

Space Environment Impacts Expert Group (SEIEG) – Minutes and Actions

Friday 26 January 2024, 11:00-16:30

No.	Item		
1.	Welcome, Apologies, Review Agenda		
Key Points			
Attendees:			
Prof Richard Horne	Chair, British Antarctic Survey	Mr David Gibbs (DG)	Civil Aviation Authority
Dr Mike Hapgood	Rutherford Appleton Lab.	Ft Lt Bryn Jones (BJ)	UK Space Operations Centre
Dr Mario Bisi	Rutherford Appleton Lab.	Dr Graham Routledge	Defence, Science and Tech Lab
Dr Jonathan Eastwood	Imperial College London	Dr Rick Tanner (RT)	UK Health Security Agency
Mr Mark Gibbs	Met Office	Dr Mike Willis	UK Space Agency
Simon Machin	Met Office	UK Government representative	DESNZ
Prof Jim Wild	Lancaster University	UK Government representative	DFT
Dr Ciaran Beggan	British Geological Survey		
Prof Paul Cannon	University of Birmingham		
Dr Ellen Clarke	British Geological Survey		
Prof Clive Dyer	University of Surrey		
Dr Sean Elvidge	University of Birmingham		
Dr Lucie Green	University College London		
Prof Cathryn Mitchell	University of Bath		
Prof Huw Morgan	Aberystwyth University		
Prof Keith Ryden	University of Surrey		
Dr Gemma Attrill	Defence, Science and Tech Lab		
<p>This is the first meeting of 2024. The Chair welcomed everyone to the meeting. He thanked Prof Richard Harrison for his work on the committee and welcomed Dr Lucie Green to cover solar aspects now that Richard had retired. The Chair reminded everyone that the committee and its views are independent of Government.</p>			
2.	Items arising from the last meeting		
Key Points			

The Chair confirmed most actions are now closed. The following actions are ongoing:

- David Gibbs to take forward action on discussing MOR forms offline with DfT/CAA.
- The action for recent SSW event slides to be published on the SEIEG website is ongoing.
- The action for the Chair to arrange for someone within the Space Based Solar Power team to present at a SEIEG meeting was delayed until the next meeting.

3. Recent SW events and impacts

Key Points

Simon Machin gave an overview of recent SSW events. These included several X class flares and a strong HF radio blackout on 31 December 2023.

The importance of getting messaging right on space weather events and putting out communications for smaller events to contextualise more severe ones was noted.

It was noted that the GOES16 proton detector is malfunctioning, so the UK is monitoring events at geostationary orbit from a single satellite (GOES 18) at present.

4. Update and discussion on SWIMMR S6 Report

Key Points

Before the presentation on the S6 Rhea report, the Chair noted that SEIEG had not been asked to do a full independent peer review on the report. However, SEIEG members had provided comments on parts of the draft report based on what they could read in the time available. At present there were factual errors in the report that need to be corrected. Only a few high-level comments could be made at this meeting due to time. Matthew Allcock (Rhea) then gave an overview of the report. Alyssa Frayling (Know Space), Gordon Black and Prof J Rae (U of Northumbria) also attended for this item.

It was suggested that the cross-sector section should be put upfront in the report. This is to reflect how complex and interdependent impacts on each sector would be. It was also noted that power and GNSS are both crucial sectors where disruption would affect all sectors.

It was noted that the timeline slide only covers the acute phase of impacts, and that this does not fully capture longer term impacts of a space weather event. It was suggested that a second diagram be added which captures the chronic phase of space weather event impacts over a few years, to help convey the longer-term impacts.

It was noted that the energy section of the report focusses on damage over disruption, and that disruption needs more emphasis since it can be just as problematic.

It was strongly suggested that the recommendations need to be reduced and rewritten, that there is clarity over which stakeholders are responsible for which actions and should follow a common format.

It was felt that the role of GNSS across sectors is underestimated in the report.

It was also suggested that the National Space Strategy should be referenced in the report, as well as working more closely with government departments and involving policy owners for key issues.

The committee strongly supported independent peer review.

The Chair thanked Matt Allcock (Rhea) for being very open and receptive to these suggestions.

5.	Ground-based requirements for Space Weather
<p>Key Points</p> <ul style="list-style-type: none"> . Mike Hapgood provided an update on the current state of play of ground-based requirements for space weather in the UK. . It was highlighted that the real time operation of UK geomagnetic observatories is a consequence of commercial requirements for directional drilling, and as such, space weather may need more funding in the future to continue operations. . The need for a UK Space Weather Operations Requirements document was discussed. The need for a requirements document on solar observations had already been raised in another forum. It was agreed that SEIEG members would support development of ground based requirements with the expectation that the Met Office will set the initial parameters. <p>New Action</p> <p>Mike Hapgood to lead a sub-group to produce a space weather requirements document for ground-based observations.</p>	
6.	Update/developments on GNSS
<p>Key Points</p> <ul style="list-style-type: none"> . Cathryn Mitchell gave a presentation on GNSS. There is a cross-Government initiative to bring together several experts on GNSS to create a framework for resilience, setting out a strategy for Position, Navigation and Timing. The framework is finished but needs to be implemented. . It was noted that as GNSS impacts everything, it is very hard to run tests on disruption. However, tests on removing GPS a ship at sea revealed several unexpected dependencies and highlighted the importance of such tests. . The group discussed using eLoran as a backup system if GNSS was lost. It was generally understood that eLORAN is very robust but the sky wave could be affected by energetic particle precipitation into the D region. 	
7.	Criteria for initiating a severe SW warning
<p>Key Points</p> <ul style="list-style-type: none"> . Lucie Green gave a presentation on solar pre-cursors of a large solar event. This follows previous work by other members of SEIEG. The intention is to find a set of criteria and a more objective way of deciding when to initiate a severe space weather warning. This would be very helpful to the Met Office. . It was noted that this is a very challenging task, but it might be possible to identify a number of key factors and setup a checklist to help decision making. <p>New Action</p> <ul style="list-style-type: none"> • Lucie Green to lead a new sub-group on solar pre-cursors. 	
9.	Key new research papers with impact – short summaries
<p>Key Points</p> <ul style="list-style-type: none"> . Four short summaries of recently published research papers with impact likely were presented. They were: 	

- a. Satellites - Meredith et al. *Space Weather*, (2023)
- b. Railways - Patterson et al. *Nature Sci Reports*, (2023)
- c. Power Grid - Mac Manus et al. *Space Weather*, (2023)
- d. SEP events – Bard et al. *Proc Roy. Soc.*, (2023)

The presentations and links to the papers will be put up on the SEIEG web site.

10.	Review ESWW and note future meetings
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Key Points

- . The group discussed the last ESWW, noting key points from the week.
- . A call was put out for people to run sessions for the next ESWW.
- . Suggested date for next SEIEG meeting was Friday 5 July.

11.	Updates from around the table
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Key Points

- . SEIEG congratulated Ian McCrea on his Service Award by the Royal Astronomical Society for his “invaluable service to the UK and international space weather research community.”

12.	All actions
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- 1) SEIEG to discuss MOR forms offline with DfT/CAA.
- 2) Recent SSW Event slides to be published on SEIEG website.
- 3) The Chair to arrange for someone within the Space Based Solar Power team to present at a SEIEG meeting.
- 4) Mike Hapgood to lead a sub-group to produce a space weather requirements document for ground-based observations.
- 5) Lucie Green to lead a new sub-group on solar pre-cursors.