Final Report

*Workshop on Progress in Radar Research*

- *PIRR 2015 -*

*Held 23 - 24 September 2015*

*at the University of Adelaide*

*North Terrace Campus*

1.0 Background to the *PIRR* series of meetings

The *Progress in Radar Research (PIRR)* series of workshops was initiated in 2005 and has been held annually since then, except for 2008 and 2013 when *PIRR* was subsumed into the highly successful *International Conference on Radar* events (Radar 2008 and Radar 2013) held in Adelaide in September of those years.

The term *Progress* in the workshop series title is used advisedly as it is intended to underline the idea that the series invites a stock-take on current, not necessarily completed, radar research and is not only a forum for reports of completed work. There is scope for exposing preliminary and partially-developed concepts to an expert peer group and a number of authors took advantage of this means of exposure this year. Each *PIRR* event also provides an opportunity for tuning of papers, including those by students, intended for subsequent presentation at a formal conference or for journal publication. *PIRR* requires no written papers and publishes no proceedings; presenters are invited to make their presentation material available after the event the majority did so.

The networking opportunity provided by the *PIRR* series is a key outcome and the program is arranged to allow generous break times and a cocktail event at the end of day 1. The radar research community in Australia has come to see *PIRR* as the annual networking event for the community. It is a unique opportunity for radar researchers from government, industry and academia to meet together in one place.

2.0 Management arrangements for *PIRR 2015*

This year DST Group provided the majority of the funding through a Research Agreement with Adelaide University. The Association of Old Crows Australian Chapter and CEA Technologies Pty Ltd also contributed financially with the University of Adelaide providing support as identified below.
The event was held on-campus at the University of Adelaide as the survey from last year indicated a majority of attendees were happy with the venue. On-campus bookings are only possible during non-teaching periods so this limits the choice of dates.

Services delivered to the Workshop were sourced as follows:

- **Venue:** The University of Adelaide, North Terrace
  - Presentations: Hughes 309 lecture theatre
  - Morning and afternoon tea and poster sessions: Hub Central mezzanine floor
  - Lunch: Ingkarni Wardli atrium
- **Catering:** Taste Bagette (morning and afternoon tea), Aroma (lunch), Uni of Adelaide Club (cocktail function) in the Reading Room of the Barr Smith Library
- **Web-site management, badges and signs, registration desk assistance, IT management:** University of Adelaide Radar Research Centre (special thanks to Christine Thursby, Tran Nguyen, and Ruiting Yang).
- **Financial management and accounts:** University of Adelaide School of Electrical and Electronic Engineering (Stephen Guest).
- **Workshop Convenor and Manager:** Dr Bevan Bates on behalf of the University of Adelaide
- **Printing of program:** University of Adelaide School of Electrical and Electronic Engineering (Daphne Zammit).
- **Technical Program Committee:** Irina Antipov, Van Nguyen, Tim Coombs (DST Group), Waddah Al-Ashwal and Bevan Bates (University of Adelaide).

All management arrangements worked well and there are no recommendations for major change for future events. The post event survey supports this conclusion (See Section 3.4).

### 2.1 CAR 2025 event

A workshop on “The Characteristics of Adaptive Radar 2025” was organised on the Friday immediately following PIRR at the request of Dr Anthony Szabo of DST Group. The stated aim was “to expose the state-of-the-art in adaptive radar in Australia and to establish the key characteristics of adaptive radars that will be fielded in the 2025 timeframe. This information will be used to drive DST Group’s future looking adaptive EW program.” The attendees were addressed by Prof. Bill Moran of RMIT University of “The History of Adaptive Radar” and by Dr Mike Turley of DST Group on HF adaptive radar developments and then split into three syndicate groups. Each group was asked to address the following questions:

- What is the anticipated signal environment?
- What aspects of the signal environment will require radars to become adaptive?
- What radars/radar functions will be amenable to adaptive approaches in 2025?
- What will be the characteristics of these adaptive radars/radar functions?
- What technology developments are required to implement these adaptive radars/radar functions?

Each syndicate group reported back to the whole group after lunch. Feedback on the event was mixed with some indicating it needed more focus or to be conducted at a classified level but others saying it was a “good format” or a “good idea.” Note the program was updated to include the Mike Turley presentation after the PIRR booklet was printed (which is what is included as Annex 1).
3.0 Reporting details

3.1 Program

In response to two calls for papers and targeted invitations issued in the lead-up to the event, a total of 30 abstracts were submitted and evaluated by the Technical Program Committee. (In 2014 the figure was 37.) No submissions were rejected – all were selected for oral presentation (the maximum that can be comfortably fitted into a two-day single-stream program) and there were no poster presentations. One paper was withdrawn and one additional paper was invited as an opening presentation.

The final program is at Annex 1.

Post-event all presentation material cleared for release by oral and poster presenters was made available via a shared Dropbox folder at https://www.dropbox.com/sh/iw77cdvh6ye4m5/AABivuOfAoJd2yeV-zhAwi2pa?dl=0. The same digital content was made available to DST Group on CDROM, to be accessible on the DST Group intranet. These presentations are also included in the supplement to this report provided to DST Group.

3.2 Attendance

Historically registrations exceed attendance by 5 to 10% and this proved to be the case again this year. There were 111 recorded registrations for PIRR 2015 and CAR 2025 combined: about 100 attended PIRR at some time during the event with attendance numbers declining to around 50 by the end of day 2 and about 45 people attended CAR 2025 (53 registrations). Six people registered only for CAR 202.

Registrations came from universities: 27, defence: 59, other government agencies: 3, industry/consultants: 21, and un-affiliated individuals: 1. This is in line with previous trends. About 5 people came from interstate (actual addresses were not collected).

3.3 Budget and costs

In the interests of encouraging as broad an audience as possible, including students, no charge is made to attend PIRR workshops. Interstate participants were responsible for their own travel and accommodation costs. As indicated above, costs of delivering PIRR 2015 were met from DST Group, AOC, and CEA Technologies. The overall cost of the event (not including in-kind support) was around $18k (including GST).

3.4 Attendee evaluations

A post workshop survey was sent to all registrants on the Monday after the workshop. The questions were asked via Survey Monkey and 40 responses were received over the following two weeks which is a response rate of 35%. There were two questions related specifically to PIRR 2015 and one question asking about attendance at CAR 2025 as well as an opportunity for overall comment. In response to the question “Overall, how well did PIRR 2015 meet your needs?” 89% responded either very well or extremely well (34/38), with 4 saying somewhat and 2 did not attend. Of the
39 responding, 16 indicated they attended CAR 2015. On the question “How would you rate location, catering, technical content, format, timing, and administration” all aspects achieved an average rating of more than 4 out of 5 with technical content being 4.15 and administration being the highest at 4.42.

The results of the survey were made available to all registrants via the link https://www.surveymonkey.com/results/SM-FBZNQLG2/ This excluded the comments which are included at Annex 2. The complete survey results (including all comments) are available at: https://www.surveymonkey.com/results/SM-MP9FK5Z2/

4.0 Outcomes and recommendations

PIRR 2015 was clearly perceived by attendees as worthwhile and there is a strong call for PIRR to continue as the annual gathering of the Australian radar research community in its current format. The networking outcomes appeared to be significant, with a number of researchers who previously had been ignorant of each other’s work making contact and resolving to follow-up.

Bevan Bates
Workshop Convenor and Manager
30 October 2015

Distribution:

DST Group (with supplement)
AOC Australian Chapter
CEA Technologies
Assoc. Prof Cheng Chew Lim, Head of EEE School, University of Adelaide
Prof Iain Reid, University of Adelaide (Adelaide Radar Research Centre)
Day 1, Wednesday 23rd September, 2015

0830 Registration and coffee
0900 Opening Announcements – Bevan Bates, Workshop Chair and Manager
0915 Opening Address and Overview – Gordon Frazer “Recent Innovations in HF Radar”
0945 Overview - Dennis Longstaff “Some Current Projects at Teledyne Defence Australia Pty Ltd”
1015 Overview - James Palmer “An overview of DST Group’s Passive Radar Research and Development programme”

1045 BREAK (30 mins)

SESSION 1 – Radar Applications Chair: Stuart Anderson
1115 Robert Palumbo “Development of a Forest Fire Detection and Monitoring Algorithm”
1140 Bronwyn Dolman and Iain Reid “Near Real-Time Rainfall Information Retrieved from Wind Profiling Radars”
1205 Graham Brooker “Low Cost Millimetre Wave Imaging Using a Commercial Plasma Display”

1230 LUNCH (50 minutes)

SESSION 2 – Radar Signal Processing 1 Chair: Robert Young
1320 Rocco Melino, Sandu Kodituwakku, and Hai-Tan Tran “Imaging of Rotating Blades Using Orthogonal Matching Pursuit”
1345 Stephen Searle, Alex Grant and Robby McKilliam, “Identification of returns in radar signals as a problem of multiple frequency estimation”
1410 Brian W.-H. Ng, An Phan and Hai-Tan Tran “Contrast based estimation of total rotational velocity in 3D InISAR systems”

SESSION 3 – Imaging Applications Chair: Waddah Al-Ashwal
1435 P.B. Pinicus, M. Preiss, D.A. Gray, and N.J.S. Stacy “Image formation on undulating terrain using the upgraded Ingara L-band radar system”
1500 Hai-Tan Tran “Translational Motion Compensation for Narrowband Radar Imaging”

1525 BREAK (25 minutes)

SESSION 4 – MF and HF Radar Chair: Bronwyn Dolman
1550 Andrew Spargo, Iain Reid and Andrew MacKinnon “Interferometric radar measurements of ionospheric gravity wave momentum fluxes”
1615 Lenard Pederick “Modelling the Interference Environment in the HF Band”
1640 Stuart Anderson “Joint Estimation of Target Class and Altitude in OTHR Systems Via Diffuse Surface Scatter”
1705 Andrew Heitmann, Robert Gardiner-Garden, Andrew MacKinnon, Iain Reid, Bruce Ward “Preliminary observations of 2D angle-of-arrival and Doppler from a new high-fidelity ionospheric sounder”

1730 COCKTAIL RECEPTION
Day 2, Thursday 24th September, 2015

0830  Coffee
0900  Overview - Brett Biddington “The Australian Space Sector: Status Report and Recent Developments”

SESSION 5 – Radar Systems and Components  CHAIR: James Palmer
0930  Luke Rosenberg and Mark Sletten “The NRL multi-aperture SAR system description and recent results”
0955  Gerard Rankin and Andrew Tirkel “Sequence Families for MIMO Imaging Radar”

1045  BREAK (25 mins)

SESSION 6 – Clutter and CFAR  Chair: Irina Antipov
1110  Stephen Bocquet and Luke Rosenberg “Parameter and threshold estimation for Pareto distributed clutter with noise”
1135  Graham Weinberg and Aris Alexopoulos “Dual Order Statistic CFAR for X-Band Maritime Surveillance Radar”
1200  Vichet Duk, Brian Ng and Luke Rosenberg “Small Target Detection in Sea-clutter using 2D Wavelet Transform”
1225  Si Tran Nguyen Nguyen and Waddah A. Al-Ashwal, "Sea Clutter Mitigation using Resonance Based Signal Separation”

1250  LUNCH (50 minutes)

SESSION 7 – Radar Signal Processing 2  Chair: Doug Gray
1340  Tri-Tan Van Cao, Marion Byrne, and Gavin Currie “XPAR-2 Search Mode Signal Processing and Tracking: Initial Experimental Results”
1405  An Phan, Brian Ng and Hai-Tan Tran, “ISAR Imaging with High Cross-Range Resolution and the Estimation of the Scaling Factor”
1430  Gregory Hellbourg “Spatial interference filtering: advantages and limitations”
1455  Si Tran Nguyen Nguyen, Douglas A. Gray, Paul Pincus and Mark Preiss, "Pixel based (beam forming) approach for SAR image formation”

1520  BREAK (25 mins)

SESSION 8 – Education, Modelling and Simulation  Chair: Leigh Powis
1545  Trevor G. Anderson, David G. Johnson and David Battle “GPU-based Simulation of Radar and Sonar”
1610  Robert Palumbo “Towards a New Paradigm in Phased Array Radar Education and Collaborative Research”
1635  Kin Shing Bobby Yau “RCS Prediction of Open Cavities Using the Shooting and Bouncing Rays Method”

1700  END DAY 2
my interests were somewhat peripheral to the main themes but I believe that PIRR was very well organised and conducted. Congratulations, Bevan
only suggestion is to publicize it better in the future. Just by pure luck that I heard about it.
Thanks for Hosting and organising. Perhaps cognitive radar and fusion might be added to the programme next time
An excellent way to see a snapshot of what is happening in Australian Radar Research and to catch up with and interact with colleagues.
Some session chair roles were performed better - & more formally with a summation - than others.
This series is well established as an effective networking and information exchange for the research community in radar and radar-related fields. I hope DSTG, universities and industry realise what a magnificent investment in the future it represents.
Need to have well defined outcomes that are set out before the start. The scenarios were essentially identical for each syndicate and groups had difficulty telling the difference between some of the questions
I'd sum up with a mark of 10/10
Another enjoyable PIRR!
Varied content of presentations was good.
Attended day 1 and thought it went well. Intending to attend next year.
Thanks Bevan. I appreciated the PIRR and due to other matters missed CAR2025
Funding permitting, let's change the location. Somewhere down to the beach, up on Adelaide hills, Victor Harbour, or Barossa Valley would be nice and may attract more people to the workshop.
Extended breaks including poster sessions would be good. Better than sitting in lecture theatre for extended periods.
Event was very well run and was helpful for networking. No issues or complaints.