

# European Radiation Facilities Network ERFNet

**Livio Narici**

*Department of Physics – University of Rome Tor Vergata – Tor Vergata, Rome, Italy*

***for the ERFNet collaboration***

University of Rome Tor Vergata  
Via Orazio Raimondo,1  
00173 Roma  
Italy

Att: Prof. Livio Narici  
[narici@roma2.infn.it](mailto:narici@roma2.infn.it)

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**estec**  
European Space Research  
and Technology Centre  
Keplerlaan 1  
2201 AZ Noordwijk  
The Netherlands  
T +31 (0)71 565 6565  
F +31 (0)71 565 6040  
[www.esa.int](http://www.esa.int)

Responsible Contracts Officer  
Ms Georgia Ekatomati(IPL-PSS)  
Tel. (31) (0)71 565 5616  
Fax (31) (0)71 565 5662  
E-mail: [georgia.ekatomati@esa.int](mailto:georgia.ekatomati@esa.int)



# **ERFNet**

## **European Radiation Facilities Network**

ESA RfQ/3-15226/17/NL/GE

### *Feasibility Study*

*Prepared by  
Livio Narici  
University of Rome Tor Vergata*

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# Background Needs

Research on radiation effects on living tissues, radiation environment in space habitats, as well as development of radiation protection technologies and systems, needs:

- combined and coordinated approaches to exploit knowledge.  
*radiobiology, space systems engineering, life support and habitability, materials science and technology, computing science, space mission and operations engineering, ...*
- integrated approaches for implementation of physical and virtual facilities: a network of facilities.
  - demonstrators of Habitat infrastructural elements
  - human exploration oriented irradiation facilities  
*should provide adequate development environment for most intended applications to test advanced design solutions and operations in the frame of radiation mitigation in space habitats*

# Key Requirements

- 1) broad access to related information, including data;
- 2) smart support in the modelling and design of experiments;
- 3) optimized use of the facilities involved;
- 4) modular structure, easy to be upgraded;
- 4) synergy with similar realities around Europe and worldwide;
- 5) a risk model, to be used as radiation mitigation optimization tool;
- 6) applicability to space flight (i.e. whenever possible the moduli could be seeds for similar moduli to be use during deep space missions)

This presentation is going to briefly mention the approach we are going to use to study the ERFNet feasibility and the needs it should respond to. We are therefore seeking suggestions to further improve the approach. We are also proposing a synergy between ERFNet and WRMISS

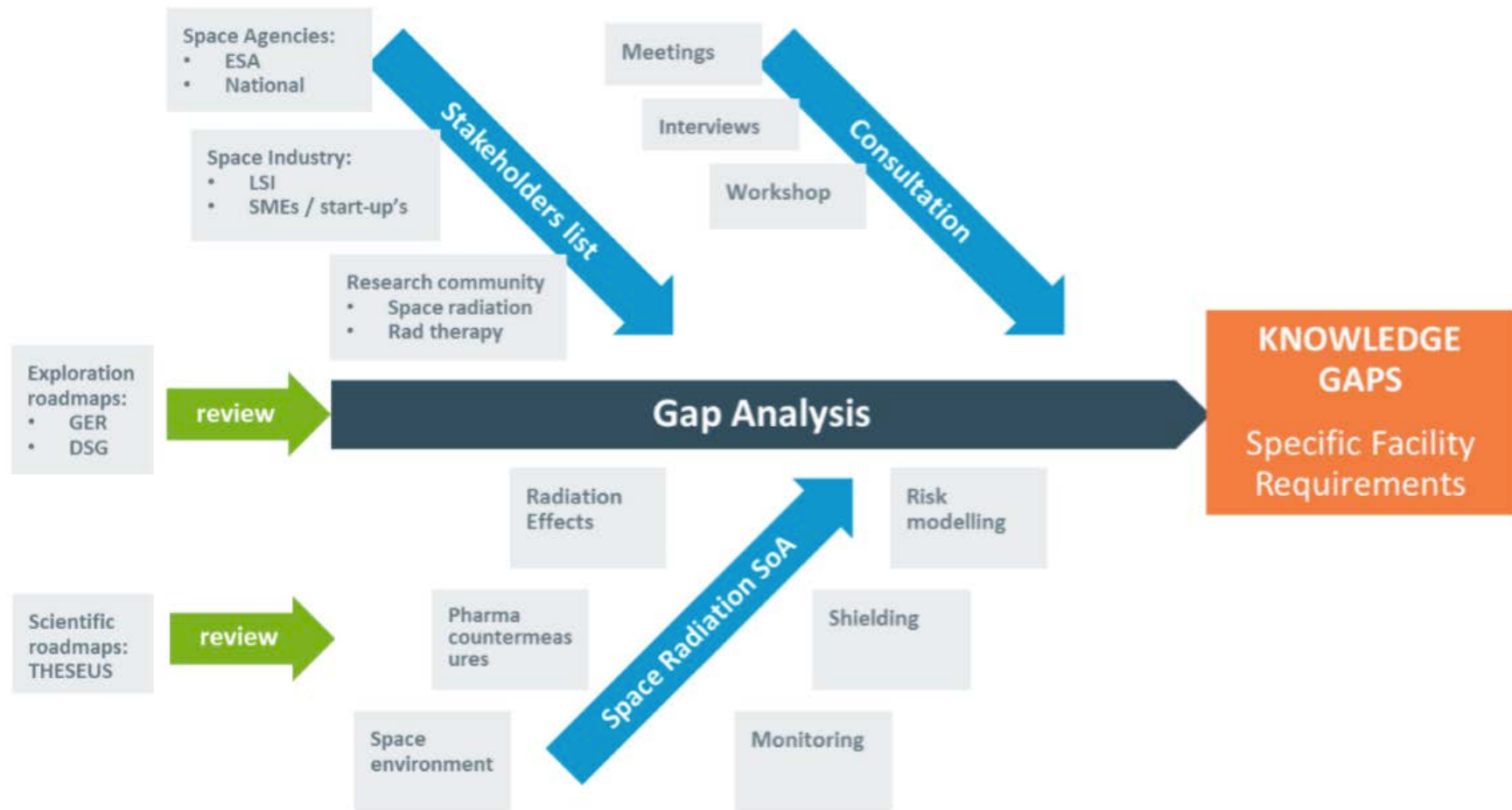
# ERFNet Objectives

- Support users in the design and optimization of their scientific and technological activities in the field of radiation applied to human space exploration.
  - a single access point to the information including links to the leading institutions in the field
  - an easy access to the information to
    - i) assess the feasibility, novelty and relevance of a new concept,
    - ii) design and optimize the best strategy for its development,
    - iii) provide indications how to optimally test it.
  - guided links to relevant irradiation and habitat (physical and/or virtual) facilities
- Suggestions for needed and optimized upgrades of these facilities
- A smart system to manage all radiation-related inputs, to suggest strategies to optimize the habitat, and optimal irradiation validation strategies, etc.

# ERFNet Objectives

- Use radiation risk as optimization parameter
  - develop a structure to efficiently pair the radiation risk to the optimization routines
    - *maintaining the highest degree of upgradability to be able to follow future developments*
- Study, in the ERFNet developing stage, a risk assessment model, based on the knowledge and expertise in Europe
  - accordingly and in synergy with similar worldwide efforts
  - providing a first input for the optimization endpoints
- Be easy to access and user friendly,
  - to facilitate newcomers in the field,
- Provide a valid knowledge-base and physical tools to the experienced researcher.

# Knowledge Gaps



# Important Reference Documents

## Recommendations for ESA-supported ground-based research on space radiation protection

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**estec**

European Space Research  
and Technology Centre  
Keplerlaan 1  
2201 AZ Noordwijk  
The Netherlands  
T +31 (0)71 565 6565  
F +31 (0)71 565 6040  
[www.esa.int](http://www.esa.int)

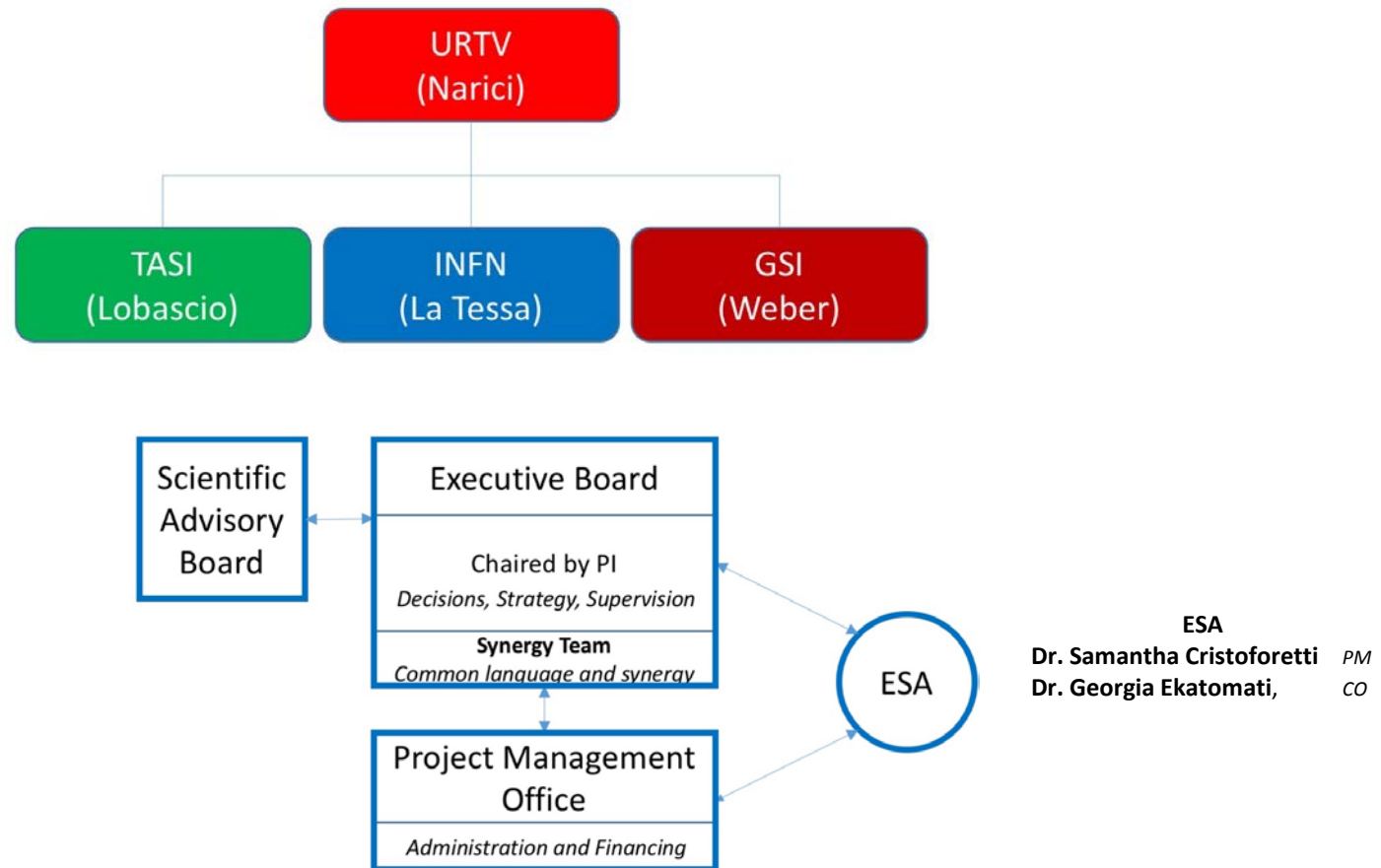
### Application of the FAIR Facility to Space Radiation Research

Final Report

**DOCUMENT**

ASI Supported Irradiation Facilities (ASIF) initial  
assessment report

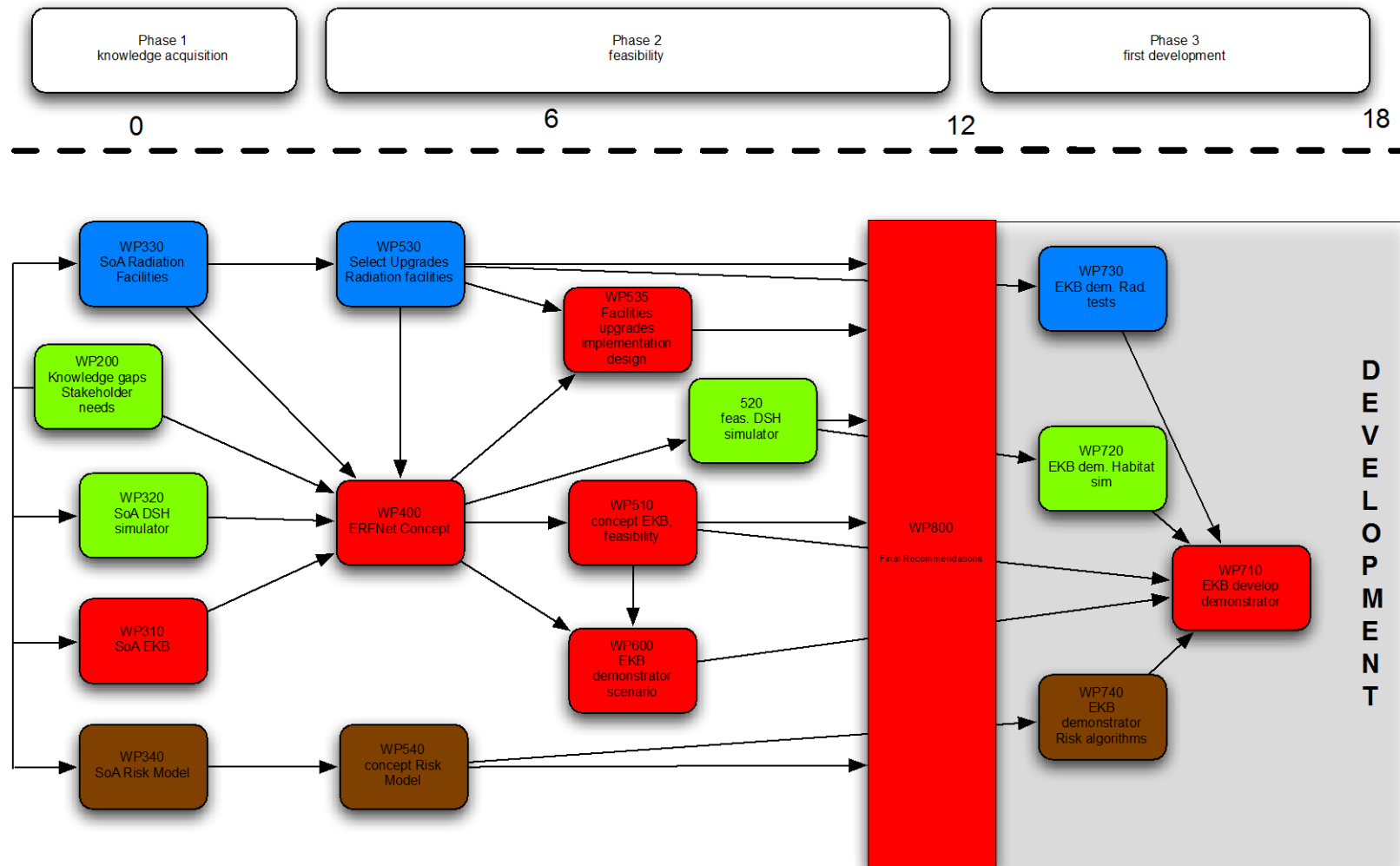
# Players for ERFNet Feasibility Study



## SCIENTIFIC ADVISORY BOARD

- Dr. Emmanouil Detsis**, FR, *ESF Science Officer, Sci. PM for H2020 and ESA of ESF*
- Dr. Speranza Falciano**, IT, *PI for the ASI-INFN agreement for ASIF, member of the INFN Executive Council*
- Dr. Daniel Heyndericks**, BE, *DH Consultancy, Belgian Institute for Space Aeronomy, PM of several radiation projects (ESA).*
- Dr. Guenther Reitz**, DE, *Former director of the department of Radiation Biology of DLR, Chairman WRMISS*
- Dr. Edward Semones**, US, *Head of Space Radiation Analysis Group – JSC NASA*

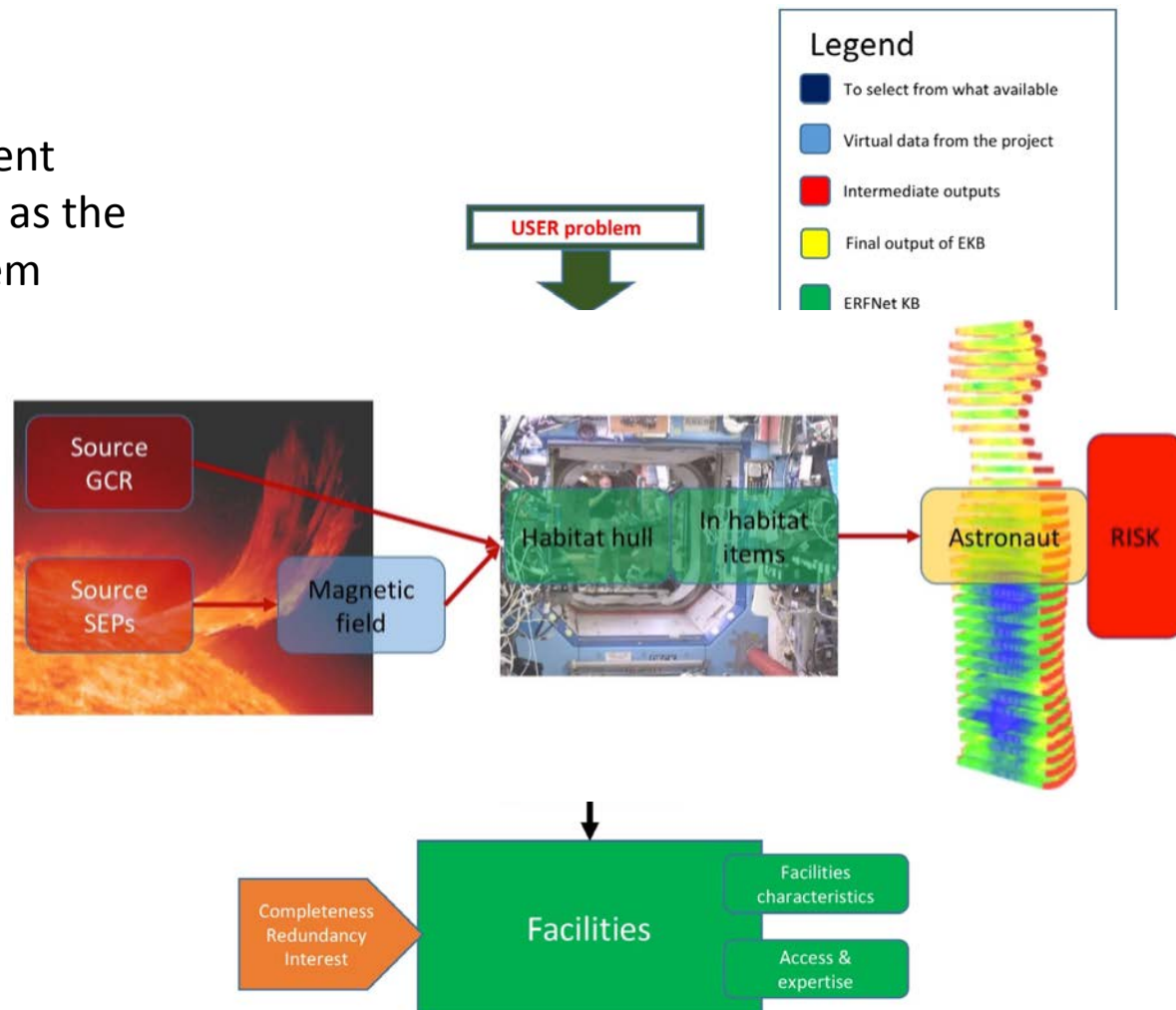
# Workflow - Worklogic



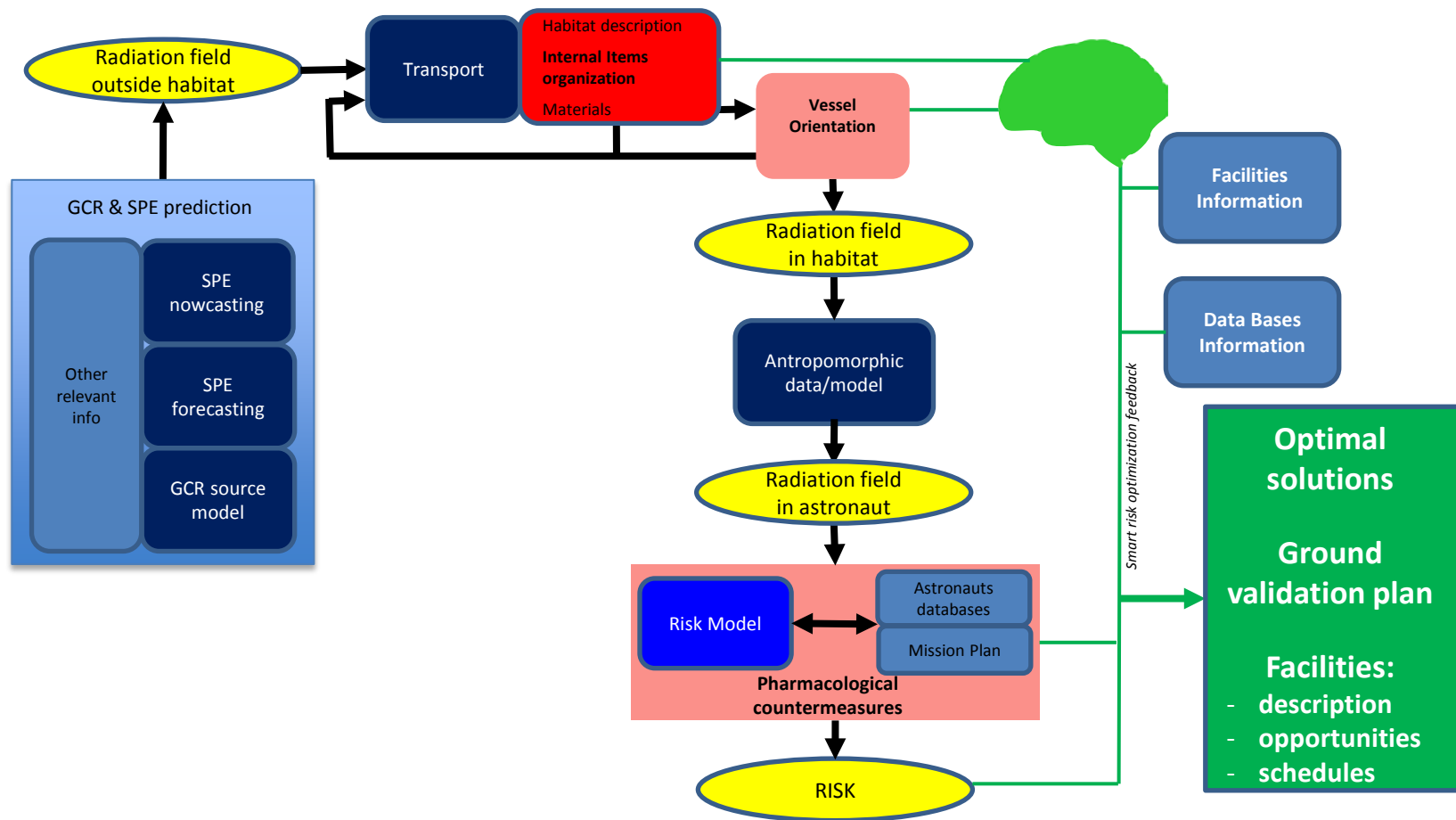
# ERFNet concept

The core nodes of the ERFNet are:

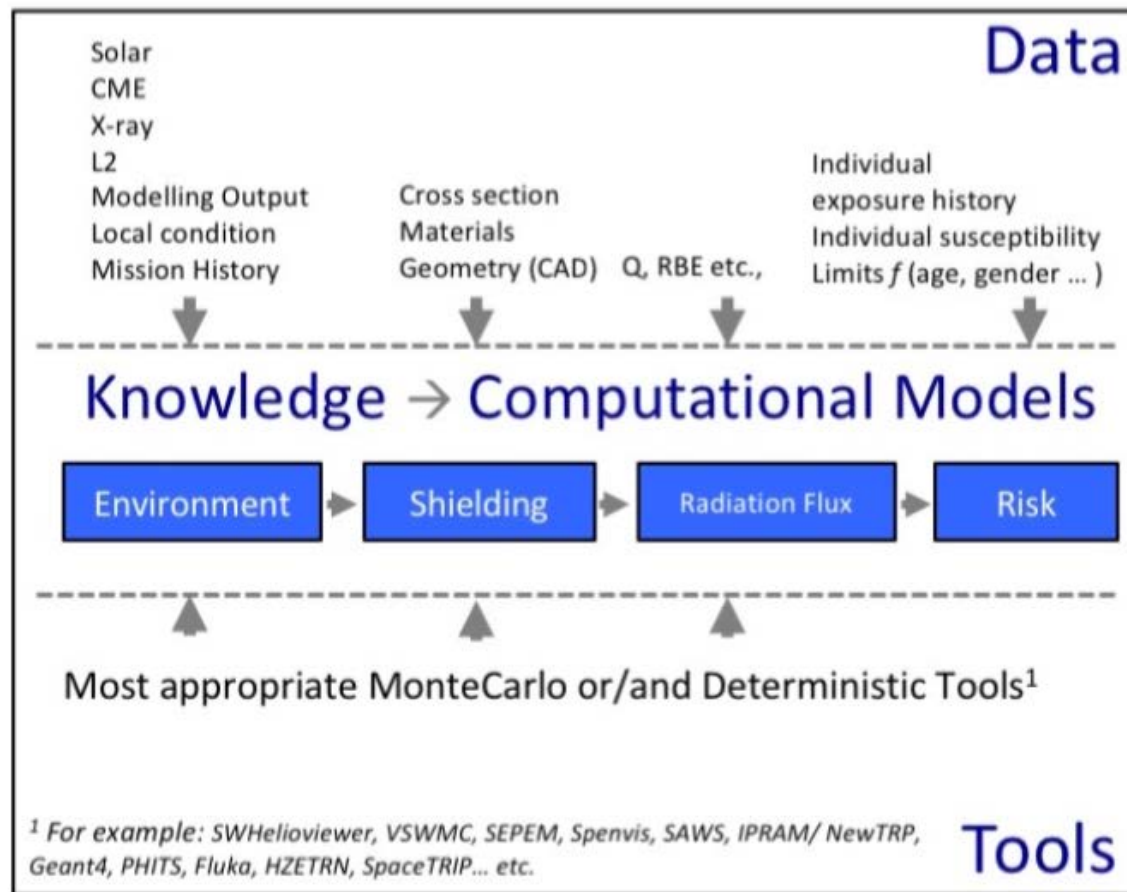
- the facilities for
  - irradiation testing
  - habitation-related development
- the ERFNet Knowledge Base (EKB) as the key knowledge management system



## EKB



## Another point of view: COMPUTATIONAL MODELS



# The ERFNet Integrated Approach

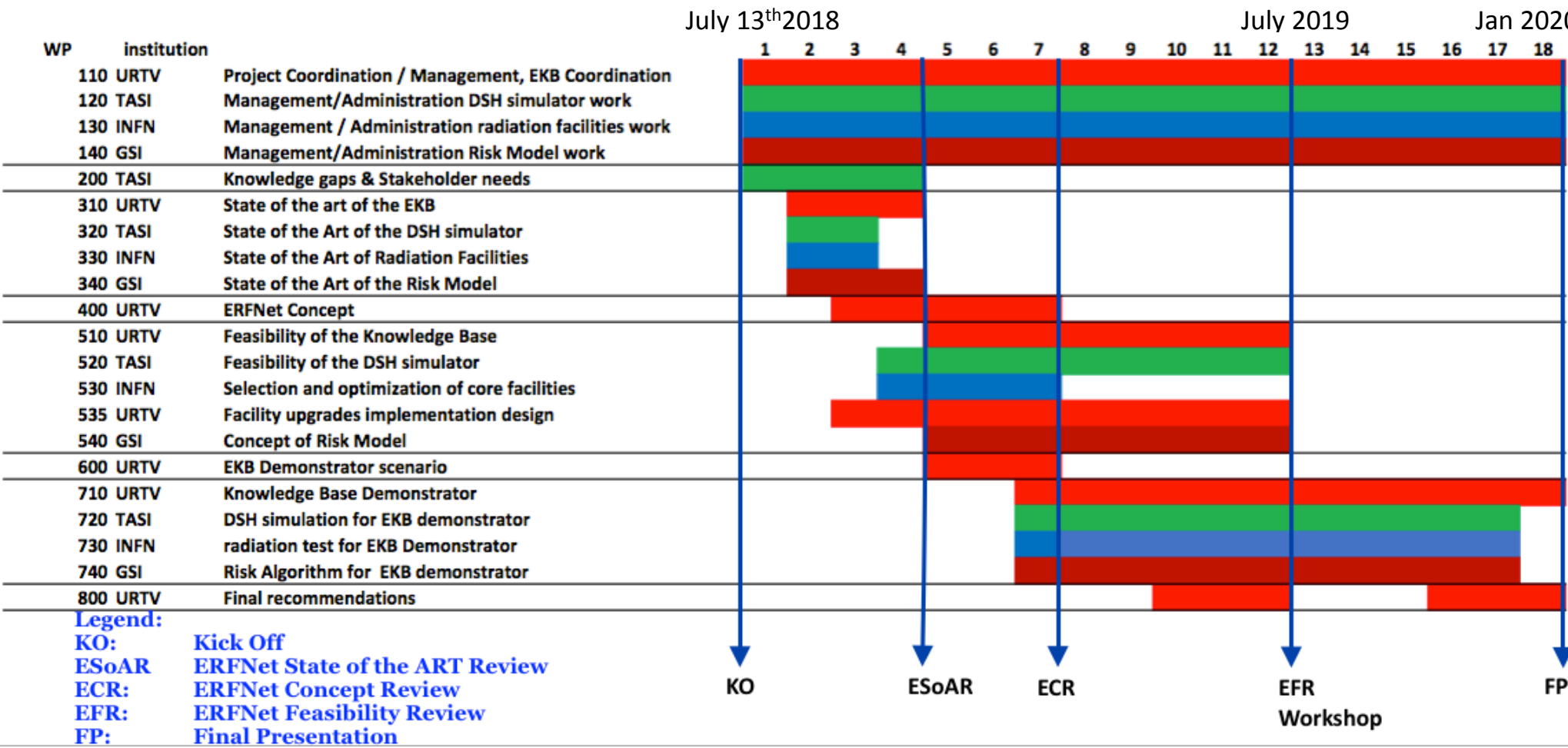
*“One of the ERFNet pillars is the integrated approach for implementation in full scale of **demonstrators of selected Habitat infrastructural elements**, providing the adequate **physical** and/or **virtual** development environment for most intended applications, to test advanced design solutions and operations.”*



# Therefore, once developed, ERFNet should provide ...

- 1) A single access point to the information related to radiation and human exploration:
  - scientific and technological free data,
  - guided links to the leading institutions in the field
  - guided links to the pertinent existing databases.
- 2) Habitat models, physical and/or virtual mock-ups and simulators of the habitation elements focused on radiation protection-related features: shielding and sheltering,
- 3) A smart system to manage the optimization of the user questions, handling the radiation-related inputs
- 4) Suggestions for optimal irradiation validation strategies and support for consequent 'best' access to the irradiation facilities
- 5) An easy upgradable risk model modulus, to provide risk assessments as EKB optimization endpoints.  
*also support, in synergy with similar worldwide efforts, for the development of a novel advanced space radiation risk assessment model, based on the knowledge and expertise in Europe, and worldwide.*

# Time Chart



## ... seeking

- Suggestions (questionnaire)
- Coordination/collaboration with WRMIS

**Thank you for your attention**