



**SHOAL**™

# **DEVELOPING AUSTRALIA'S SPACE INDUSTRY**

## **HOUSE OF REPRESENTATIVES INQUIRY**

***SUBMISSION TO THE STANDING COMMITTEE ON  
INDUSTRY, INNOVATION, SCIENCE AND RESOURCES***

### **RELATIONSHIP BETWEEN SPACE INDUSTRY CAPABILITY AND NATIONAL RESILIENCE**

***PREPARED BY***

***Graeme Dunk, Head of Strategy***

***SHOAL-REPORT-017-2021-S002***

***ISSUED 29 JANUARY 2021***



**SHOAL**™

+61 2 6239 4288  
[shoalgroup.com](http://shoalgroup.com)

PO Box 7038 Hutt Street  
SA 5000 AUSTRALIA

Shoal Group Pty Ltd  
ABN 49 604 474 204





**ISO 9001 QUALITY  
Certified System**

Provider of systems thinking, engineering, and research; complex systems design; asset management systems design; modelling, simulation, and analysis; strategic and operational analysis; tender support services; and related professional services.

**COPYRIGHT NOTICE**

This material has been copied and communicated to you by or on behalf of Shoal Group Pty Ltd pursuant to Part VB of the Commonwealth of Australia Copyright Act 1968 ('the Act'). The material in this communication may be subject to copyright under the Act. Any further reproduction or communication of this material to you may be the subject of copyright protection under the Act.

**DO NOT REMOVE THIS NOTICE**

## **PREFACE**

The House of Representatives Standing Committee on Industry, Innovation, Science and Resources has invited interested persons and organisations to make a submission to their inquiry into developing Australia's space industry

This submission focuses primarily on the relationship between space industry capability and national resilience.

## CONTENTS

PREFACE	3
CONTENTS	4
1 INTRODUCTION	5
1.1 INQUIRY TERMS OF REFERENCE	5
1.2 SUBMISSION FOCUS AND CONTEXT	5
2 INQUIRY RESPONSE AND RECOMMENDATIONS	6
2.1 WHAT IS NATIONAL RESILIENCE?	6
2.2 SPACE, DECISION FRAMEWORKS AND NATIONAL RESILIENCE	6
3 RECOMMENDATIONS	8

# 1 INTRODUCTION

## 1.1 Inquiry Terms of Reference

The Minister for Industry, Science and Technology, the Honourable Karen Andrews MP, asked the House of Representatives Standing Committee on Industry, Innovation, Science and Resources ('the Committee') to inquire into and report on developing Australia's space industry per the following Terms of Reference:

*"The House of Representatives Standing Committee on Industry, Innovation, Science and Resources inquire into and report on developing Australia's space industry, including:*

- *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;*
- *Future research capacity, workforce development and job creation; and*
- *Other related matters.*

*The Committee will focus on how the Australian Government can support and encourage the space industry while preserving and protecting the space environment."*

## 1.2 Submission focus and context

The national space capability, and by extension the Australian space industry, has two separate foci, namely:

- Economic activity and contribution to Australian exports, and
- National resilience and security.

This submission focuses primarily on the relationship between space industry capability and national resilience.

This submission is supplementary to an earlier Shoal submission to the Committee (SHOAL-REPORT-658-2020-S002) that focused on economic activity and the contribution to Australian export matters affecting the development of the Australian space industry.

This submission is also consistent with submissions made by Shoal to the inquiry conducted by the Senate Select Committee on COVID-19, and to the Joint Standing Committee on Foreign Affairs, Defence and Trade Inquiry into the implications of the COVID-19 pandemic for Australia's foreign affairs, defence and trade. These submissions emphasised the importance of a national approach to the development of national resilience, and hence focused on the mitigation of risk.

## 2 INQUIRY RESPONSE

### 2.1 What is national resilience?

Earlier Shoal submissions to parliamentary inquiries have highlighted the following factors, drawn from a [NATO policy on a resilient society](#), as being the key pillars of resilience, namely:

- Continuity of **government** – requires the ability to choose and to conduct free and fair elections
- A capable and functional **defence force** – necessary for deterrence and for defence. In turn, this depends on defence industry capabilities.
- Provision of **energy** in a reliable and sustainable manner
- A capable and functioning **health** system
- Ongoing provision of **food** and **water**
- A functioning **telecommunications** network, with a high level of **cyber protection**
- Robust **transportation** systems.

The *Security Legislation Amendment (Critical Infrastructure) Bill 2020* nominates a wider set of activities as being critical that generally map onto the list above, with the addition of activities in the following sectors:

- Data storage and processing
- Financial services and markets
- Higher education and research
- Space technology.

The space industry can therefore be considered as a critical enabler for resilience and having extensive inputs into other industry sectors. A similar observation was made by **Dr Megan Clark AC**, the founding Head of the Australian Space Agency, in her introduction to the [Advancing Space. Communications Technologies and Services – Roadmap 2021-2030](#) when she wrote:

*Space technologies and services touch virtually every sector of the Australian economy. Space capabilities are drawn on by Australian farmers to monitor the health of their crops, by marine pilots to guide cruise liners, by emergency workers to plan and respond to bushfires, and by scientists to study the effects and impact of droughts. When positioned alongside other core industries like manufacturing, resources and agriculture, space is also an enabler of industry growth and will help Australia's economy emerge out of the COVID-19 pandemic.*

This submission, therefore, predominantly addresses the *Other Related Matters* section of the Terms of Reference but has relevance to commercialisation and industry benefits.

### 2.2 Space, decision frameworks and National Resilience

Space is an integral part of many aspects of Australian society. Improvements in space-related capabilities are expected to have commensurate benefits for these industry sectors, and potentially in yet to be identified areas. Conversely, the restriction of access to space,

either through active intervention or through industrial or legal restriction, is likely to have a deleterious effect on industrial activities and on the general functioning of society across the areas of national resilience identified above.

Understanding the relationships of the space capabilities and technologies with other sectors across the Australian society will illuminate the ways in which the space sector interacts with these other sectors and will, therefore, serve as a guide to the optimum way in which the Government can support such development.

With such a high level of complexity across the Australian society, and when considering each element of critical infrastructure as a system within a system, a methodological approach to developing a Resilience Framework develops from a Systems Thinking perspective. Systems Thinking, and the range of associated methodologies, tools and frameworks, provide an insight into how a Resilience Framework can both be constructed and applied in practice.

Decision Frameworks are diverse and vary in their application and, at their core, are designed to facilitate robust and contestable decisions. They include aspects such as problem definition, strategic goals, planning and observations, and provide a conceptual, or abstracted view, of the issues and insights that inform decision making. Structuring, or codifying these conceptual and integrated aspects, provides a richer picture to the decision maker.

Decision Frameworks give structure to the information, integrating multi-disciplinary domain knowledge, thereby enhancing the understanding in the decision maker. Decision Frameworks, based on systems thinking, support policymakers to understand the multi-domain and interrelated consequences. At Shoal, we employ model-based frameworks to improve our designing of resilient and elegant solutions to complex problems, whether they are physical, organisational, or societal. They provide us with three main outcomes:

1. They facilitate the exploration of options and capture decisions, with rationale
2. They integrate information from across multi-disciplinary domains
3. They enhance our knowledge transfer, providing a current and common understanding such that the knowledge from the mind of the producer (analyst) can be easily transferred to the mind of the consumer (decision maker).

Decisions Frameworks have common principles, processes, and practices that enable information and analysis to inform decisions. They identify the problem, support the capture and analysis of information, and build the knowledge towards informing decisions across all aspects of society. If we are to develop a Resilience Framework for the protection of critical infrastructure, we must capture the relationships between the various components within society in order that the most effective decisions can be made. A well-structured, model-based decision framework (derived from systems thinking) can allow us to achieve this and deliver the robust and contestable decisions we need.

Understanding the relationships between space-related activities and critical infrastructure protection is one example where national resilience can be enhanced through an improved understanding of the impact of space applications and technologies.

A model-based decision framework will enable better decision making by providing a structure and hence bringing clarity to the interconnectedness of cross domain problems and solutions. This is even more important for decisions around building resilience, where Government investment is required, and funding will be finite. It will deliver a 'rich picture' of an appropriate sub-set of information to the decision makers providing the digital thread of rationale that realise contestable decisions. We will know the impact of a 'shock' on the system, because the model will draw the digital thread of *cause* and *effect* throughout the system, and the '*system of systems*' in which it lives; that is, the relationship between the infrastructure sectors identified by the Government.

A national resilience model would build on existing regulatory frameworks and consider the relationships between them. The model would ensure that any inconsistencies are identified and hence able to be resolved. The model will not result in multiple duplicates of the same information as a single point of truth would be developed.

A model can be as broad and as detailed as required for particular circumstances or in specific areas. A model that incorporates high fidelity data in one area, for example space, with lower fidelity in another, for example energy, is possible. Additional sectors and/or higher fidelity information can be added as it is required or becomes available. Modelling will enable better decision-making in a highly complex environment as the relationships and dependencies can be modelled, and a single point of truth can be developed.

## 2.3 Conclusions

Space is an important sector to the functioning of the Australian society, and to a national resilience posture.

Understanding the way that the space sector supports, facilitates, and enables other key sectors within the Australian economy is critical for understanding consequences of actions undertaken *in* and *for* the sector, from both a benefit and risk standpoint. Modelling can be used to illustrate the flow on benefits of investing in certain areas, such as space technology, and equally show how shocks to the overall system may manifest.

The development of a model-based national resilience framework can provide the basis for this understanding - for planning, policy, funding and risk mitigation strategies - and for subsequent decision-making.

## 3 RECOMMENDATIONS

The following recommendations are made for consideration by the Committee:

**Recommendation 1:** That Government implement a specific policy to address national resilience, including the space component.

**Recommendation 2:** That Government investigate the benefits of developing a model-based national resilience framework, including the space component.

**Recommendation 3:** That, assuming that the benefits of a model-based national resilience framework are accepted, Government commence the process to incrementally develop such a framework.