



WOOMERA TEST RANGE (WTR) Air Force Ranges Directorate Air Warfare Centre, RAAF



"testing tomorrow's systems – today"

A New Heart for an Old Radar **Vivek Chanana (Dr)**



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Overview

- ◆ History and capability of WTR
- ◆ Radar tracking capability
- ◆ Issues with radars
- ◆ Remediation project
- ◆ Design considerations/challenges
- ◆ Design options



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Historical – Long Range & Space Weapons Testing

- At the height of the long-range weapons testing program during the 1950s and 60s, and it was second only to Cape Canaveral for the number of annual rocket launches from its nine launch areas across the range



Area 6 (Lake Hart)– Launcher A



'PROSPERO' – launched from Lake Hart



'ELDO' – launched from Lake Hart



'Blue Streak' – launched from Lake Hart



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Strategic Role of WTR in AWC

AWC operates the WTR and meets its higher level mission requirements through provision of four operating environments supporting:



- ◆ the testing of **air and space-based** weapons systems



- ◆ the testing of **ground-based** weapons systems



- ◆ the testing and disposal of **hazardous war materials**



- ◆ the conduct of **force preparedness** and other warfighting readiness training, testing, and evaluation

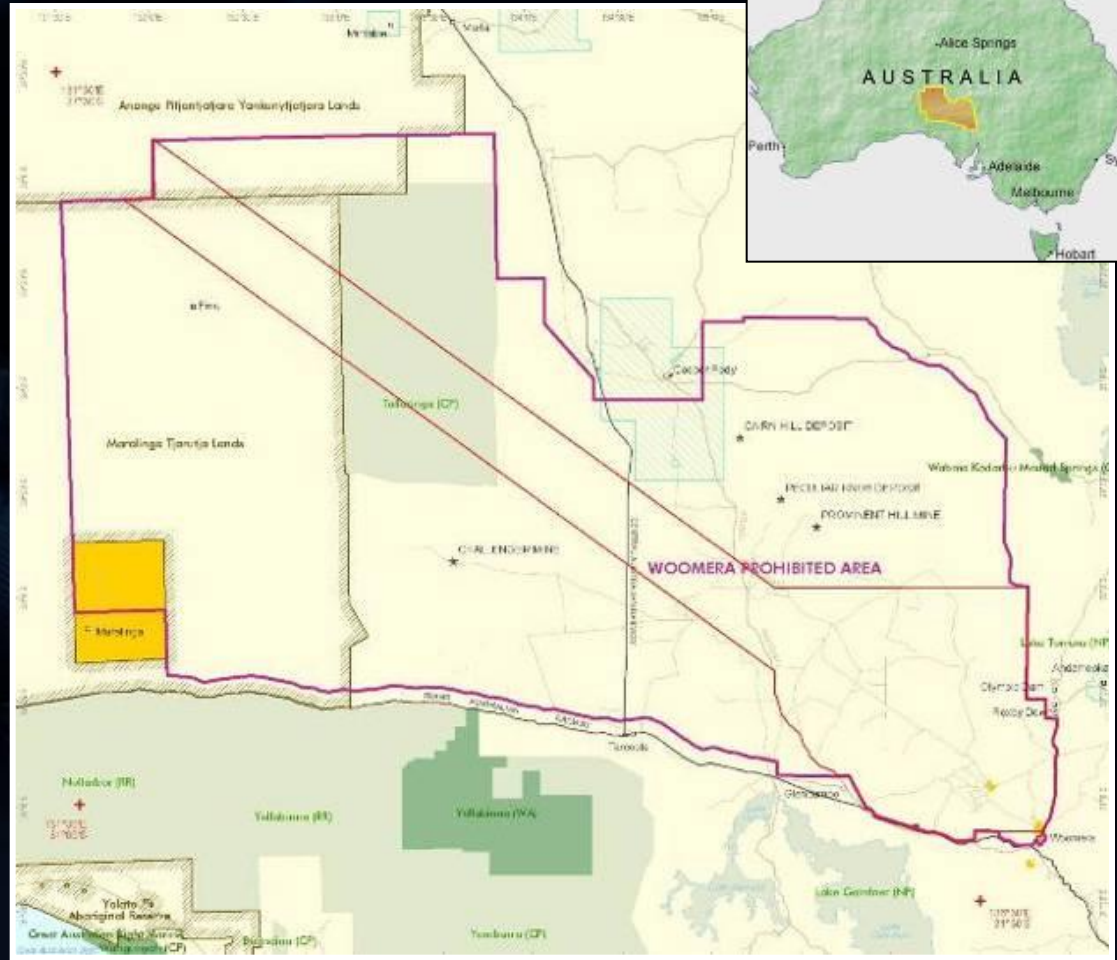


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Woomera Test Range – General Description

The Range is:

- 122,000sqkm (WPA) plus the airspace above (WRX)
- Defence – Primary use controlled by RAAF
- Small Parcels of Commonwealth Land
- At least a 635km Centreline
- Shared Access Controlled by Defence under special Federal Legislation



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WTR - Operational Attributes of 'Place'

The natural attributes of the WPA translate to the operational environment as follows:

- ◆ **Landspace:** Largest land-based test and evaluation range
- ◆ **Airspace:** Very low traffic airspace
- ◆ **Safety:** Extremely low population density - a low-risk environment
- ◆ **Security:** Remoteness and low population density coupled with federally regulated and enforced access control
- ◆ **Recovery:** The flat easily accessible terrain
- ◆ **E-Quiet:** Benign electromagnetic environment



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Mission System Capability

- ◆ Range control and safety system
- ◆ Instrumentation at remote sites
- ◆ Reliable mitigation strategy
- ◆ Major upgrade project - AIR3024
- ◆ Full Operating Capability by 2020



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Extant Radar Tracking Capability

- ◆ 3 C-band single object tracking radars
 - MPS-36 radar (1MW)
 - 2 Adour radars (R1 & R2) (250kVA)
- ◆ Capability need: At least two reliable radars to provide two independent TSPI sources to support complex trials



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Issues with Adour Radars

- ◆ **Obsolete**
 - Well beyond LOT
 - Not undergone any tech refresh
- ◆ **Unreliable**
 - Component failure
 - Unreliable connectors present connection problems
 - Aggravated by usage pattern – extended down time
 - Failed during trial campaigns
- ◆ **Unsupported**
 - No material sustainment agreement
 - Lack or non availability of spares
 - Most documentation not in English

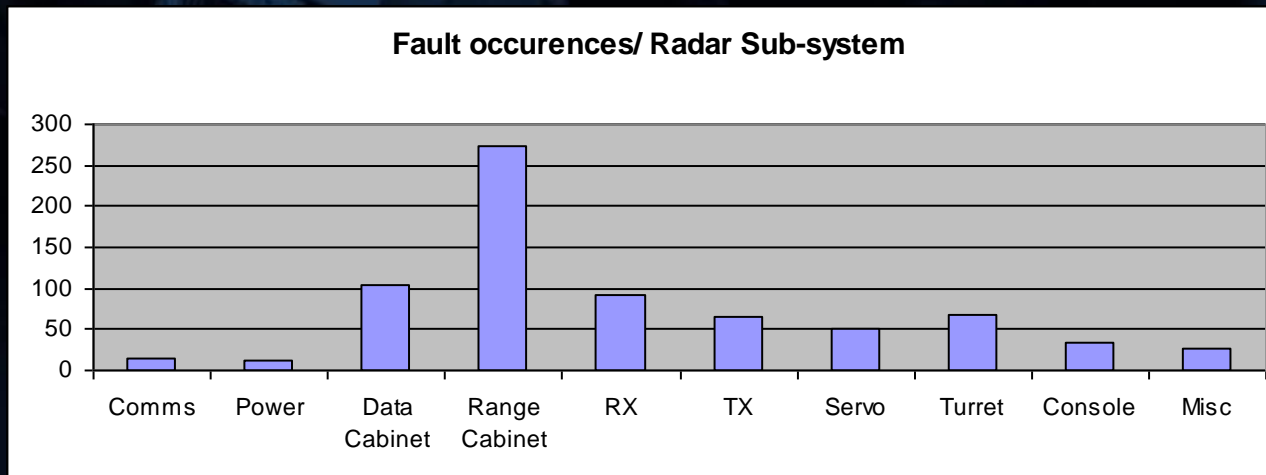


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Remediation project

Improve reliability and availability

- ◆ Compiled fault log
- ◆ Performed failure analysis
- ◆ Some patterns emerged
 - Range and Data cabinets main contributor
 - Digital Circuit Module failure and intermittent contact between module and backplane



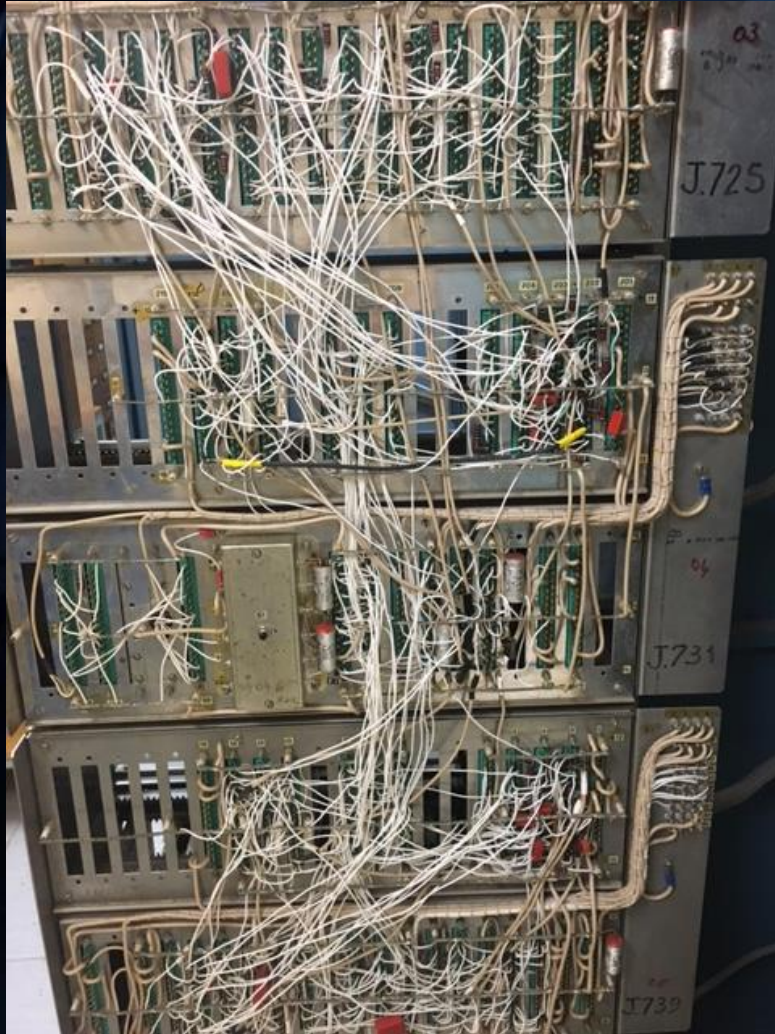
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Digital Circuit Module

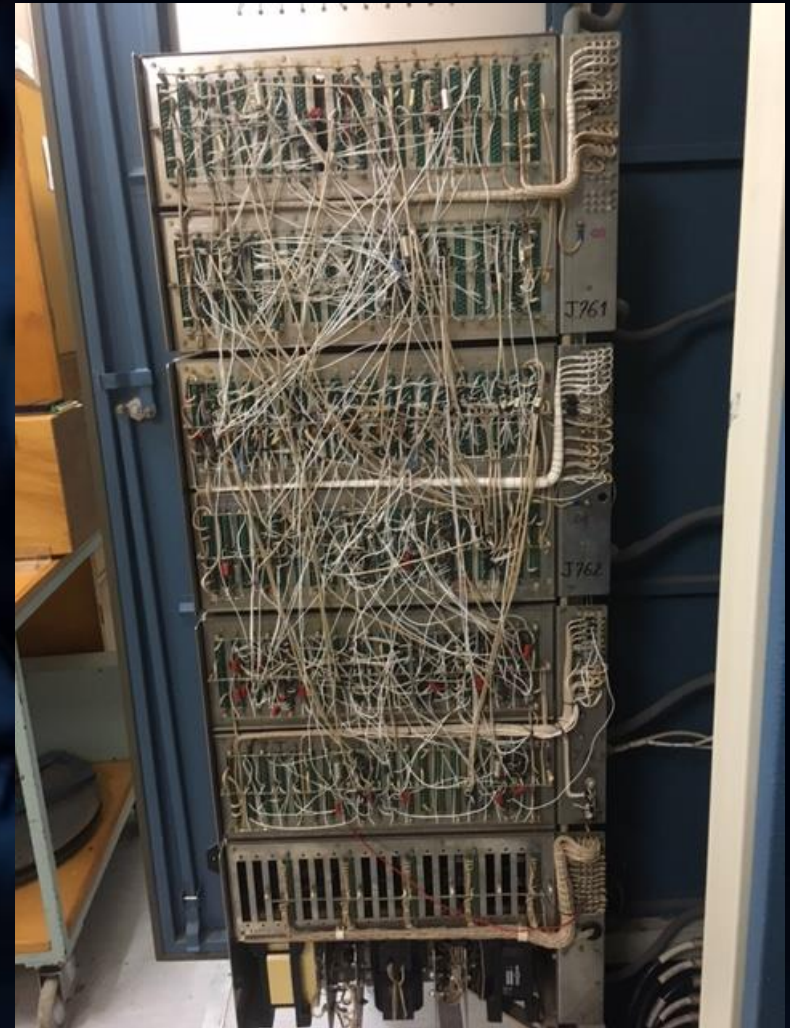


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Radar Backplanes



Back of Data Rack

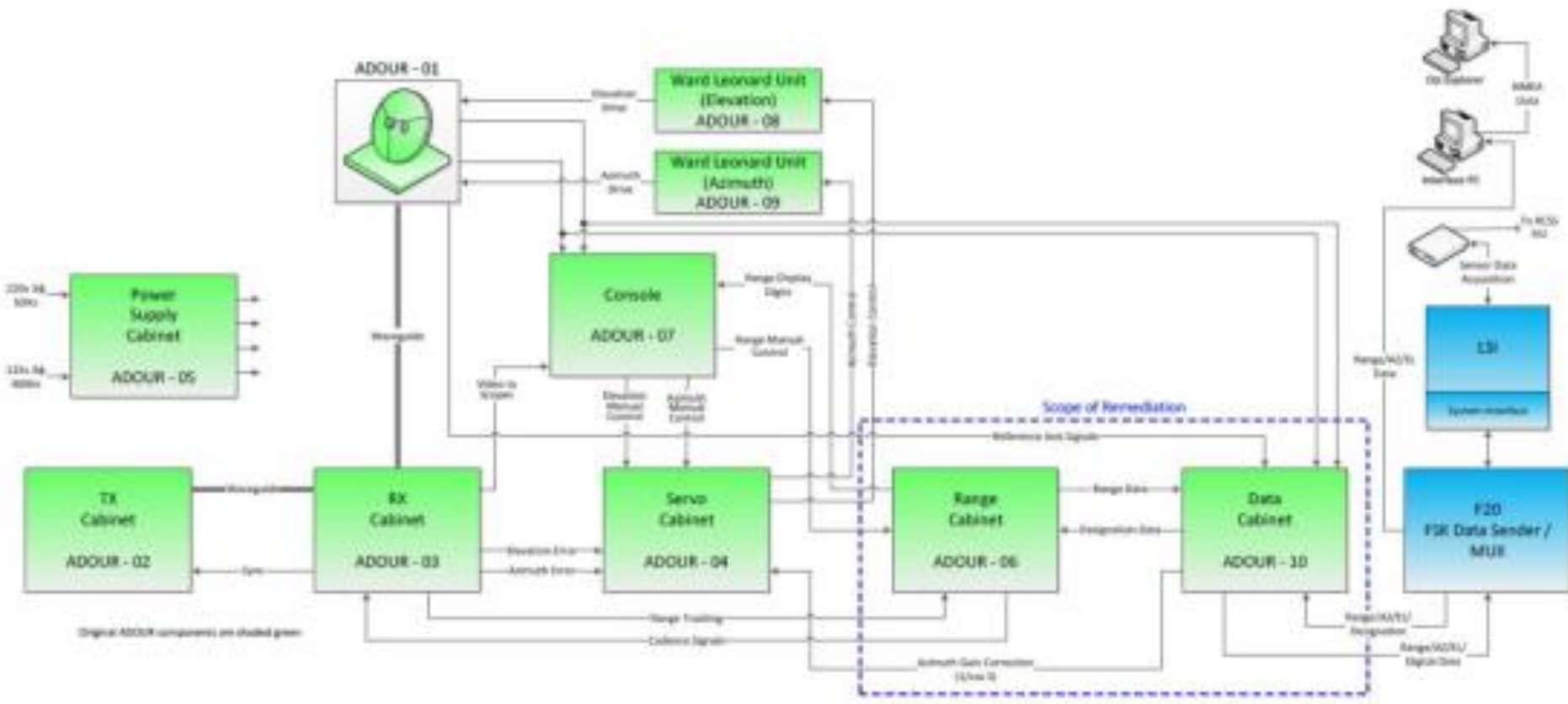


Back of Range Rack



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Scope of remediation project



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Challenges moving forward

- ◆ Geographic location of Range
- ◆ Limited local technical expertise
- ◆ Capturing/understanding interface signals
- ◆ Incomplete documentation
- ◆ Most of documentation not in English
- ◆ Organising funding for the project
- ◆ Major Range upgrade project underway



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Making progress

- ◆ Two-step process
- ◆ Feasibility study
- ◆ Outcome of feasibility study
- ◆ Statement of work
- ◆ Engaging the contractor
- ◆ Choosing the radar(s) for upgrade



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Design considerations/challenges

- ◆ Combination of analogue and digital interfacing
- ◆ Operate in harsh environment
- ◆ Operate in ambient RF noisy environment
- ◆ Ability to meet very tight time constraints
- ◆ Generate very stable pulses
- ◆ High speed video processing capability
- ◆ Flexible in meeting interfacing requirements



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Design Options

1. Component level circuit design
 - Custom-built design of moderate complexity
 - Very difficult to change during interfacing
 - Difficult to upgrade further without redesign
2. Computer based solution
 - Difficult to generate precise timing signals
 - Difficult to generate stable pulses
 - Difficult to handle combination of analogue and digital interfacing



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Design Options (contd.)

3. Programmable hardware – FPGA based design

- Can generate precise timing signals
- Flexible development environment
- Can meet interfacing requirements
- Very small component count
- Maintainability and longevity of support
- Flexible for any future upgrade



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Development phase

- ◆ Some scope creep
 - F20 computer
 - Interface computer
- ◆ Number of site visits
- ◆ Responding to clarification questions
- ◆ Emulation of the Adour interfaces for development



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Integration/ Installation challenges

- ◆ Availability of WTR SMEs to support project
- ◆ Disruption to Range operations
- ◆ Incremental integration sequence
- ◆ Ability to tailor the FAT configuration baseline whilst on site



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System Acceptance Test Plan

1. Baseline Existing Radar
2. Interface Verification
3. Functional Verification
4. Baseline Performance Verification



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Conclusion

- ◆ Upgrade project delivers more reliable radar
- ◆ WTR can keep supporting trials until AIR3024 FOC



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Questions



'SHARPEN THE SPEAR'



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