

Submission

2016 National Research Infrastructure Roadmap Capability Issues Paper

Name	Phil R. Cummins
Title/role	Prof. Natural Hazards
Organisation	Research School of Earth Sciences, Australian National University

Other comments

In this submission I suggest that the 2016 National Research Infrastructure Roadmap consider a broad view of international engagement. According to the Issues Paper (IP), “National research infrastructure comprises the assets, facilities and services to support research that drives leading-edge innovation in Australia”. While this definition is usually taken to mean infrastructure physically located and used within Australia, the IP is far-sighted in recognising the increasingly important need for Australian researchers to access international research infrastructure. However, the IP restricts consideration to how the two alternatives, of Australia either developing its own infrastructure or accessing international infrastructure, might benefit Australia. The 2016 Roadmap could also consider how joint development and management of international infrastructure might be mutually beneficial to both Australia and its international partners.

The case for joint development and management of research infrastructure is particularly compelling for the earth and environmental sciences, especially in the context of fostering leading edge, collaborative research between Australia and Indonesia. This submission makes the case that important benefits would accrue to both Indonesian and Australian earth science communities from infrastructure in the form of a geophysical instrument pool based in Indonesia and co-managed by Australia and Indonesia, that would support collaborative studies in earth and environmental sciences.

Background

Australian earth science is now at the forefront of international geoscience and geospatial research thanks in large part to AuScope, established in 2007 by NCRIS. AuScope aims to help build Australia’s wealth through supporting the discovery, development and management of natural resources, and to contribute to the management of natural hazards for both Australia and our immediate neighbours. AuScope does this by developing new baseline data on the physical state of the Australian continental crust. AuScope was also an important milestone in that it was the first truly national collaborative infrastructure program in the history of Australian earth science, and many valuable lessons were learned about governance and management of such a complex, collaborative infrastructure project.

Although Auscope has made tremendous progress in imaging and understanding the Australian continent, it can be argued that further progress will be hampered unless AuScope extends its scope beyond the Australian continent to the active tectonic plate boundaries surrounding it. These plate boundaries are the sources of the forces that generate the stress field that permeates the Australian continent, causing faults to rupture in earthquakes and influencing our ability to recover resources (and sequester carbon). Also, these plate boundaries are where the geologic processes that formed the Australian continent are still active, and they are best studied *in situ*. One of the best ways to capitalise on the benefits AuScope brings to Australian earth sciences will be to extend its reach to the tectonically active regions surrounding Australia.

In addition to being one of Australia’s most important trading and security partners, Indonesia is a natural laboratory for active tectonics. It encompasses over 18,000 km of major tectonic plate boundary, more than twice that of Japan or Papua New Guinea, including sections that have some

of the world's largest earthquakes and volcanic eruptions. Such events, when combined with often dense and very vulnerable populations, result in some of the most catastrophic natural disasters: the Indian Ocean tsunami of 2004 resulted in over 220,000 deaths, and even in 1815 the Tambora eruption killed 71,000. Australia is not immune from the effects of these disasters; Australia pays a high cost in direct contributions to humanitarian relief, but they also erode progress made in Australia's development aid program to Indonesia. Finally, as a major destination for Australian tourism, it can be argued that in terms of fatalities the hotspot for Australian geohazard risk lies not in Australia at all, but in Indonesia.

At the same time, the economic growth that has accompanied Indonesia's emergence at the turn of the 21st century as the world's 3rd largest stable democracy, means that Indonesia is poised to make important strides in the development of its science and education, and its management of natural disasters. Since the 2004 Indian Ocean tsunami, Indonesia has developed sophisticated national networks for geophysical and environmental monitoring. It has over 3,000 universities and 400 research institutions, educates 5 million university students, and has recently established the Indonesia Science Fund that earmarks US\$60 million a year for science and technology research. This makes Indonesia a viable partner for Australian earth science research.

An Australian-Indonesian Earth Imaging Facility

Earth imaging facilities have led to tremendous advances in earth sciences worldwide. In addition to Auscope, the US National Science Foundation's (NSF) Earthscope program deploys thousands of seismic, GPS, and other geophysical instruments to study the structure of the North American continent and the processes that cause earthquakes and volcanic eruptions, and similar networks have been deployed in Japan and Europe. Programs like AuScope and Earthscope have spurred important advances in our understanding of earth structure and tectonic processes, and these have led to important social and economic benefits through improved management of resources and natural hazards. These programs have also been important in bringing research communities together to work towards a common goal. Finally, they have also been very highly successful vehicles for outreach, with the Australian Seismometers in Schools program bringing state-of-the-art seismology to over 54 primary schools Australia-wide, and the Earthscope outreach program running numerous seminar programs and workshops for primary schools.

This submission suggests that the 2016 Roadmap consider an earth imaging infrastructure program be developed jointly between Australia and Indonesia. Such a program might consist of a pool of 250 seismometers for passive and active seismic experiments, 50 GPS receiver/antenna sets for monitoring of crustal deformation, and 20 infrasound instruments for the study of volcanic activity. A rolling deployment of these instruments throughout the Indonesian archipelago, undertaken over a period of 5 years, would realise a quantum leap in our understanding of the crustal structure of Indonesia, lead to a completely new picture of the crustal strain signatures from both known and unknown earthquake faults, and help develop new models for the eruptive potential of the 140 active volcanoes in Indonesia. The imaging of crustal structure would be a boon to resource exploration in Indonesia, in which Australian companies are heavily invested. The improved understanding of the potential for destructive earthquakes, tsunamis and volcanic eruptions, would be help of immense social value because it would enable disaster managers to make evidence-based decisions on disaster mitigation – decisions that will potentially save the lives of Australian visitors to Indonesia.

In addition to these social and economic benefits, such an instrument pool will act as a crucible for the forging of collaborative ties between Australian and Indonesian earth scientists. It will open a whole suite of opportunities for Australian and Indonesian earth scientists to study of some of the world's most intense tectonic activity on the planet, and these opportunities will inevitably lead to much stronger educational links between Australian and Indonesian earth science institutions. It also provides an excellent opportunity for Indonesian earth scientists to benefit from the experience their Australian colleagues have gained in the governance and day-to-day management of collaborative research facility as complex as AusScope.