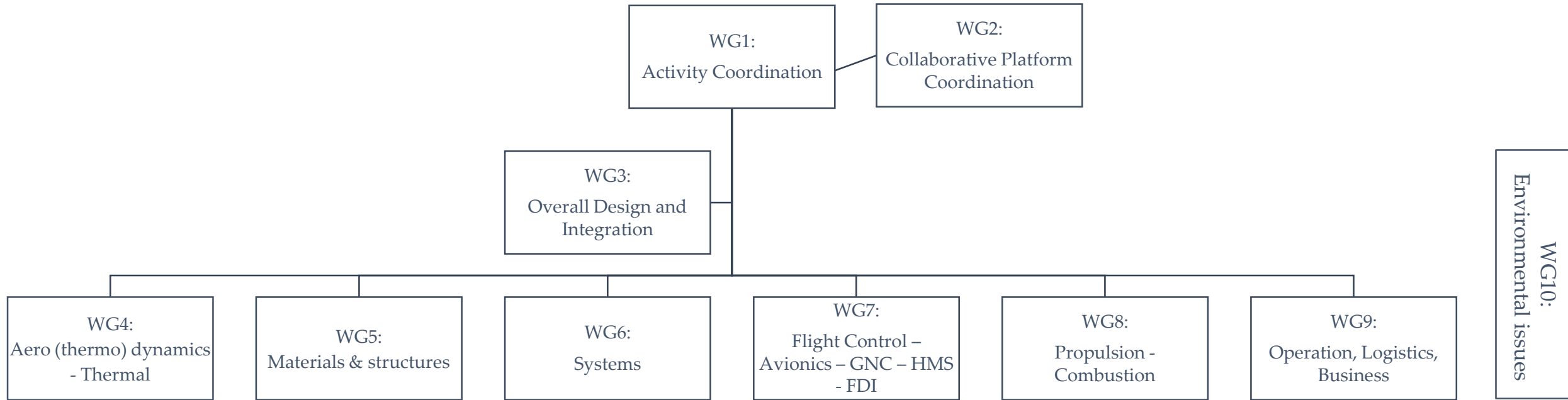


European Space Agency



High Speed Initiative (Workshop Porto, October 21<sup>st</sup>, 2016)

# Suggested Working Groups



**Reminder:** *The student challenge is to design a high speed, 300-passanger aircraft while demonstrating economic viability. This will require detailed investigations among and across several disciplines where both experimental and modelling approaches are welcome. Potential contributions from the attendees can be aligned with the topics listed below. If required, additional ones can be defined during the workshop:*

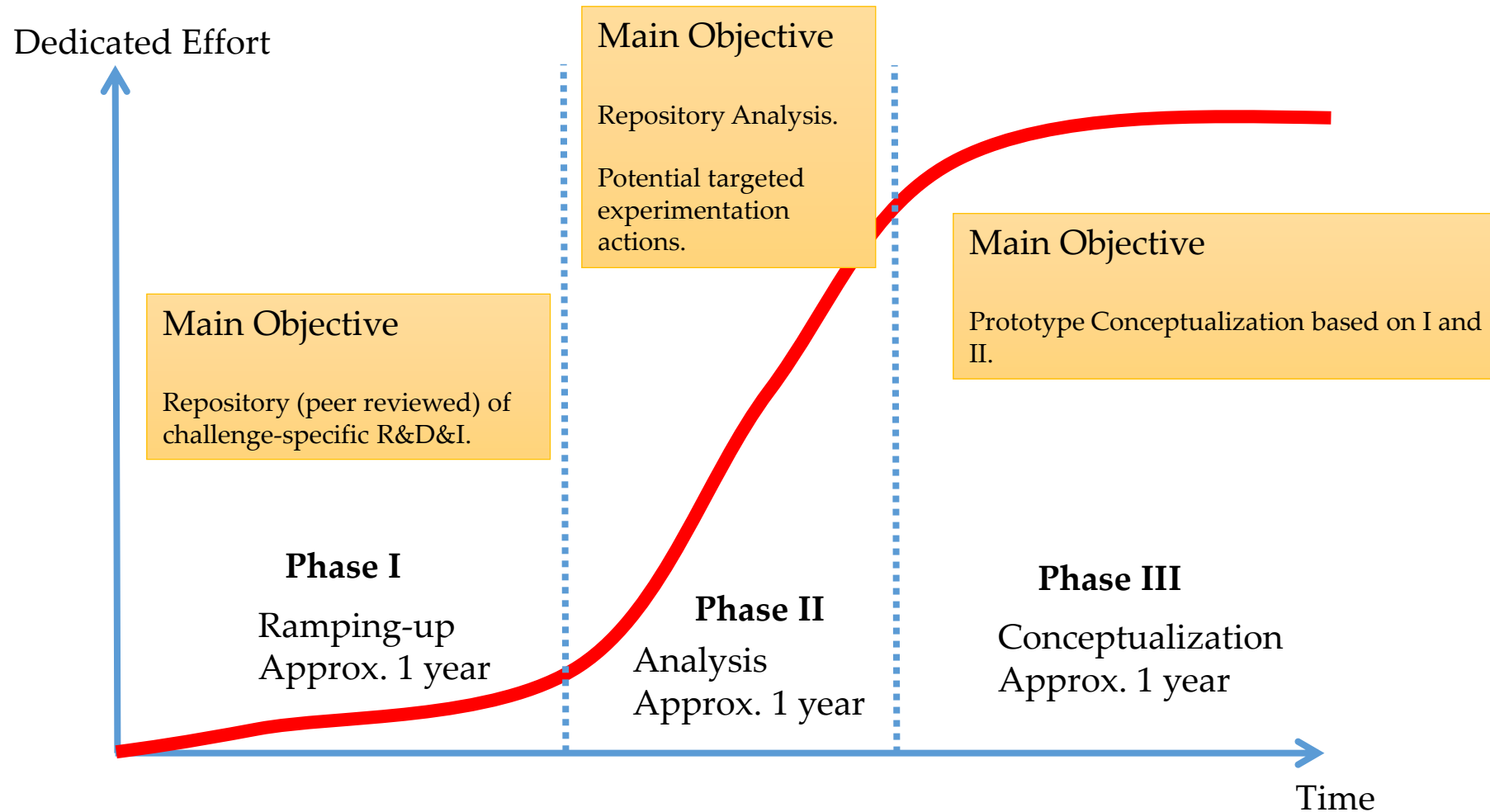
**Overall Design and Integration:** *conceptual design of a high-speed vehicle with a close integration of propulsion units within the airframe while maximizing the overall aero-propulsive-structural efficiency, multi-functional airframe design, interior design and in-flight services, cockpit design and related ergonometry....*

- **Aero-Thermo-Dynamics:** *high-speed aerodynamics and stability, performance at TOL, transitional effects such as compressibility, heating, steps & gaps...; conjugate heat transfer...*
- **Thermal:** *active and passive thermal protection systems, cryogenic insulation....*
- **Materials:** *high-temperature, light-weight materials development and characterization wrt thermo-mechanical fatigue, creep etc... for long-life time characterization of airframe and propulsive structures when exposed to typical thermo-mechanical loads for high-speed vehicles...*
- **Structures:** *static and dynamic behaviour of integrated, multi-purpose structures for the full speed range i.e. TOL, climb, cruise,...; optimization of structural layout...*
- **Systems:** *design of on-board systems able to cope with the fast reaction times, environmental conditions (from cryogenic up to very high temperatures....); on-board power generation, ECLS...*
- **Flight Control:** *avionics, GNC, HMS, FDI etc. for high-speed vehicles; static and dynamic analysis, automatic rerouting capabilities, fast instrumentation-measurement equipment of vehicle's attitude and condition...*
- **Propulsion:** *variable high-speed propulsion cycles and (sc)ramjet for acceleration & cruise; intake and nozzle design, combustion processes, sloshing in tanks...*
- **Combustion:** *modelling and validation of high-speed combustion processes, technologies to reduce emission, combustion instabilities, improvement thermal efficiencies...*
- **Operation, Logistics, Business:** *Flight routes, market capture, turn-around times, cryogenic (re)fuelling, airport infrastructures and interfaces, cost assessment for development-manufacturing-exploitation, commercial viability...*
- **Environmental issues:** *re-use and recyclability, REACH, sonic boom, jet noise, emissions at TOL and during climb and cruise within the upper stratosphere*

# Initiative overview

Minimum effort is 3 years;

If EU funding available it could be extended.



# Phase I: Ramping-up

## Resources

- Existing curricular activities and resources in organizations.
- CERN first version of collaborative platform available (allows creating repository).

## Effort

- Each organization requires limited effort.

## Objectives

- Increased engagement of Universities
- After 1 year elaborate a peer reviewed database out of existing R&D&I activities specifically **challenge oriented**.
- R&D&I database (or repository) based mainly on students' projects (i.e. master thesis, PhDs, etc).

## Modus Operandi

- Distribute participating organizations around the challenges (Work Groups).
- Each WG has an overall coordinator.
- Materials uploaded in repository should be peer reviewed by professors of each institution.

# Phase II: Repository Analysis

## Resources

- **Within existing or beyond** curricular activities in organizations.
- Enhanced version of collaborative platform (CERN).

## Effort

- Effort from each WG coordinator beyond “daily activities”.

## Objectives

- After 2 years elaborate a synthesis of the gathered **challenge oriented** R&D&I.
- Propose complementary and missing key experimentation/ simulation suitable to be realised by students.
- Integrate results in the synthesis.

## Modus Operandi

- Each WG coordinator spends time elaborating synthesis of results of Phase I and indicates key missing experiments/ simulations.
- Each organization determines the feasibility to carry on key missing experimentation/ simulation
- Each WG coordinator elaborates a final report per challenge.

# Phase II: Repository Analysis

## Must have

- In-kind contribution of participants.
- Enhanced collaborative platform.
- Final synthesis report per challenge.
- At least 3 meetings among WG Coordinators.

## Nice to have

- EU funding to cover efforts related to synthesis and potential experimentation/simulation as well as other activities (i.e. design of enhanced collaborative platform, meetings, workshops, etc).
- General Workshop(s) for all participant organizations (i.e. to share and check challenges vs. synthesis).
- Extra key experiments/simulations based on synthesis report.

# Phase III: Conceptualization

## Resources

- **Existing and beyond** curricular activities in organizations.
- Enhanced collaborative platform.

## Effort

- Each organization requires effort beyond “daily activities”.

## Objectives

- After 3 years conceptualise a prototype of the future 300 passenger civil supersonic aircraft.

## Modus Operandi

- Organise participating organizations around the challenges (Work Groups).
- Each WG has an overall coordinator.
- General student activity: conceptualize prototype with information of all WGs.



# Phase III: Conceptualization

## Must have

- In-kind contribution of participants.
- Enhanced collaborative platform allowing WG collaborative work (synergies).
- Final conceptualization report.
- At least 3 meetings among WG Coordinators.
- General Workshop(s) for all participant organizations (i.e. to share and check challenges).

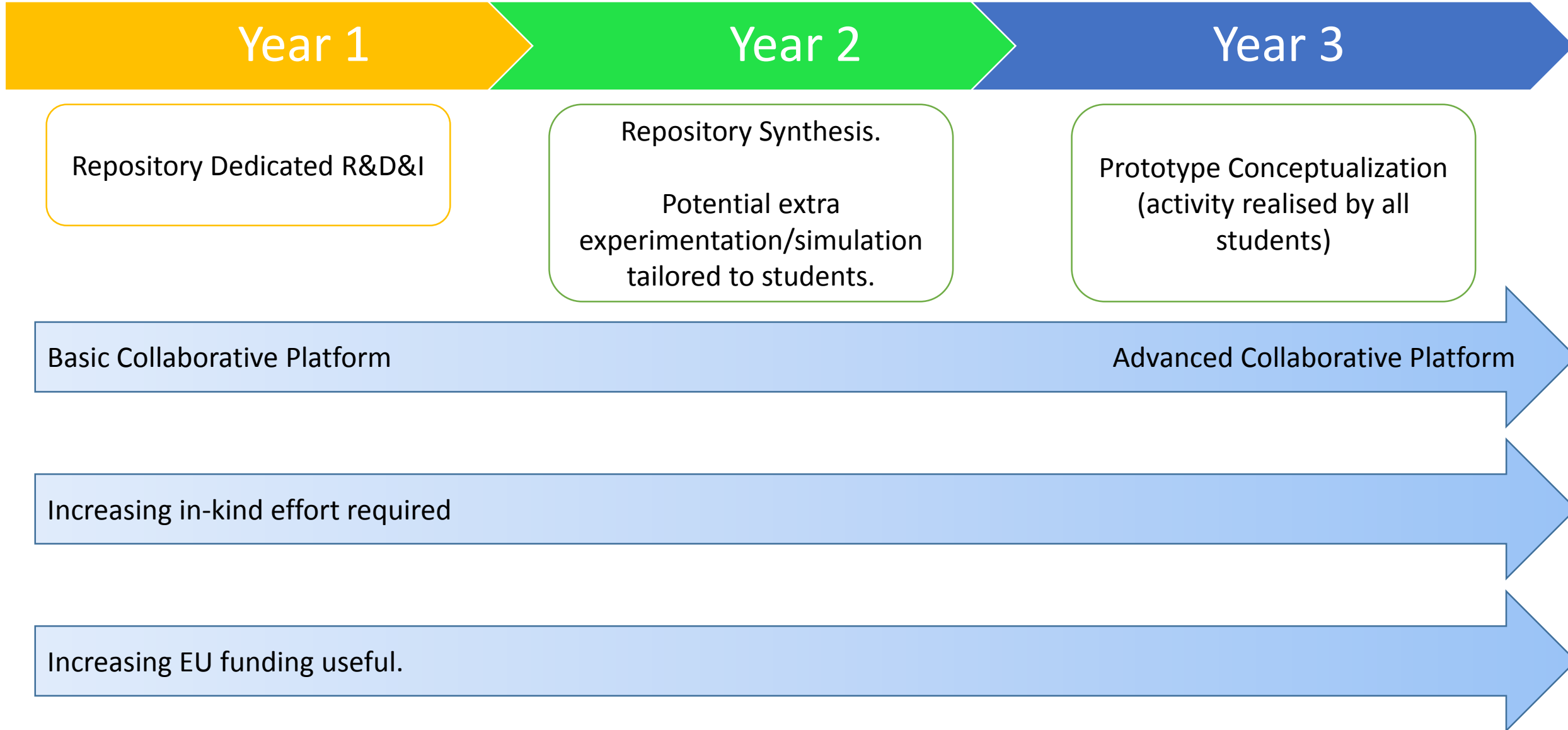
## Nice to have

- EU funding to cover efforts related to conceptualization and potential experimentation/simulation as well as other activities (i.e. design of enhanced collaborative platform, meetings, workshops, etc).

# High Level Gantt Chart

Minimum effort is 3 years;

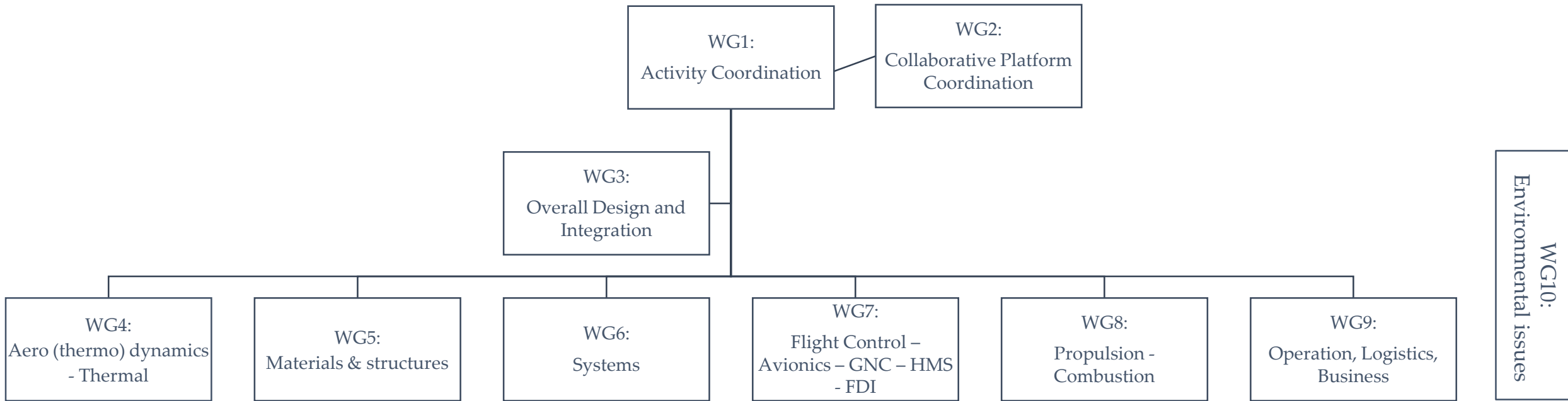
If EU funding available it could be extended.



## Next steps: organizing the ramping up

- ❑ Identify those of you willing to take part in this initiative.
- ❑ Populate the different Working Groups and challenges.
- ❑ Nominate WG Coordinators.
- ❑ Start developing the R&D&I repository.

# Suggested Working Groups



- WG Structure review
- WG Coordinators?
- WG Participants?

