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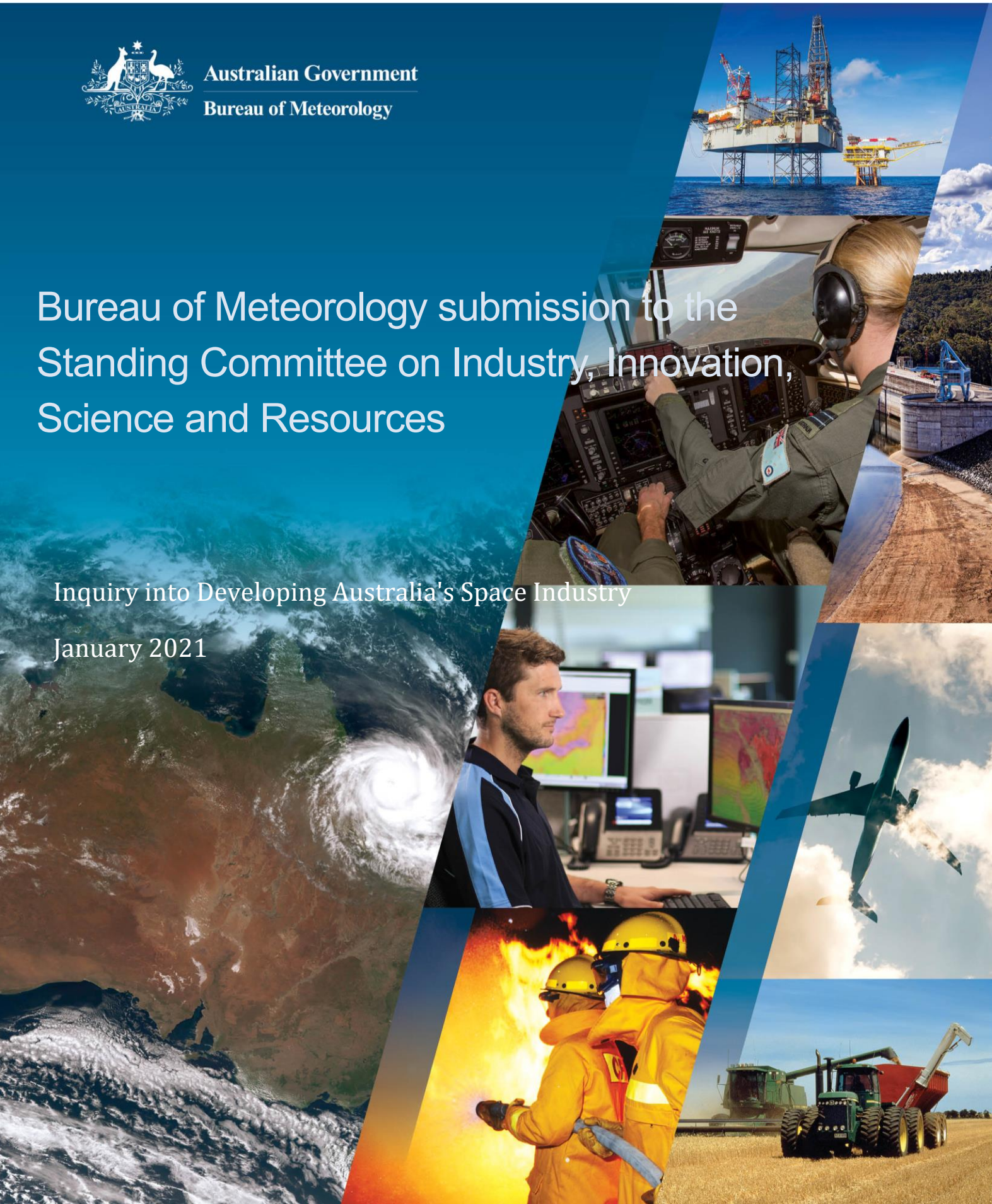


Australian Government
Bureau of Meteorology

Bureau of Meteorology submission to the Standing Committee on Industry, Innovation, Science and Resources

Inquiry into Developing Australia's Space Industry

January 2021



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Bureau of Meteorology Submission to the Standing Committee on Industry, Innovation, Science and Resources' Inquiry into Developing Australia's Space Industry

The Bureau of Meteorology (the Bureau) welcomes the opportunity to make a submission to the Standing Committee on Industry, Innovation, Science and Resources.

The Bureau's submission provides:

1. an overview about the Bureau of Meteorology and its role in Australia's space industry
2. a response to the following parts of the inquiry's terms of reference:
 - development of space satellites, technology and equipment
 - international collaboration, engagement and missions
 - commercialisation of research and development, including flow on benefits to other industry sectors.

In summary:

- The Bureau's Space Weather Service makes a significant and tangible contribution to the security of the Australian space industry through the prediction and forecasting of space weather.
- The Bureau provides forecasts, warnings, and alerts to protect Australian communications satellites, contributing to the security of the Australian space industry.
- The Bureau depends heavily on Earth observations from satellites to predict the weather. Australia does not own or operate Earth Observation (EO) satellites and relies on foreign-owned satellites for these observations. China, Japan, United States, Europe and Korea are among the key owners and operators of satellites that the Bureau relies on, and there is no guarantee that access to satellite data will continue in the long term.
- Developing a sovereign Australian EO satellite capability would assist in guaranteeing long-term access to meteorological observations from space and reduce the risk of losing free and open access to critical satellite data streams required for weather forecasting.
- International collaboration is crucial to meteorology and Australia is an active contributor to the international space and space weather community. Growth in the Australian space industry may offer additional opportunities to benefit from international collaborations.
- The Bureau contributes to the development of space research and commercialisation through collaboration with private and public sector entities and is continuing to maximise engagement opportunities through contributions to the development of the Australian Government Satellite Earth Observational Roadmap and colocation with the Australian space industry at Lot Fourteen in Adelaide.

The Bureau welcomes the opportunity to further discuss its involvement in Australia's space industry, and future opportunities to work collaboratively with Government agencies, industry, and research organisations in developing Australia's space industry.

The Bureau of Meteorology

- The Bureau provides forecasts, warnings, and alerts to protect Australian communications satellites, contributing to the security of the Australian space industry.

The Bureau is Australia's national weather, climate and water information agency. It operates under the authority of the *Meteorology Act 1955* and the *Water Act 2007*, which together describe a range of functions that underpin delivery of information, advice, forecasts, warnings and associated services to meet Australia's needs.

The Bureau is an Executive Agency under the *Public Service Act 1999*, and a non-corporate Commonwealth entity under the *Public Governance, Performance and Accountability Act 2013*. The Bureau operates under the Agriculture, Water and the Environment portfolio and reports to the Minister for the Environment generally, and to the Minister for Resources, Water and Northern Australia on water matters. The Bureau also provides weather, climate and water information to the Minister for Agriculture, Drought and Emergency Management.

The Bureau makes substantial use of Earth observations from space for its data and services to deliver improved economic, safety and security outcomes for Australia. The Bureau's Space Weather Service makes a significant and tangible contribution to the security of the Australian space industry through the prediction and forecasting of space weather.

The Bureau broadly engages with the space industry in two ways:

1. utilising foreign satellites to conduct earth observations to predict the weather, and
2. providing forecasts, warnings, and alerts to protect Australian communications satellites.

Response to inquiry terms of reference

Development of space satellites, technology and equipment

- The Bureau depends heavily on Earth observations from satellites to predict the weather. Australia does not own or operate satellites and relies on foreign-owned satellites for these observations. China, Japan, United States, Europe and Korea are among the key owners and operators of satellites that the Bureau relies on, and there is no guarantee that access to satellite data will continue in the long term.
- Developing a sovereign Australian EO satellite capability would assist in guaranteeing long-term access to meteorological observations from space and reduce the risk of losing free and open access to critical satellite data streams required for weather forecasting.

Usage and Value

The Bureau has been a substantial user of Earth observations from space for several decades, and this continues to grow at a significant pace. The Bureau currently assimilates data from over 30 satellites into weather prediction and visualisation systems every day. This is crucial for the provision of weather forecasts and warnings across Australia and beyond, to support both national commitments for safety and security specified in the *Meteorology Act 1955*, and global commitments such as international data exchange.

Over the next decade, data volumes are predicted to increase by a factor of 30 – 50 with the development of next generation meteorological sensors that more accurately measure phenomena in the atmosphere, on land and at the sea surface. Observations from these types of sensors have the greatest impact of any other type of weather observation (for example, from an automatic weather station) on forecast accuracy.

The value of Earth observations from space was demonstrated during the devastating 2019-20 Black Summer bushfires. In addition to the extensive routine satellite data the Bureau already accesses from several foreign satellites, the Japan Meteorological Agency (JMA) and the Korea Meteorological Administration (KMA) generously provided additional rapid-update satellite data from their geostationary satellites. This data provided valuable intelligence for forecasters, allowing them to better pinpoint the location of fires and identify smoke plumes in near real time. Access to data from foreign owned satellites depends on capacity of foreign meteorological services and may not always be assured.

Safe operation of satellites in space

In addition to utilising observations captured by satellites, the Bureau also provides forecasts, warnings and alerts to Australian communications satellites. Satellites are particularly vulnerable to the effects of space weather produced by the Sun, which can result in system failure. It has been estimated that the impact of severe space weather events on satellites could cost up to \$90 billion (globally) from lost revenue and satellite replacement if a solar superstorm event occurred today.

The Bureau's Space Weather Service, through its forecasts, warnings and alerts for space weather events, can contribute to delivering improved economic, safety and security outcomes to the Australian space industry. In collaboration with research organisations other government agencies, including the Australian Space Agency and the Department of Defence, can contribute to:

- improving satellite resilience
- improved system design
- input/advice for space craft design
- increased mission success (launch, in-orbit)
- improved Space Situational Awareness capabilities.

Reliance on foreign-owned satellites

Despite its heavy reliance on satellite-derived Earth observations, Australia does not own or operate EO satellites. All satellite data used by the Bureau is received from international partners, including China, Japan, Korea, United States, and Europe, who share the data freely and openly under World Meteorological Organization (WMO) Resolution 40 (discussed further below). This arrangement has worked well but access to this data is not guaranteed into the future. In recent years there has been an exponential growth in commercial satellite data providers offering new business models, resulting in potential threats and opportunities in the space industry. In the future, this may pose a risk to the volume of data the Bureau can access if current arrangements for the free and open exchange of international satellite data are reduced.

A sovereign satellite capability

Given that the Bureau is wholly dependent on satellite data produced by other countries, Australia would benefit from developing some level of sovereign EO satellite capability. This would mitigate risks related to the supply of critical meteorological data in an evolving geopolitical landscape.

Data security would also be ensured by enhanced and coordinated Australian contributions to the international meteorological satellite community, through partnerships in international satellite missions, and by sharing data and science from Australian made and operated satellite missions.

This provides an opportunity for the Australian space industry to design, develop and manufacture sensors to meet the future needs of the Bureau's forecast and warning systems, and those of the international meteorological community. The Bureau can support the Australian space industry

through requirements specification, research and development, assisting the calibration and validation of instruments, and data distribution.

Benefits to Australia

Developing a sovereign EO satellite capability would bring benefits to the Australian space industry including the development of Australian made technology that is designed for the unique geographic, environment and climate of Australia. This could result in enhanced weather and climate services for the Australian community, industries, national security, and regional partners. Australian industry would build expertise and capability in technologies that could be exported globally and applied to future outer space activities. Data from an Australian owned EO satellite could be shared globally with international partners and assist Australia in meeting data sharing requirements under WMO commitments and bilateral agreements.

International collaboration, engagement and missions

- International collaboration is crucial to meteorology and Australia is an active contributor to the international space and space weather community. Growth in the Australian space industry may offer additional opportunities to benefit from international collaboration.

International collaboration in meteorology is crucial, as no single country alone can sufficiently observe and understand the whole Earth system to deliver accurate weather and climate services. As noted earlier, the Bureau has several bilateral agreements with counterpart national meteorological agencies and international satellite data providers to obtain access to the satellite data required to support the Bureau's weather forecast and warning services. The Bureau also co-chairs the Meteorology Five Eyes Community of Practice in which it addresses the effects of space weather on key defence operations.

Australia is an active, visible and influential member of the WMO. Under WMO's Resolution 40, Australia benefits from the free and open exchange of satellite data from WMO members and the Bureau contributes observations to member countries. Through WMO, the Bureau actively supports meteorological agencies within the South-west Pacific region to improve their capability in satellite data utilisation through technical engagement on collaborative projects, discussion and the provision of training. Bureau staff also participate in international science teams that seek to improve meteorological satellite missions and data.

The development of an Australian space industry offers new opportunities for engagement in the international meteorological satellite community, including potential future partnerships in satellite capabilities. The benefits to Australia would include secured access to data from these missions in the future, a strengthened relationship with key international partners, and an opportunity for the Australian space industry to develop technology to benefit the international meteorological community.

Commercialisation of research and development, including flow on benefits to other industry sectors

- The Bureau contributes to the development of space research and commercialisation through collaboration with private and public sector entities and is continuing to maximise engagement opportunities through contributions to the development of the Australian Government Satellite Earth Observational Roadmap and colocation with the Australian space industry at Lot Fourteen in Adelaide.

The Bureau's Space Weather Service supports several industry sectors. For example, the Bureau works closely with industries and operations exposed to space weather risk and tailors space weather forecasts and warnings to their specific needs. This includes industry sectors that rely on space-based technologies, such as mining and resources, communications, agriculture, and environmental sectors.

The Bureau contributes to the operationalisation of space research in support of key Australian industry sectors such as aviation, defence, energy, the community, and space. Given that space weather can pose a serious threat to increasingly complex communications and technology systems that industries rely on, bespoke operationalised products and services can directly increase the resilience and operational effectiveness of these industry sectors.

The Bureau works with national organisations and research institutions (for example Saber Astronautics and the Australian National University) as well as international agencies and organisations such as NOAA and the National Aeronautics and Space Administration to assist in the developing and operationalising space weather research.

The Bureau also works across Government with the Australian Space Agency, CSIRO and Geoscience Australia to contribute to the development of space research and development. For example, the Bureau is collaborating with the Australian Space Agency to develop the Earth Observation Roadmap, with the objective to help build the Australian space industry in areas that meet Government, research, and industry needs. It will help identify future opportunities where the Bureau can support the space industry, improve access to space technologies that enhance the Bureau's services, reduce reliance on external organisations, and strengthen Australia's sovereign capabilities.

The Bureau has also undertaken steps to maximise engagement opportunities with the space industry and the Australian Space Agency by creating a Space Industry Lead role based at Lot Fourteen in Adelaide, South Australia. Colocation with Australian space industry public and private sector partners will facilitate opportunities to increase development and commercialisation of products and services to support the Australian space industry.