2016 National Research Infrastructure Roadmap
Capability Issues Paper

Name	**Professor David Young**
Title/role	**Professor**
Organisation	**The University of New South Wales**

Thank you for the opportunity to respond to the 2016 National Research Infrastructure Roadmap Capability Issues Paper. As a research group leader working on ARC-funded research to combat metal corrosion in industry settings, I depend on access to state of the art research instrumentation. Specifically, in the coming years I will require access to advanced atomic scale microscopy tools, including aberration-corrected transmission electron microscopy and atom probe tomography. For the sake of brevity, I have answered only the questions I consider relevant to my specific research field, below.

Advanced Physics, Chemistry, Mathematics and Materials

Question 21: Are the identified emerging directions and research infrastructure capabilities for Advanced Physics, Chemistry, Mathematics and Materials right? Are there any missing or additional needed?

It concerns me that there are essential emerging technology areas that have not been mentioned in the capability issues paper. These include new generation aberration-corrected transmission electron microscopy, atom probe microscopy and new-generation high sensitivity microanalytical tools. These technologies are not currently available to all researchers who require them in Australia.

In the coming years, access to these instruments will be essential for materials scientists, condensed matter physicists, chemists and biomedical engineers across Australia. The high-end instruments can cost up to $10 million, and are beyond the scope of normal University or ARC investment.

To provide Australia's researchers with access to these facilities, a strategic and national approach is needed. It would be a highly ineffective use of taxpayer's dollars for each institution to compete to provide their researchers with the best possible infrastructure, leading to widespread duplication of resources. Mid-range machines, supported through institutional investment, can be located across the country and used to collect data that is of high quality, but perhaps not at the maximum possible resolution. Samples that are identified as requiring high-resolution information and of suitable quality would then be analysed at centrally located flagship facilities supported by NCRIS.

The Australian Microscopy and Microanalysis Research Facility is experienced in operating national microscopy facilities according to such a model. I understand that they are developing a business case to bring the latest microscopy instrumentation to Australia.

My own research is in the field of corrosion, specifically high-temperature alloy-gas interactions. New energy technologies are proposed to use carbon-rich, high temperature environments, and it is essential that we understand the unusual corrosion of alloys exposed to these conditions. This is necessary in order to efficiently design these systems, and prevent disasters. My ARC-funded research on this topic has benefited enormously from access to the atom probe flagship instrumentation available at the University of Sydney. It has enabled the dissection at an atomic scale of aspects of the corrosion reaction mechanism.

Without the AMMRF, I would not have had access to this technology. New-generation instruments have high-efficiency detectors, and will improve the yield, providing accurate and quantitative data that can be compared to thermodynamic model predictions. I sincerely hope that NCRIS will provide access to this instrumentation. It has certainly been my expectation in applying for ARC support that I would have continuing access to state-of-the-art research infrastructure for my ongoing work.