (*provide a specific RI for what is declared available*)
- **Refine the methodology for ranking the RIs.**

How to proceed:

- Establish a task force with **independent experts** from universities supported by WG 5, EREA, AirTN/MSG and industry
- Why experts from universities: experienced in RI scene, no commercial interest & cover the educational aspect

Independent experts → each representative would be reluctant to close a RI in his organism.

How do we proceed with missing information in the catalogue?

How can we appreciate the avaibility and the precision of each need and each RI?

Some "redundant" facilities were built on national interests only.

Why and how the reached conclusions will be correct (robustness, validity for all the community…)?

If a University team is involved, skills in multicriteria analysis will be required (but not in RI!)

How to progress?
What consistency? (*required*)
What rules? (*and agreement of each EU partner*)

AirTN NextGen suggested actions towards identification of new RI needs:

- Define a methodology based on:

  • Refinement of the criteria (RDT&E capabilities) and definition of thresholds inside each criterion. Assessment of the robustness of the final criteria to establish valid conclusions for each type of facilities.

    • Multicriteria (*a mess? → can avoid reluctant position?*) → The use of **Multicriteria analyses** was recommended (*do not use only the weighted sum!, the partial ranking output is relevant to different types of RIs…*)

  • Flightpath needs are the European **objectives**. Europe organization, the world environment and RI are **constraints** → The use of **Function analysis and value management** was recommended**.**

→ At the end, conclusions about rankings, future organization of networks, **mitigations**…

Other AirTN NextGen actions concerning RI : Seminar and Workshop on the topic "Towards virtual certification":

- A seminar (October 2014, DLR): "Towards virtual certification: Key challenges in the field of simulation capabilities for European Research Infrastructures."

→ http://airtn.eu/event/airtn-nextgen-seminar-research-infrastructures-simulation-capabilities-2/

- A Workshop (May 2016, NLR): "Virtual testing, towards virtual certification".

→ http://airtn.eu/event/airtn-nextgen-workshop-on-virtual-testing-towards-virtual-certification/

"Towards virtual certification" → Key recommendations (Synthesis report):

- **The establishment of a roadmap of research infrastructures in Europe is essential**. It must take into account the VHT trend, the design process, the industry needs, the EASA needs and all the Research Infrastructure competitors. **This roadmap must take into account a simultaneously management of strategic Research Infrastructures and strategic codes.** A white paper on virtual testing by industry will be helpful to establish this roadmap.

- **The involvement of the regulator representatives in the different steps** of an aircraft development is essential to foster the efficiency of the certification process.

- Models and simulations are key elements for virtual certification. But different types of real tests will be always needed too. **The key issue is the good balance between the developments of the different means of compliance**: numerical tools, experimental tools and flight tests.

- **The use of statistical methods** (design of experiments, big data, machine learning, surrogate-based global optimization methods) **should be encouraged to tackle the quality of the results** and to increase the confidence of the stakeholders in the reached conclusions.

- Concerning the education, **the engineer courses in a physical domain should be completed by specific courses on the management of uncertainties**.

"Towards virtual certification" → Key recommendations (Synthesis report):

- **The establishment of international databases shared by the aeronautic community is clearly identified** in the following fields: environmental, materials and structures. To build such databases, the quality and the accuracy of the data have to be known. This task requires the comparison of results obtained in different laboratories worldwide. To foster this action, the **European Commission could organize specific international cooperation calls** dedicated to the establishment of such databases.

- **The impact of a technology replacement should be evaluated** not only on the specific part that is replaced in the aircraft but also **by the consequences on integration and on security.**

- The establishment of an efficient network between the aeronautic stakeholders is essential. Furthermore, **in the field of security the evaluation of the performance of solutions requires platforms and procedures offering a high level of confidence for each stakeholder.**

- **The research aeronautic community should establish strong exchanges with other domains to build simulation platforms efficiently.** The increase of exchanges with teams involved in the **urban traffic** simulations could be helpful for Air Traffic Management simulation activity. In general, the exchanges with teams involved in **military simulation activities** have to be fostered because of their long experience in the simulation and the validation topics on one hand and because of the needs to develop simulations concerning the aviation security on the other hand.

AirTN Catalogue of the European Aeronautical Research Facilities (Facts & Figures) – Conclusion

A catalogue of Strategic and Key infrastructures is available and is a key tool to identify and to list the major **research facilities** in Europe. A lot of proposals were suggested by AirTN-NextGen team to achieve Flightpath 2050 goals with a high level of efficiency and consistency → **This catalogue will be used in the European RINGO project**.

AirTN-NextGen team pointed out key issues and has suggested appropriate recommendations which are **concrete paths to improve the efficiency and the consistency of the aeronautic activities dedicated to virtual certification for the future.**

→ **The outcome of AirTN NextGen work gives concrete keys and actions to improve the competitiveness of Europe in the aeronautic field.**

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Thank you for your attention!