Topical Discussion Meeting n°16 report

A Topical Discussion Meeting aims at active participation or interaction between the participants. The participants work and discuss on a predefined theme or problem heading towards an outcome or target. A working meeting is a 1h informal afternoon meeting with NO abstract submission form and therefore NO poster contributions.

Name of the meeting: Facilitating Innovation in Space Weather Service Development
Conveners: Alexi Glover, Quentin Verspieren, Sacha Bressollette
Secretary: Sacha Bressollette
Date – Time – Room: 30/11/2025 – 5:00PM to 6:00PM – Miklagård Room
# of attendees: 20
Speakers, if any (names and institution): Adamantia Dimitrakoula – National and Kapodistrian University of Athens; Elena Gomez del Pozo – Carlos III University of Madrid; Nathaniel Edward-Inatimi – University of Reading; Pierre Guéno – IPSA.
Form of TDM: Panel Forum

Objective of the TDM

How (format & method)

- Run a lively, case-study-driven discussion drawing on lessons learned and prior experience to accelerate innovation and utilisation of new/upcoming data sources.
- Present recent ESA initiatives as case studies and discuss possible next steps in particular the Space Weather Resilience Hackathon organised as the first event of the ESA Acceleration Days (with winning team to share their experience) and how such an event fits into a wider concept of an innovation journey.
- Highlight current innovation models in use from other sectors and their potential application to the space weather domain.
- Facilitate exchange among researchers, developers, end-users, industry, policy/governance reps, and innovation facilitators.

Why (content, outcomes & impact)

General objectives:

- Build on the ESWW2024 panel outcomes which debated the respective benefits of open vs directed innovation, and highlighted the need to boost commercial dynamics.
- Raise awareness of the growing demand for tailored services from end-users in space-weather-exposed sectors and increasing interest in development of commercial solutions.

Short-term outcomes:

- Gauge how familiar the community is with different innovation models.
- Identify practical enablers and constraints for applying different innovation approaches (e.g. pre-prepared datasets, challenge-based formats).

Long-term orientations:

- Identify innovation models that can best support the development of relevant, tailored, user-driven space-weather services.
- Strengthen commercial dynamics and support emergence of commercially viable services.
- Inform future policy and programme development to accelerate adoption and

operationalisation of space-weather capabilities in Europe.

Discussion highlights

1. Landscape of Innovation Formats

A wide variety of innovation models exist — including hackathons, innovation sprints, intrapreneurship programmes, incubators and accelerators, living labs, open innovation challenges, regulatory sandboxes, and academic partnerships. Each model is highly adaptable, with formats and outcomes varying considerably depending on context and objectives.

Using a **recognisable and established format** is advantageous: it attracts greater attention, increases the pool of participants and mentors, and enables teams to start more efficiently due to prior familiarity with the approach.

However, **well-known formats may also be strongly associated with specific activities or participant profiles**. This is particularly true for *hackathons*, a term widely linked to coding challenges, which may discourage applicants from non-technical backgrounds and, in turn, reduce the diversity of participants and the overall range of skill sets. This should be taken into account when preparing an event and the related communication.

2. Participant Preparation

For innovation models in which idea generation is intended to take place exclusively during the event, offering **pre-event background material** 1-2 weeks before the event helps ensure participants arrive with a shared baseline of understanding, without creating conditions that pressure participants into pre-event solution development or risk making the event appear intimidating.

3. Event Delivery

During the event itself, **optional support sessions** can be valuable for participants who encounter difficulties. However, these should remain voluntary, as compulsory sessions may detract from precious working time in short, intensive events (e.g., two-day hackathons).

4. Team Composition

The **ideal team size** is between four and six people. Smaller teams often lack the diversity and capacity needed for rapid progress, while larger teams face coordination challenges that can hinder efficiency and creativity.

5. Problem Definition and Expected Outcomes

Hackathons or innovation sprints with a **clearly defined problem statement** allow teams to begin developing solutions immediately, leading to more mature and technically advanced outputs. However, this clarity also introduces constraints that can reduce creativity and limit exploration.

Identically, where teams are only expected to focus on the core technical solution and not taking into account legal, policy, or business framing requirements, they are typically expected to deliver near-final prototypes or proof-of-concept demonstrators.

6. Mentoring and User Involvement

Having **mentors and end users readily available** throughout the event enables rapid feedback and ensures that ideation remains aligned with practical needs from the outset. This interaction enhances both the feasibility and the relevance of emerging solutions.

For space weather services in particular, engaging end users is essential, as these services must be closely tailored to specific operational contexts. It is therefore highly valuable for end users to share concrete examples of space weather impacts they have experienced, helping participants understand the real-world challenges and requirements their solutions must address. The audience agreed that ESA can play an important facilitation role by connecting innovators with end users — as demonstrated during the ESA Space Weather Resilience Hackathon — ensuring that space weather innovation remains anchored in operational reality.

In this context, the CassandRA Team — winners of the ESA Space Weather Resilience Hackathon — mentioned that they were pleasantly surprised by the enthusiastic feedback and strong interest they received when presenting their solution to the wider space weather community during the ESWW. This response showed that there is genuine interest within the community in advancing space weather services through innovation models that incorporate end-user feedback.

7. Interdisciplinarity and Fresh Perspectives

Teams composed of participants from **diverse professional and disciplinary backgrounds**—not necessarily domain experts—often generate the most innovative ideas. External perspectives can challenge existing assumptions and encourage creative, cross-cutting approaches to problem-solving.

8. Incentives and Motivation

An incentive structure that rewards **teamwork, engagement, and project continuity** is more effective than one focused solely on competition. Prizes or follow-up opportunities that encourage further development help maintain momentum and increase the likelihood that promising ideas evolve into real-world applications.

9. Community Value and Cultural Impact

Innovation formats such as hackathons are still relatively new to the space weather community, as evidenced by the fact very few examples could be cited. However, the attendance and engagement of participants at the TDM showed that the **space weather community** is eager to explore such approaches for their ability to introduce fresh, external perspectives.

Indeed, as commented by one of the TDM participants, while experts often have deep awareness of the sector's challenges and limitations, this can inadvertently discourage risk-taking. External participants bring renewed curiosity and openness, helping to overcome this "over-cautiousness" effect and invigorating the innovation ecosystem.

10. Barriers to Implementation Beyond Ideation

a. <u>Sustained support</u>

Sustained support is essential to translate promising ideas into operational concepts and services. Hackathons and related initiatives are often viewed as standalone educational exercises rather than as the **first step in a longer innovation pathway**. Without ongoing support, high-potential ideas frequently stall after initial prototyping.

In this context, the first ESA Acceleration Days and its "Innovation Journey" — comprising a hackathon and an innovation sprint — offered a valuable initial exploration of a more structured route from ideation to prototyping and, ultimately, to service delivery.

b. Technical Constraints

A major, recurrent challenge concerns **data sharing and confidentiality**. Many service providers, particularly in the private sector, are reluctant to disclose operational data or disruption records due to reputational risk and commercial sensitivity.

This hesitancy limits opportunities for:

- **Service calibration and tailoring**, as developers lack access to real-world performance data;
- **Service refinement and validation**, since feedback loops remain incomplete without insight into actual operational impacts.

This results in a **circular dependency**, where teams require real-world data to build a compelling business case, but cannot obtain that data without first demonstrating their potential value.

To address these barriers, early engagement may **focus on institutional and public-sector actors**, who typically operate under more open or transparent data regimes. The adoption of **robust data governance frameworks**, **anonymisation protocols**, and **controlled-access environments** – with for instance ESA acting as a facilitator – can also build trust and enable meaningful collaboration without compromising confidentiality.

In parallel, **theoretical and modelling limitations** — including uncertainty in model assumptions and input data — continue to affect both the scope and perceived credibility of derived commercial services although a number of enabling studies are currently underway. The underpinning models and tools remain an active area of R&D, and a key part of the ESA Space Safety Programme (S2P) space weather development strategy.

c. Collaboration challenges

Overcoming these intertwined data and modelling challenges requires **coordinated collaboration** among data providers, model developers, and service providers, supported by clear legal, ethical, and operational agreements for secure data exchange and model validation.

Main conclusion of the meeting

The Space Weather Resilience Hackathon organised as part of the ESA Acceleration days was well received by the space weather community and those participating in the TDM expressed clear interest in more events of this type.

Hackathons and similar formats are powerful catalysts for space-weather innovation. It was also noted they realise most lasting value when embedded in a resourced, staged **innovation journey.** The "Innovation Journey" tested during the ESA Acceleration Days represents a promising first approach and possible pathway through which teams can progress from challenge to prototype, pilot and operational service.

Outcomes are strongest when innovation events follow agreed **design principles** — pre-event background material delivered 1–2 weeks in advance, optional support sessions, teams of 4–6, and continuous access to mentors and end users.

Three key recommendations emerged from the TDM:

(i) **Clear definition and communication of the event's format and expected outcomes** — crucial for reaching the right communities, attracting suitable profiles, and ensuring that

the outputs align with the intended objectives.

(ii) **Post-event continuity** — which, for space weather, still requires further consideration, but is likely to include structured mentorship and access to end-user feedback (e.g. through the ESA Acceleration Days/Innovation Journey or the ESA BICs/Incubators Network).

(iii) **Trusted data access** — that respects confidentiality through robust governance, anonymisation and secure/federated environments. The approach used during the ESA Acceleration Days / Space Weather Resilience Hackathon — where participants and end users were able to freely exchange information on impacts and potential solutions within the event framework — demonstrating that such trusted data-access arrangements are both feasible and effective.

In short, pairing **adequate innovation models** and **clearly communicated formats** with **durable support** and **confidentiality-aware data pathways** can **strengthen commercial dynamics** for **relevant** and **user-driven** space weather services.

Annexes

<put in annexes additional relevant information such as participant list, minutes of meeting, presented material, etc.>