

Towards an Australian Centre of Excellence in Space Weather

Iver Cairns^{1,2}, David Pontin³, Melanie Johnston-Hollitt⁴, Suelynn Choy⁵, Brad Carter⁶, Andrew Dempster⁷, Jason Held⁸, Michael Wheatland¹, Brett Biddington⁹, Alina Donea¹⁰, Hannah Schunker³, Daniel Baker¹¹, Amal Chandran¹¹, Gary Zank¹², Nick Pogorelov¹², Yu Lin¹³, and the Bid Team

¹ School of Physics, University of Sydney, Sydney, Australia (iver.cairns@sydney.edu.au), ² ARC Training Centre for CubeSats, UAVs, and Their Applications (CUAVA), ³ University of Newcastle, Australia, ⁴ Curtin University, Australia, ⁵ RMIT University, Australia, ⁶ University of Southern Queensland, Australia, ⁷ University of New South Wales, Australia, ⁸ Saber Astronautics (Australia & USA), ⁹ Biddington Research (Australia), ¹⁰ Monash University, Australia, ¹¹ LASP, University of Colorado at Boulder, USA, ¹² CSPAR, University of Alabama at Huntsville, USA, ¹³ Auburn University, USA.

1. Abstract

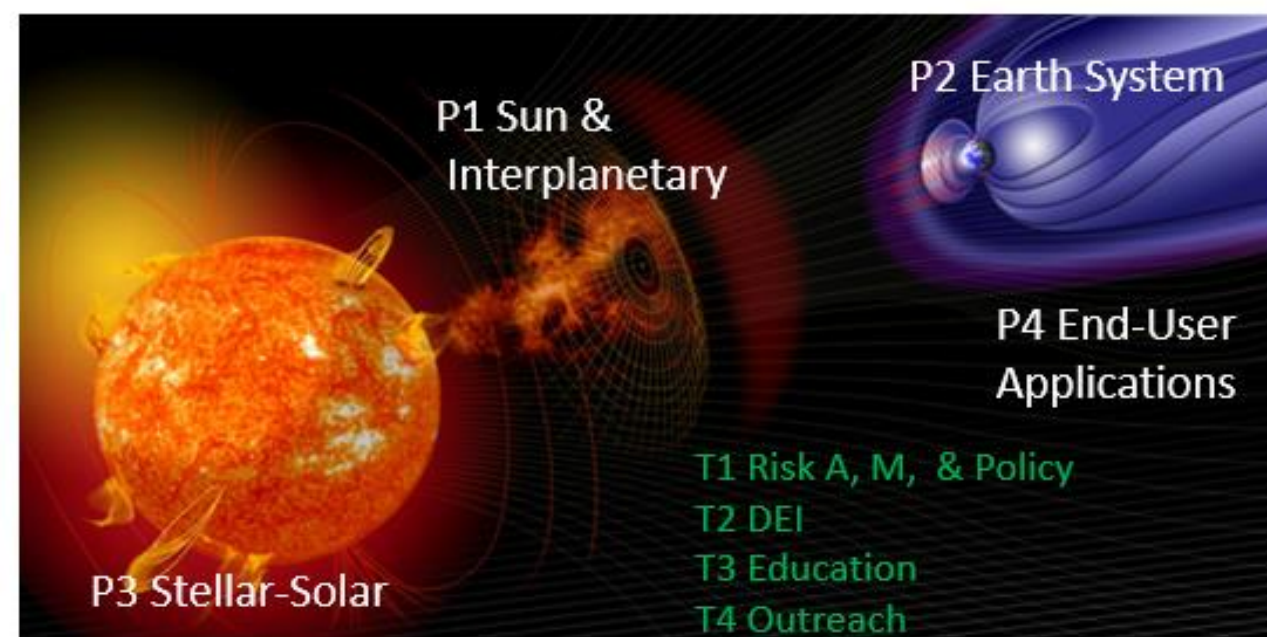
A group of Australian, American, British, Indian, and Japanese colleagues are developing a bid for an Australian-based but internationally linked Centre of Excellence in space weather research. The Centre is intended to be broad and to complement existing international efforts. It currently aims to understand, predict, and verify space weather observationally from the Sun to the ground in time for benefit and mitigation. At the workshop we seek to learn from and of international efforts, identify complementary programs, and find additional partners for mutual benefit.

2. Australian Centre of Excellence Scheme

- 7 years with total ~ AU\$42M = US\$30M (ARC \$5M pa)
- No indirect costs & separate PhD scholarships too.
- Requirements
 - Fundamental / transformational research
 - Truly national but with extensive connections to international Centres
 - Widespread impact and benefit (e.g. end-users)
 - Build sustainable capabilities and community, including DEI & leaders
- Timeline:
 - Expression of Interest due ~ end July 2024
 - Full proposal (~ 15-20% success) ~ March 2025.
 - Interviews ~ Sept 2025
 - Decision ~ November 2025 (~50% full proposals)
 - Start January 2026.

3. Current Approach

- “Quantitatively understand, predict, and verify space weather from the Sun to the ground in time for benefit & mitigation”. [Includes Moon & planets](#)



- Programs = Geography
 - P1 = Sun & Interplanetary
 - P2 = Earth System
 - P3 = Stellar-Solar
 - P4 = End-User Applications
- Cross-cutting Themes = Wider Impacts
 - T1 = Risk Assessment, Management, & Policy
 - T2 = DEI
 - T3 = Education
 - T4 = Outreach
- Theory, simulations, observations, ML/AI →
- **Research & Partner Benefit rather than Operations or RTO.**

4. Current Partners in Bid

Australia:

- **Universities:** U. Sydney, U. Newcastle, RMIT U., Curtin U., U. Southern Queensland, Monash U., Flinders U., U. Tasmania
- **Companies:** Saber Astronautics, Hex20, & Biddington Research
- **Govt Labs:** CSIRO, DSTG

International:

- **Universities:** U. Alabama at Huntsville, Auburn U., U. Colorado Boulder (all USA)
- **Centres:** CSPAR & LASP (USA), BAS & RAL (UK), PRL (India), NICT (Japan)

Still seeking complementary partnerships: NASA CoE and DRIVE Centres, Europe,?

5. Connections & Links

- Interleave Australian and partner expertise to build a timely, complementary, and beneficial program.
- Australia: Natural and historical southern hemisphere foci, uniqueness, capabilities, and interests, incl. **SKA**
- 3D reconnection, flares, CMEs, radio, SEP, & turbulence theory, simulation, & observations
- GNSS, comms, & radar issues (scintillations, fade-outs etc), power grid, satellite ops / issues / orbits,
- Stellar extreme events, likelihoods, and implications
- 4D ionosphere:
- 4D interplanetary:
- Ionosphere-focused smallsat constellation