



Austrian Armed Forces
Directorate CIS and Cyber

MoD Approach to Space Weather

UN Workshop “Space Weather Initiative”

Brigadier-General Dr. TEICHMANN Friedrich

Ministry of Defense Austria

30 June 2023

WIR SCHÜTZEN ÖSTERREICH.

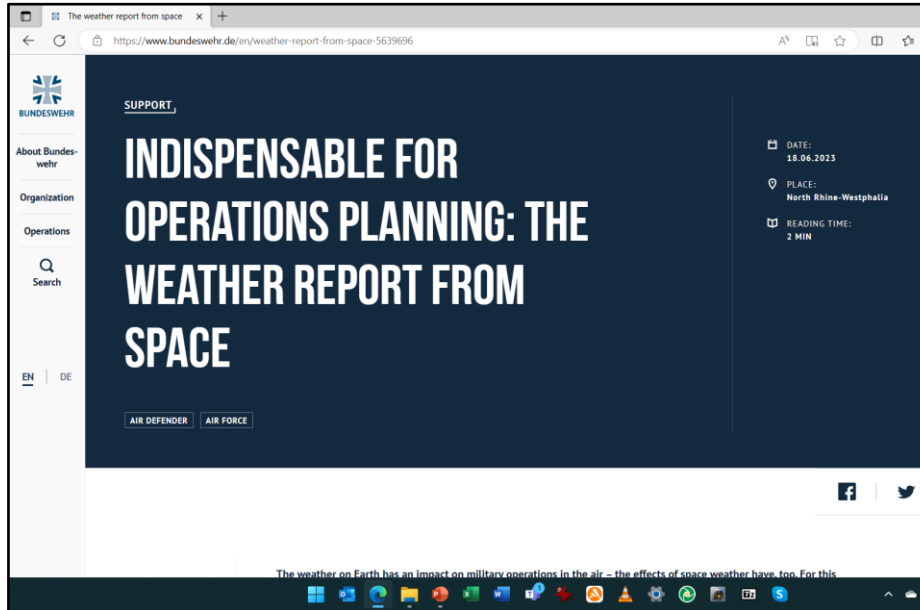
   [bundesheer.at](https://www.bundesheer.at)



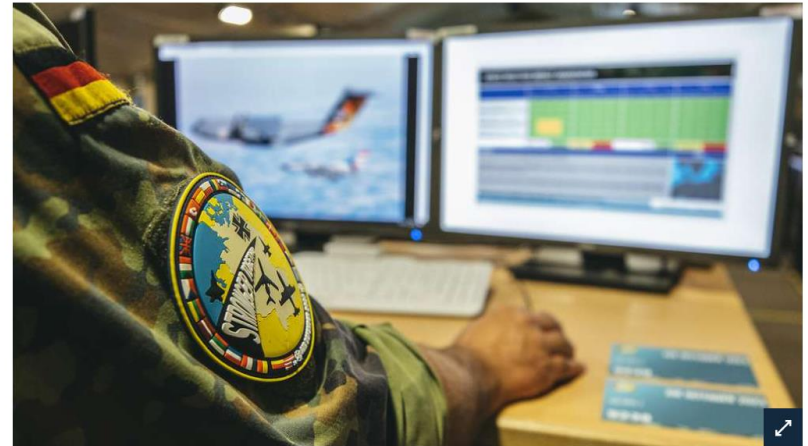
UNSER HEER



NATO Air Defender 23 Exercise



The weather on Earth has an impact on military operations in the air – the effects of space weather have, too. For this reason, specialists of the Bundeswehr Space Command employed at the tactical air operations centre of the Air Defender 23 exercise ensure that mission personnel and aircrews are provided with the latest data from space.



Thomas R. is preparing his daily space weather briefing at the JFAC HQ

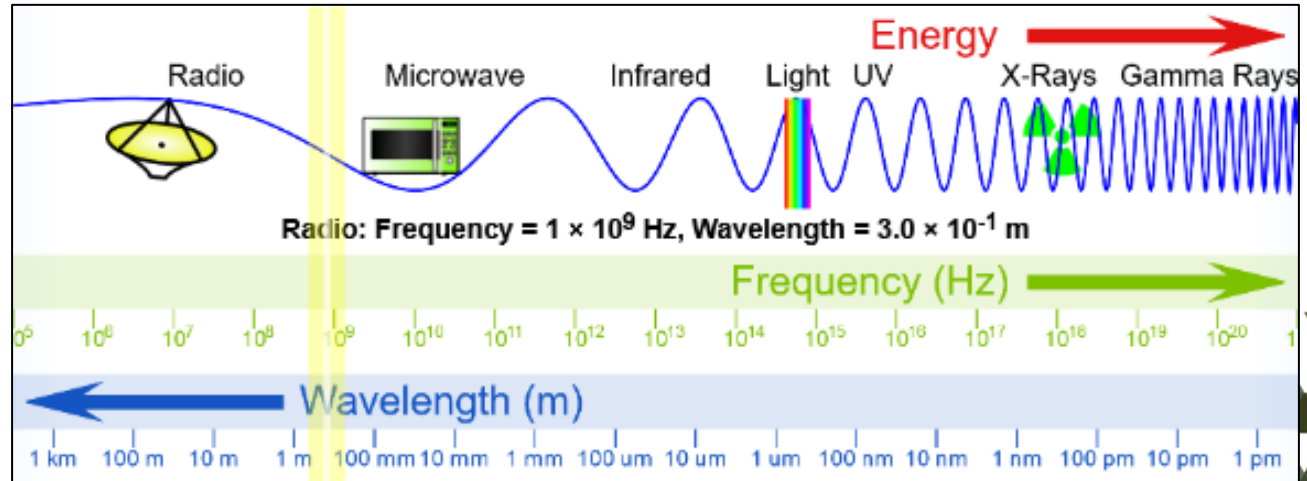
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Primary Interest

Use of space services

- ▶ Sat-Nav
- ▶ Sat-Com
- ▶ Space EO/RS



EMS = Electro-magnetic spectrum



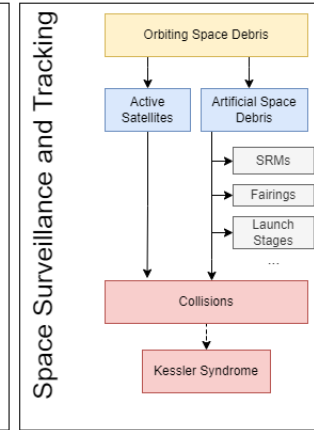
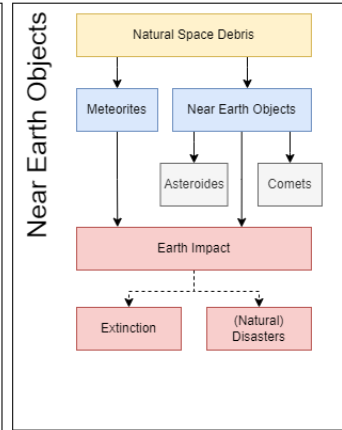
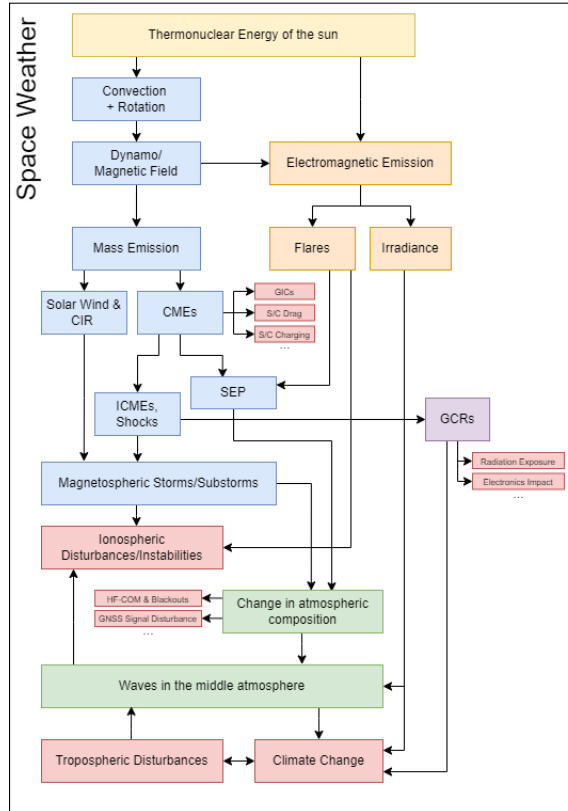


Space Services for Security and Defense

| Space Service | Opportunities and Challenges for Missions and Operations |
|----------------------------------|--|
| Satellite- Navigation | Command and Control (C2) Common operational picture (COP - Friendly Force Tracking) Timing for all mobile networks (PNT) PNT for autonomous vehicles and robotics |
| Space-based Earth Observation | Eyes and ears for foreign missions two work strands: Intelligence and Geo |
| Satellite- Communications | Dominant communication option between radio and land-line especially worldwide and very flexible |
| SSA-SDA | Protection of space assets (satellites) early warning (e.g. space weather) for sensitive technologies |



Map of (civil) Space Situational Awareness



Legend & Acronyms

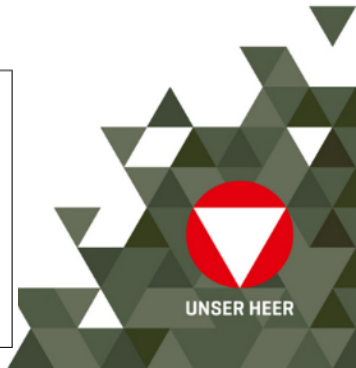
Space Effects ■ ■

Atmospheric Effects ■

Effects & Impacts ■

CIR Corotating Interactive Regions
 (I)CMEs (Interplanetary) Coronal Mass Ejections
 SEP Solar Energetic Particles
 GCRs Galactic Cosmic Rays
 GICs Ground Induced Currents

Note: The is diagram is by no means complete



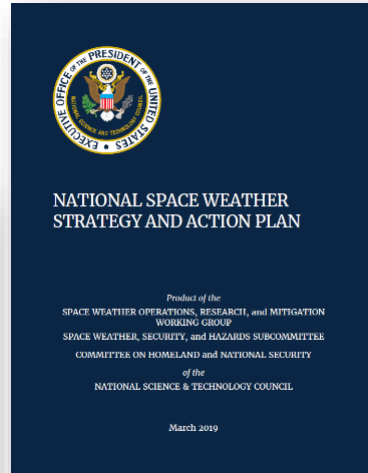


Space Weather Development Plans



Federal Operating Concept for
Impending Space Weather Events

May 2019



UNCLASSIFIED/UNLIMITED



European Space Weather Activities

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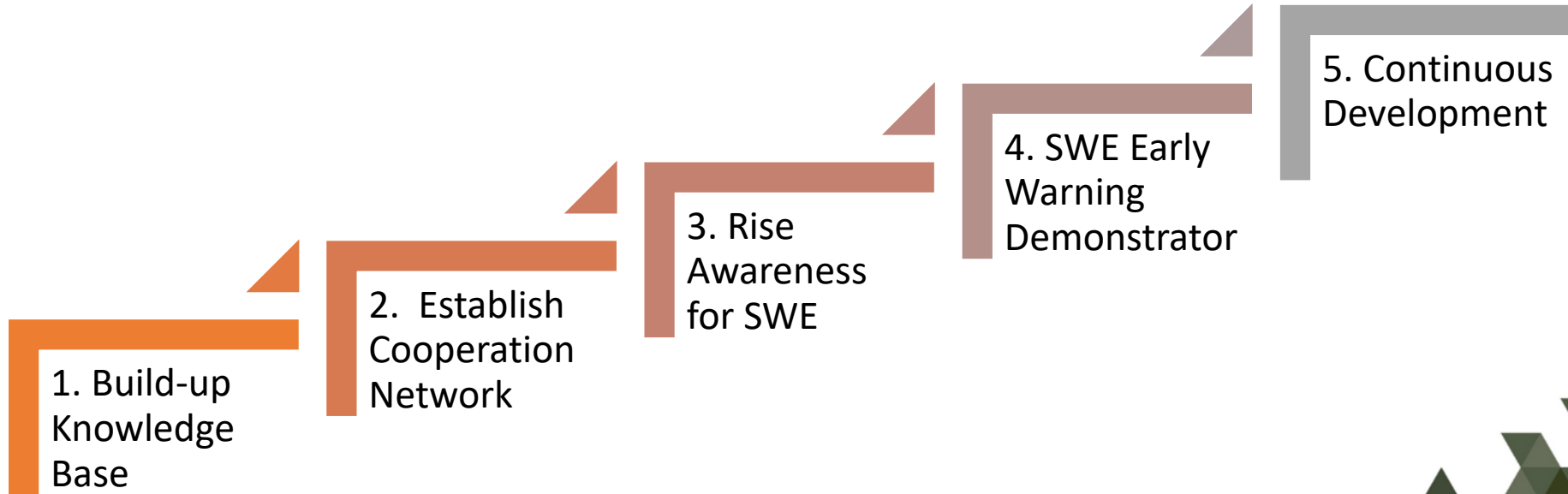
Abstract

Many space weather activities were carried out in the last ten years in Europe. These activities are several studies, projects and actions as well as different workshops, conferences, space weather weeks, outreach and educational initiatives. This paper also describes scientific and user orientated efforts towards an European Space Weather Programme (ESWP).





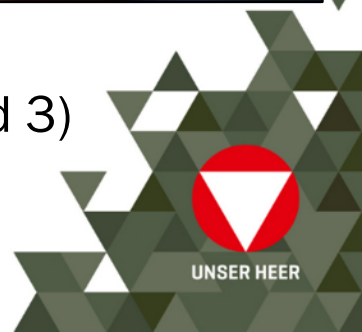
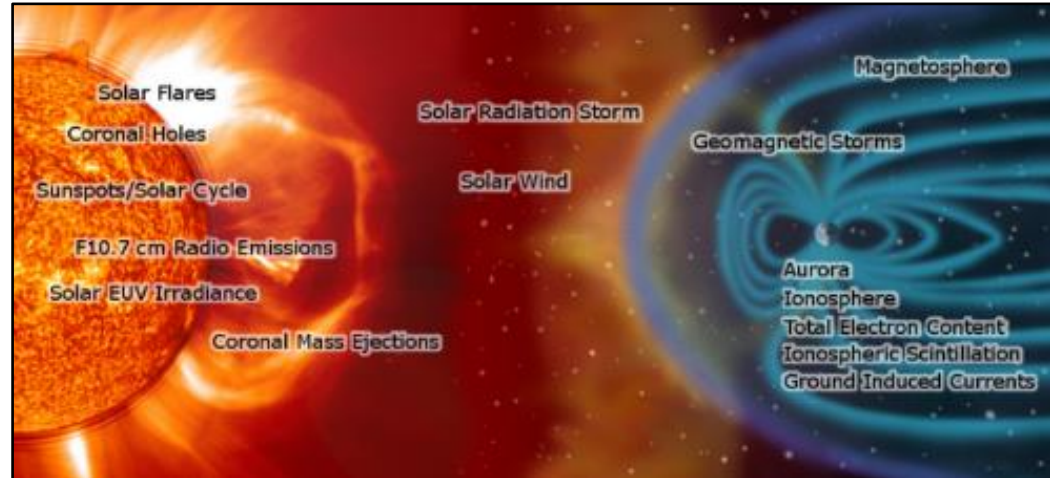
MoD AUT Space Weather Development Plan





1. Build-up SWE Knowledge Base

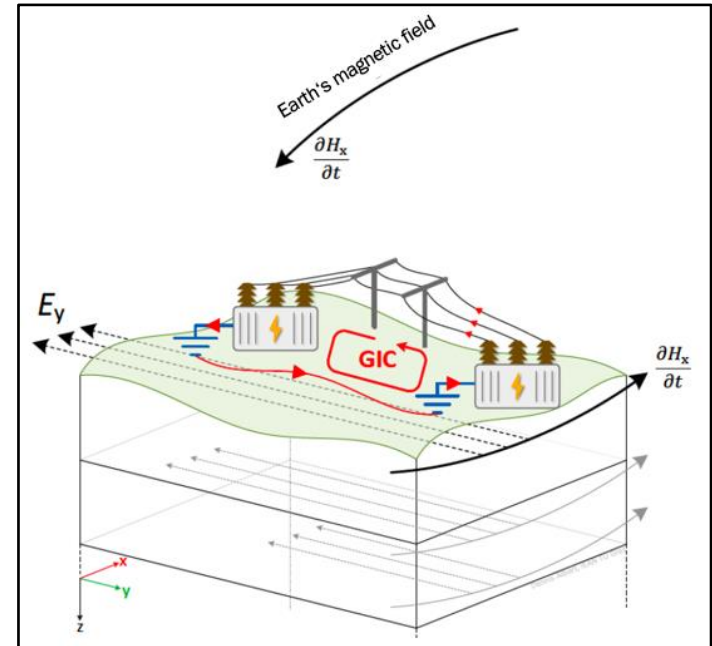
- ▶ Train current staff
- ▶ Bring in new experts
- ▶ Join programs and projects
- ▶ Meetings and International WG
- ▶ 1) Knowledge of SWE and 2) Knowledge of the Organization and 3) the effects of SWE for critical systems





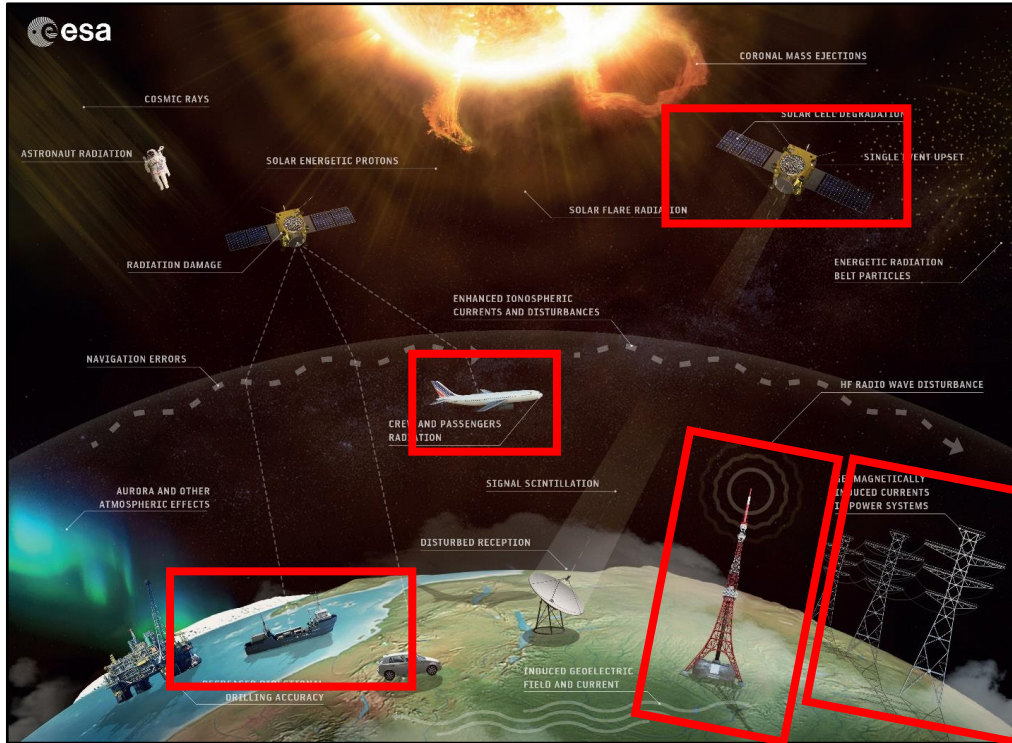
2. Establish SWE Cooperation Network

- ▶ Cooperate with “Environmental Picture” Providers: Geo and Met
(e.g. Geosphere)
- ▶ Universities and R&D Organizations
- ▶ National R&D Programs (e.g. SWAP)
- ▶ WG and Meetings (EU)
- ▶ Especially military:
 - ▶ EDA (European Defense Agency): PT SSA
 - ▶ EDF (European Defense Fund): SSA calls





3. Rise Awareness for SWE



Intern (MoD) and extern

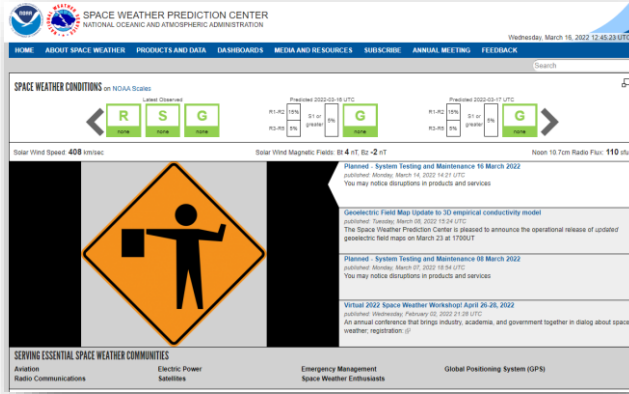
- ▶ Tele-Communication
- ▶ Air- and Space-Services
- ▶ Networks
- ▶ Critical Infra-Structures
- ▶ Ministries (Security and Safety)

National Day AUT

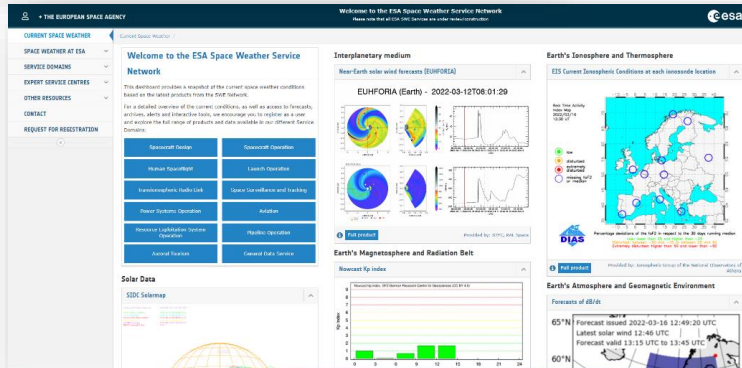




4. SWE Early Warning Demonstrator



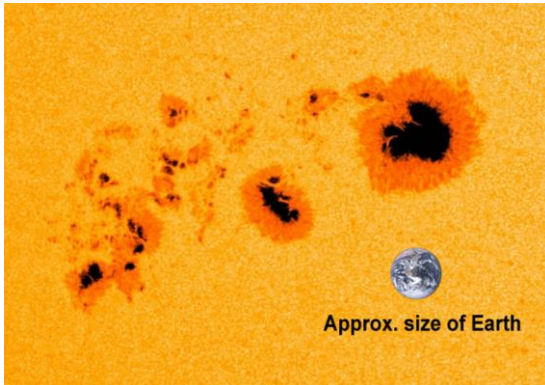
- ▶ Draw on existing ideas
- ▶ Merge available data and services
- ▶ Translate SWE science into MoD needs
- ▶ Develop Demonstrator for SWE “Early Warning”





4. SWE Early Warning Demonstrator MoD

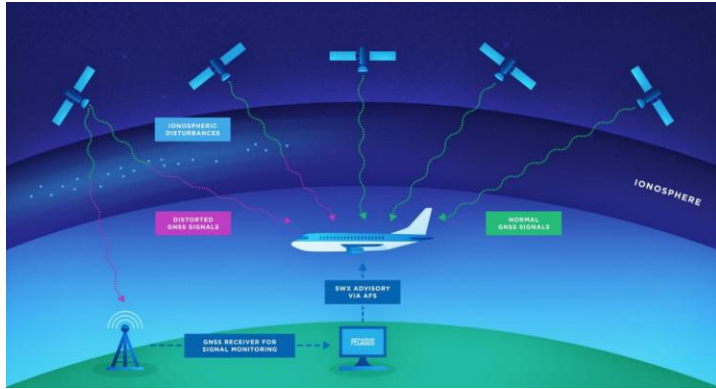
- ▶ Coronal Mass Ejections (CMEs): up to 15h warning, duration days
- ▶ Solar Energetic Particles (SEPs): up to 1h warning, duration hours to days
- ▶ High-Speed Solar Wind (HSSW)
- ▶ Solar Flares



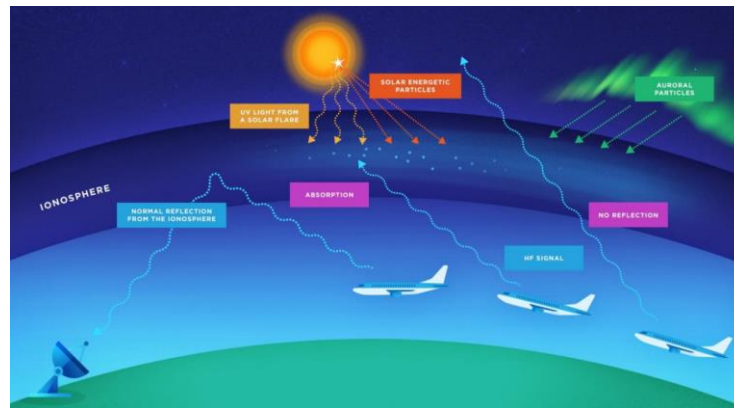
| Event/Bsp | Ankunft / Dauer | Physische Auswirkungen | Technologische Auswirkungen |
|---------------------------------------|---|--|--|
| Geomagnetisch → CMEs, HSSW | <ul style="list-style-type: none">• Ankunft: ca. 15h• Dauer: Tage | <ul style="list-style-type: none">• Geomagnetisch induzierte Ströme• Erhöhte Ionisation in der Ionosphäre• Erwärmung der Thermosphäre• Ausdehnung der Atmosphäre (→ Widerstand) | <ul style="list-style-type: none">• Zusammenbruch des Stromnetzes• Störung der Navigation (GNSS)• HF-Kommunikation• Beschädigung von Satelliten Hardware• Geänderte Trajektorien |
| Geladene Teilchen → SEPs | <ul style="list-style-type: none">• Ankunft: ca. 15 min – 2 h• Dauer: Stunden bis Tage | <ul style="list-style-type: none">• Erhöhte Strahlungswerte• Erhöhte Ionisation in der Ionosphäre | <ul style="list-style-type: none">• Beschädigung von elektronischen Komponenten• Desorientierung von Satelliten• Instrumentelles-Rauschen• Einschränkungen in der HF-Kommunikation |
| EM-Strahlung → Solar Flares | <ul style="list-style-type: none">• Ankunft: ca. 8,5 min• Dauer: 1 bis 2 Stunden | <ul style="list-style-type: none">• Erwärmung der Thermosphäre | <ul style="list-style-type: none">• HF-Kommunikation• Radar Interferenzen• Kurzwellen Funk schwindet |



5. Continuous Development



- ▶ Radio Frequencies Interference
- ▶ Radiation interaction
- ▶ Interruption of Communications
- ▶ ...





MoD AUT Space Weather Development Plan

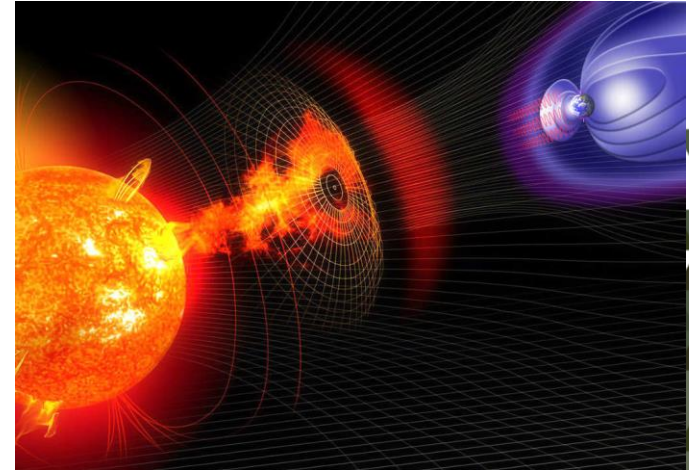
1. Build-up
Knowledge
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2. Establish
Cooperation
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3. Rise
Awareness
for SWE

4. SWE Early
Warning
Demonstrator

5. Continuous
Development





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Questions?

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