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### **WG3.3 Industry Engagement Review Final Report**

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#### **Executive Summary**

Recognizing the benefits which industry engagement can bring, WG3.3 sets out recommendations that we believe will foster improved industry – institution relationships, to better exploit the benefits from emergent technologies from improved industrial (commercial) knowledge and insight. The previous decadal review set a great ambition to ‘engage’ with industry. In our work we reviewed how successful this engagement has been, in order to determine our recommendations for the challenges of the coming decade.

The efforts of the past ten years provide a number of case studies of varying success, providing important guidance to where our effort should now be directed. In our review we also considered afresh how the community should develop industry engagement expertise and practice to the benefit of both parties – institutional/astronomy and commerce (industry).

The foreseen range of projects demand more mature, informed, and sophisticated approaches to industry engagement by the Australian Astronomy community than in the past. Some mega-projects are already within our horizon – e.g. GMT, SKA, and possible ESO membership, the latter bringing its own framework for engagement. Moreover, we reasonably expect that further opportunities will emerge over the course of the decade. However the landscape is not only about international mega-projects - well-executed industry engagement would also bring benefits to our smaller-scale projects.

We conclude that better industry engagement will not happen simply from being written into a plan. Our recommendations are that a substantial coordinated effort needs to be directed towards two new strategic actions. These must be endorsed and led by the NCA, harnessing expertise and resources (including funding) from the wider community to succeed. These actions encompass developing appropriate commercial (professional) skills, within our community via close interaction with industry-based personnel, through to developing practical mega-project execution processes. We believe that these actions will significantly improve Australia’s astronomical community’s expertise and effectiveness in the sphere of industry engagement and thereby deliver benefits to all parties.

*We note that feedback from WG3.1’s Demographic survey (Institutional industry engagement questions) was received on 27 June 2014. This was of variable, and generally of very low, quality. On review we note that this input has no effect on our conclusions.*

### **WG3.3 Review of Astronomy developments – the industry engagement challenge**

WG3.3 comprises an Executive Group of eight members, each of whom draws on their significant expertise with industry engagement issues along with good networks throughout, and external to, the Australian astronomical community. Our review also benefited from multiple discussion sessions at the Astronomy Decadal Plan Town Halls, plus a special external-partner workshop at ANU. Details are given in the Appendices. In this section we summarise our main findings.

In reviewing the principal projects on the (astronomical) horizon as well as past experience, we considered the type of engagement that would best benefit Australian Astronomy in the future, being cognisant of:

- nature of projects (international & very large; national)
- Australian level of participation
- Outcomes from the various engagements of the last 10 years
- Other nations, subject matter and projects' experiences.

More discussion of these points can be found in the material presented in the appendices. There are two key issues we identified across this review:

1. There are two different cultures involved in most astronomy-industry interactions; the commercial, and our own 'native/academic' view of the world. It is clear that a far more disciplined approach is required by astronomy to fully realise successful engagement in the upcoming decade. This is particularly true given the long gestation times for projects such as the SKA where there is a long-held promise of sizable contracts and open tendering processes. This cultural divide appears to be most successfully broken in the Gravitational Wave group where the team benefits from many years of partnerships, spin-out and tangible outcomes.

2. There are frequent perceptions across the research communities that industry should be used to do more simple "dirty" tasks and that the noble (i.e. innovative) work can only occur within the academic communities. In contrast, the perception from the industry side is that the research community is unwilling or unable to define nor deliver technological outcomes within time, cost and schedule constraints and would rather meander towards hazy success criteria.

These two issues highlight perceptions that are both simultaneously correct and false by varying degree – in any case the onus is on the astronomical community to improve our approaches and professionalism. Coupled with the fact that most astronomical developments are unique endeavours and built at the cutting-edge of technology capability, they encompass a level of risk and scalability that is unpalatable for commercial investors. Fortunately the latter point is tacitly underwritten within the academic/institutional environment of soft-money grants. Moreover, while some components of astronomical instrumentation remain truly bespoke, significant parts of the systems are increasingly built from COTS (commercial off-the-shelf) parts - and be rigorously integrated and/or engineered - to achieve the required cost-performance demands.

We conclude that a critical success factor is to ensure we build *trusted* relationships (profitable alliances rather than competition-based transactions) with industry: This is not a 'one-way' Astronomy benefit exercise. In the past decade, Australian astronomy can point to a number of successes and failures in the industry engagement space (see appendices). However in the 2016-2025 decade we foresee that mega-projects will demand skills, expertise and technologies beyond our current capabilities.

## 2016-2025 Astronomy's landscape & opportunities

Anticipating that many other parts of the Decadal review discuss upcoming projects in detail, we summarise those where significant industry opportunities currently lie –

*1 = high level, 2 = moderate level, 3 = low level*

	Optical (visible & IR)	Radio (microwave and lower)	Other wavebands (terahertz band, frequencies above UV & non-EM)
Industry only design & supply (stock item, or contracted product)	3	3	3
Collaborative research & design (at risk)	3	3	3
Collaborative research & design (paid contract)	2	1	1

Over the next decade, we foresee that these relationships are likely to transition to those shown below which have much higher industry engagement potential;

*1 = high level, 2 = moderate level, 3 = low level*

	Optical	Radio	Other wavebands
Industry only design & supply (stock item, or contracted product)	2	1	3
Collaborative research & design (at risk)	2	2	3
Collaborative research & design (paid contract)	2	1	2

*Note that this analysis does not assume that Australia will join ESO. Membership would add another increment to the entries in this table.*

### WG3.3 Review Actions

We have determined the five action points listed below are the key to developing our industry engagement over the next decade. These five points were discussed and strongly endorsed at all of the Town Hall meetings and at the ASA discussion on 22 July 2014. We note potential linkages with other Decadal Plan areas in brackets:

#1. Improve procurement and contracting processes (WG3.4, WG2.1, WG2.2)

#2. Enable strategic industry-astronomy placements and frequent interchange of personnel (i.e. project-directed 3 month – year, industry-astronomy/engineering exchanges and co-working) (WG3.1, WG3.2, WG3.4)

#3. Improve our communication of opportunities to the outside world. The criticism being that we are too difficult for external parties to understand as an ‘astronomy’ community: there are too many players, it’s too risky with complex project organisations, etc (WG3.2)

#4. Address skills gap within astronomy community by developing professional skills and commercial understanding as necessary to deliver successful trusted partnerships. (WG3.1, WG3.2)

#5. Derive suitable engagement modes for mega-projects. Appropriate skills and expectation setting are required to draw out the very best from the industry-astronomy partnership (i.e. project management, systems engineering, risk management, project reviews, etc to commercial standards, not ‘fluffy’ astronomy/academic modes of working). (WG2.1, WG2.2, WG2.3, WG3.4)

*Note that we have not considered how improvements across these five action points would be best implemented alongside the recommendations across the Decadal review process although it is clear that many synergies and co-benefits exist.*

For each of these 5 action points we have summarised the issues, strategies and impacts in the Summary Sheets (given as Attachments to this report).

### **WG3.3 Recommendations to NCA**

Our recommendation to the NCA is to consider undertaking two strategic Engagement Improvement Initiatives – together these address the concerns of the five action points endorsed by the community:

#### ***Engagement Improvement Initiative A: National leadership for procurement and mega-project success***

This recommendation addresses action points #1 and #5 and is intended to assist the community as a whole to develop sound processes to build significant industry engagement across the suite of all astronomy projects.

In this recommendation the NCA is tasked to initiate an expert working panel with, for example, representatives from Australian GMT, SKA partners akin to ASKAIC etc, to work with appropriate Dept of Industry advice to:

- devise appropriate contracting & procurement for astronomical projects, and present a combined ‘voice’ to press for adoption of same within Government procurement policy,
- provide directive leadership for mega-projects with flexible contracting arrangements to ease the pathways for significant Australian industry participation and to ensure best value-for-money to Australian astronomy investment,
- lobby for full acknowledgement of industry/commercial endeavours as part of ARC assessments, and
- provide a unified approach to commercial partners in terms of ensuring consistent engagement pathways including an RPD&E approach.

The above remit will avoid the institutes needing to resolve these issues piecemeal, which we have found to be a source of inefficiency and ongoing frustration across the community. Moreover, these issues are not astronomy-specific – other major science areas have similar issues so the NCA might find ready allies within the Academy.

### **Engagement Improvement Initiative B: Professional development**

This recommendation addresses action points #2, #3 and #4 by

- developing a clear set of professional best-practice skills for the community,
- advising and facilitating education to meet this best practice,
- fostering the exchange of personnel with industry, and
- initiating a clear first key point of contact for major project information.

In this recommendation the NCA is tasked with setting up a new office (or appoint/tender for one member agency) to host an expert group capable of delivering the above remit in collaboration with Australian astronomy members; we estimate that this will require ~2 FTEs on an ongoing basis.

Moreover we suggest that this new entity convenes an ongoing forum for all Australian Astronomical institutes to ensure development of expertise takes place in a shared and collegiate manner. It is important to avoid continuing with 'single point' experts who are currently very thinly spread across our institutes.

### **Summary**

We believe that our two recommendations will combine to mature our working partnership with industry to maximum benefit over the next ten years. We find it is imperative that we, as a community, become more skilled, and implement more effective industry engagement processes given the (i) complexity, (ii) requirement for industry expertise & input, and (iii) economic realities (i.e. the real costs), which underpin all of our developments and projects. It will be essential for Astronomy researchers to recognize the enabling contributions of selected industry partners in early-stage R&D, and to frame grant applications, project plans, and governance structures and practices to devolve high-value work beyond academia.

We note that very similar concerns and potential solutions have been noted in recent reviews by Engineers Australia and the NSW Business Chamber. In summary, Engineers Australia has noted

- The cultures of orthogonal goals and incentives between academia and industry, i.e. commercial returns vs. publishing,
- The need for more 'industrial PhDs' – graduates who are industry-ready; requires exposure to, and mixing between academia and industry,
- Australia's very poor performance in Industry engagement (last in the league table)
- Frequent misdirected attitude to IP ownership claimed by Universities and research institutes, and that
- Universities and research endeavors have their greatest economic impact as a result of their graduating students moving into industry – not the research itself.

In closing we would like to suggest also,

i) That the ASA might be encouraged to offer acknowledgement for continuing professional development (CPD) in the area of project management, industry engagement or commercial outcomes. This would couple strongly with the Improvement Initiative B to build Professional Development and could lead to a new category of member or endorsement in the manner that many professional societies award.

ii) That the NCA consider a 'council of directors' (i.e. one representative from each University, Organisation or Institute etc). Such a forum would be a very useful mechanism to facilitate Industry development, sharing of expertise (cross-institute as well as with industry) as well as to cover many other significant issues (funding, science, etc).

## **Attachment - Key topic Summaries (Section: Review Actions)**

#1. Investigates options to more effectively enable future astronomy projects by improving procurement and contracting processes.

#2. Identifies resources to explore, and if justified implement, strategic industry-astronomy placements and interchange of personnel.

#3. Explores the potential of having a one-stop shop for industry engagement information and communications, and implement if warranted,

#4. Implements or supports new programs to develop professional skills across a range of expertise as necessary to deliver successful commercial partnerships, and

#5. Defines new modes of industry engagement recognizing that (i) mega-projects require particular skills and programmatic approaches, and (ii) astronomy can rarely afford to develop bespoke technology and instead needs to become a well-informed and smart customer.

## **Appendices / supporting attachments to WG3.3's Review for Background Information**

1. WG3.3 Plan of work (November 2013) outlining the key themes we identified & our approach.
2. Evidence of wide community consultation (our compiled invitee list)
3. WG3.3 Town Hall briefing paper – input to all Town Hall discussions
4. Records of Town Hall discussions, inputs, feedback.
5. Published summary of Industry Stakeholder Town Hall, 29 April

Selected key papers emergent during this review, with similar conclusions are

- NSW Business Chamber's report on Industry-Research Collaboration (July 2014)  
<http://www.nswbusinesschamber.com.au/Lobbying/Thinking-Business>
- Contracting for success in Complex Projects (J Davis, 2014) IACCM Australia Forum
- Academia & Industry Negotiating the Cultural Divide; C Wallis, Engineers Australia, July 2014

These plus other relevant papers are also liked at <https://sites.google.com/site/wg33publicsite/>