Australian Government

Department of Defence

RECENT ACTIVITIES AT THE WOOMERA TEST RANGE

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1 INTRODUCTION

This annex to the Woomera Test Range (WTR) Capability Brief features a selection of recent and current activities conducted at the WTR, and is aimed at illustrating the diverse range of Defence and non-Defence trials that can be undertaken in this vast area. The material has been compiled by BAE Systems in consultation with the Department of Defence ('Defence') and WTR users.

2 DEFENCE TRIALS

The following sections highlight recent trials undertaken by Defence and overseas military agencies at the WTR.

2.1 AMRAAM Missile Trials

Two successful firings of the AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM) were conducted at the WTR in April/May 2001 by the Aircraft Research and Development Unit (ARDU) of the Royal Australian Air Force (RAAF) with support from 77 Squadron. AMRAAM is a software-controlled, radar-guided missile that gives pilots the ability to 'launch and leave' and to track multiple targets during a single engagement.

The firings from F/A-18 Hornets were part of the test and evaluation program leading to flight clearance by the Aircraft Stores Compatibility Engineering Agency (ASCEA) and acceptance of AMRAAM into RAAF service. Both firings were successful, with the missiles intercepting targets towed behind Kalkara drone aircraft. The 2001 trials followed initial AIM-7 Sparrow firings conducted at Woomera in Aug/Sep 2000 as part of Exercise DESERT COBRA.

2.2 ASRAAM Missile Trials

ARDU conducted live firings of the AIM-132 Advanced Short Range Air to Air Missile (ASRAAM) at the WTR in May 2002. ASRAAM has been procured for the RAAF's F/A-18 Hornets, and to introduce the missile into service, a formal evaluation of the performance of the ASRAAM capability was undertaken at Woomera. The first test involved a flight safety assessment, performed by ARDU test pilots. The Hornet was flown to the limits of its performance with the ASRAAM on its wingtip station and the behaviour monitored. Live firings of the ASRAAM were subsequently performed using Kalkara drone aircraft as targets. The Hornets were based at Woomera Airfield and the Kalkara drones were launched from Evetts Field at the Woomera Rangehead.

2.3 ALARM Missile Trials

In August 2000, the Royal Air Force (RAF) conducted in-service firings of the Air Launched Anti-Radiation Missile (ALARM) from Tornado GR4 aircraft at Woomera (Exercise DINGO DART). The ALARM missiles were directed towards a target at the Parakylia Stand-off Weapons Target Area (PASTA). AOSG provided operational support to the RAF including range control, C-band radar tracking and an F/A-18 photo-chase aircraft. Real-time cine and video coverage of the PASTA target site was also provided by AOSG. Exercise DINGO DART was sponsored by the RAF's Air Warfare Centre.

2.4 AGM-142 Missile Trials

The United States Air Force (USAF) conducts occasional trials of the AGM-142 medium-range, electro-optically guided precision stand-off missile at the WTR using B-52 bomber aircraft (pictured with missile). Inter-continental sorties initiated in the US were conducted in 1995 and 1997, with the rocket-powered missiles being launched towards a target site within the WTR. The WTR is especially well suited to stand-off weapon trials, given the large safety templates that can be accommodated, and the high security environment for classified weapons testing. Support for AGM-142 trials is provided by ARDU.

2.5 Extended Range JDAM Trials

An F/A-18 aircraft operated by ARDU provided support in 2004 for a concept technology demonstration program involving the release of a GBU-38 Extended Range Joint Direct Attack Munition (JDAM). The trials were sponsored by Boeing / Hawker de Havilland, and required a large cleared range area to allow weapon release without a flight termination system.

2.6 Miniature Munition Trials

The USAF and RAAF jointly undertaken miniature munition carriage and release trials using a F-111 bomber at the WTR in June 2004. The program was conducted under the Australia-US Deutch-Ayers Project Arrangement 24, and involved the USAF Air Force Research Laboratory Air Vehicles and Munitions Directorate for aeroacoustics, subsonic and supersonic separations and network enabled concept demonstrators. The test items entailed dual Powered Low Cost Autonomous Attack Systems (PLOCAAS) attached to a subpack and also an ASRAAM for internal carriage.

2.7 Rapier Missile Trials

Regular instrumented and operational trials of the Rapier ground-to-air missile are conducted at the Lake Hart Air Weapons Range in the WTR. The Rapier is used in low level air defence (up to 10,000 feet) and is in service with the 16th Air Defence Regiment of the Royal Australian Artillery. The Rapier system comprises a missile launcher unit and optical tracker. A radar in the launcher unit detects and identifies targets, and a transmitter on the launcher sends guidance commands to the missile in flight.

The Republic of Singapore Air Force (165 Squadron) also conducts regular instrumented and operational test firings of Rapier missiles at Lake Hart. Rapier trials usually involve a target towed behind a Learjet.

2.8 TRIGAT Missile Trials

Testing of the TRIGAT Medium Range anti-armour missile was undertaken at Woomera between January and February 1998. The trials were sponsored by the UK Ministry of Defence, and were designed to test the performance of the missile under 'hot-dry' conditions. Numerous firings were conducted by an international team comprising British, German, Dutch, French and Belgian soldiers. The WTR was selected for the TRIGAT program in view of the optimum climatic conditions, purpose-built range facilities, available technical and infrastructure support, and safety and security considerations.

2.9 Kalkara Target Drone Trials

The Kalkara target drone system operated by the Royal Australian Navy (RAN) is deployed to Woomera in support of missile firings, notably trials of AMRAAM and ASRAAM from F/A-18 Hornet aircraft (see sections 2.1 and 2.2 above). The jet-propelled Kalkara drone is rocket boosted from the ground and is capable of towing targets and carrying a variety of payloads (eg weapon sensor systems). Kalkara launches are undertaken from Evetts Field at the Woomera Rangehead. The drones are recovered by parachute at the end of their flights.

2.10 Nulka Hovering Rocket Decoy Trials

The Nulka hovering rocket is an Australian-developed, ship launched decoy used for protecting ships against missile attack. Powered by a solid fuel rocket motor, Nulka (Aboriginal word meaning 'to be quick') hovers away from its host ship, with its electronics package attracting the incoming missile by mimicking emissions from the target ship. Nulka is in service with the RAN, the US Navy and the Canadian navy.

Numerous Nulka trial campaigns have been conducted at the WTR since 1990, initially for developmental test and evaluation and subsequently for ongoing product enhancement, most recently between 1997-1999 involving a total of 15 firings. The WTR offers particular advantages for the trials, especially the high security and easy recovery of the classified Nulka decoys. Nulka trials also take advantage of the instrumentation support available within the WTR.

2.11 GPS Interference Trials

GPS interference trials are undertaken on a regular basis at the WTR by a number of Australian and overseas organisations including the RAAF, the Defence Science and Technology Organisation (DSTO), the Civil Aviation Safety Authority (CASA) and the Air Force Operational Test and Evaluation Center (AFOTEC) of the United States Air Force (USAF). The WTR is one of the few places in the world where such trials are possible without disrupting civilian GPS users. The purpose of the trials is to assess the vulnerability of GPS signals to interference, and to test counter-measures including the use of GPS Jammer Locators and adaptive signal processing techniques. The trials involve ground and airborne elements, with aircraft operations being conducted from Woomera Airfield (picture shows antenna mounting on the control tower at Woomera Airfield).

2.12 Parachute Training

Parachute training is undertaken regularly at the WTR by Australian Defence organisations and also by overseas military agencies who take advantage of the restricted airspace, excellent climatic conditions and under-utilised Woomera Airfield (and also Evetts Field at the Woomera Rangehead). For example, in 1998 and 1999, the US Marine Corps conducted an extensive series of parachute training drops (pictured) from C-130 aircraft. The training covered various levels of proficiency, including High Altitude Low Opening (HALO) drops.

2.13 Explosive Trials

Australian and UK Defence organisations have been conducting a series of explosive trials at the Large Scale Explosives Test Area (LSETA) since the mid-1980s (with individual blasts of up to 75 tonnes Net Explosive Quantity). The aim of the trials is to enhance international ammunition storage safety regulations. The trials are managed by the Directorate of Trials (DTRIALS) and involve Australia, the UK, the USA, the Netherlands, Norway and Singapore. Technical control is provided by the UK Ministry of Defence and the Dutch Ministry of Defence.

The most recent series of trials at LSETA have involved detonations of 40, 27 and 5 tonnes of high explosives (picture depicts the 27 tonne trial on 20 September 2002). The explosives for the 40 and 27 tonne trials were contained in explosive storehouses constructed to UK standards. Industrial and residential structures, built to meet the needs of the participating countries, were placed strategically around the detonation site (to simulate encroaching population). The damage to the structures and the debris distribution were analysed to identify appropriate safety distances for the storage of explosives. Instrumentation around the site measured the blast pressure and a series of 40 cameras collected video images of the blasts. AOSG provided photographic and timing control support for the trials.

2.14 Explosive Demolition

In addition to instrumented explosive trials, the WTR is used frequently by military and civilian organisations for the demolition of time-expired munitions and other bulk explosives (eg mining). Demolition activities are undertaken at the Lake Hart Demolition Area which can accommodate blasts of up to 20 tonnes Net Explosive Quantity. The most recent series of demolition activities by the Joint Ammunition Logistics Organisation (JALO) entailed blasts of several tonnes to 20 tonnes over a two-week period in November 2002.

2.15 DSTO Trials

DSTO undertakes a wide range of ground and airborne trial activities at the WTR. For example, flights of the USAF Global Hawk Unmanned Aerial Vehicle (UAV) were undertaken over the WTR during May and June 2001 for the purpose of system characterisation, sensor calibration and definition of standard operating procedures.

Other DSTO activities at the WTR include materials testing, Electronic Warfare trials, Explosive Ordnance test and evaluation, rocket guidance system development, testing of tethered balloon radio platforms, optics and surveillance system development, and trials of ground surveillance radars.

2.16 Military Exercises

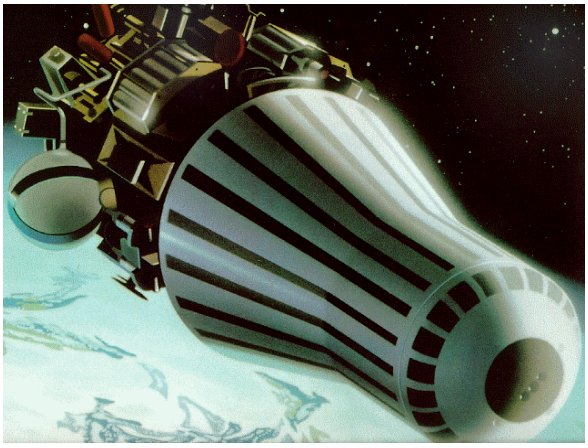
Various types of military exercises are undertaken within the WTR by elements of the Australian Defence Force and overseas military agencies. Recent examples include:

- Exercise Rhino Charge in November / December 2002 (pictured) involving 9 Brigade of the Australian Army and entailing the conduct of realistic war games;
- Exercise KUJARRA 2000 conducted by 160 Squadron of the Republic of Singapore Air Force in 2000 and involving training using the Oerlikon 35 mm Twin Gun used in air defence;
- Regular exercises by 1 Airfield Defence Squadron of the RAAF to confirm operational readiness;
- Annual Ground Based Air Defence trials at Lake Hart by 16 Air Defence and 110/111 Batteries of the Australian Army;
- Garrison Support exercises held between 1997-98; and
- Military vehicle driver training exercises.

3 NON-DEFENCE TRIALS

The following sections present examples of non-Defence trials undertaken at the WTR, typically as commercial activities for international aerospace organisations.

3.1 EXPRESS Re-entry Capsule Mission



The EXPRESS mission was a collaborative program between Germany and Japan and involved the targeted landing of an unmanned re-entry capsule in the WTR. The WTR was selected by the German Space Agency in view of the large and safe landing area. Approval for the landing was granted by the Australian Government following a comprehensive risk assessment including independent re-entry modelling of the landing footprint. In readiness for the orbital and re-entry phases, the Tjaliri Tracking Station was deployed in the WTR to the west of Coober Pedy. This temporary facility provided a full Tracking, Telemetry and Command capability, and included an Intelsat earth station link to the control centre in Germany.

The Russian built EXPRESS spacecraft, carrying German and Japanese microgravity and re-entry technology experiments, was launched from the Kagoshima Space Center in Japan on 15 January 1995. However, due to an anomaly on the launch vehicle, the spacecraft was injected into a very low elliptical orbit and re-entered the atmosphere after only 2.5 orbits. While the EXPRESS capsule did not land in the WTR as intended, the Australian support was highly commended and pioneered the approach for future spacecraft re-entry and landing programs in the WTR (refer to Hayabusa mission below).

3.2 ALFLEX Landing Trials

The Japanese Automatic Landing Flight Experiment (ALFLEX) entailed the testing at Woomera Airfield of a one third scale model of the HOPE spaceplane by the National Aerospace Laboratory (NAL) and the National Space Development Agency of Japan (NASDA). The objectives of the trials were to test the automatic landing technology to be used for HOPE. Selection of Woomera for the ALFLEX program followed a survey by NAL/NASDA of over 100 prospective sites in Japan and overseas.

Instrumentation installed at Woomera Airfield included a microwave landing system, tracking radar, laser tracker, pseudolite DGPS station, weather station and telemetry, command, display and communications equipment. The trials involved the release of the unmanned ALFLEX vehicle from beneath a Japanese twin-rotor helicopter at an altitude of 1500 metres and distance of 3 km from the runway threshold. Following release, the vehicle glided at a descent angle of 30 degrees, guided by on-board navigation and control equipment and by the ground-based microwave landing system.

A total of thirteen automatic landing trials were conducted by NAL/NASDA during 1996 over a range of experimental conditions involving release position, wind direction and programmed in-flight manoeuvres. All trials were spectacularly successful.

3.3 SRB Propellant Trials

The WTR was selected by NASDA in conjunction with the Nissan Motor Company for the shock testing of propellant material from the Solid Rocket Boosters (SRBs) used on the Japanese H-IIA satellite launch vehicle. The purpose of the testing was to determine the explosive potential and fragmentation characteristics of the propellant, and in particular, to simulate the high speed impact of unburnt propellant as might occur in the event of a launch accident.

The SRB trials were conducted at the Large Scale Explosives Test Area with the support of Defence and contractor personnel, and involved the high velocity impact of a heavy steel plate on to cylindrical masses of propellant. Acceleration of the 'flyer' plate was achieved using shaped plastic explosive. An extensive suite of Japanese-supplied instrumentation was installed at the test site, together with ARDU-supplied firing and photographic equipment.

Two successful series of SRB trials were conducted in 1997 and 1998 using propellant masses of 500 kg and 1000 kg. The tests graphically demonstrated the potential of unburnt rocket propellant to explode violently (pictured) in the event of premature impact at high velocity. The SRB trials provided essential data to NASDA for establishing safety criteria at the Tanegashima Space Center in support of H-IIA launch operations (including enhanced reinforcing of protective concrete bunkers).

3.4 Super-Sonic Transport Trials

The Japan Aerospace Exploration Agency (JAXA) has selected the WTR for the conduct of the National Experimental Supersonic Transport (NEXST-1) flight trials. The NEXST-1 program involves the rocket-boosted launch of a one tenth scale model supersonic passenger airplane. The purpose is to verify the aerodynamic design of a next generation supersonic airliner based on theoretical modelling and wind tunnel testing in Japan. Following launch, the airplane will reach an altitude of 19 km and travel 100 km down-range before returning to a landing location approximately 15 km from the launch site. Landing will be achieved using clustered parachutes and airbags.

JAXA has commissioned significant infrastructure upgrades at the WTR including the installation of a massive launcher (pictured with booster and airplane) and associated moveable shelter, and also improvements to various facilities. Extensive support is being provided to JAXA by Defence and local contractor organisations.

Two NEXST-1 flight trials are planned by JAXA, with the first flight on 14 July 02 proving unsuccessful. The second flight is scheduled in late 2005.

3.5 NASA Sounding Rocket Trials

NASA sounding rocket trials have been conducted at Woomera on an occasional basis since 1961. The most recent series, involving solid fuel Terrier-boosted Black Brant rockets, were undertaken in 1987 and 1995 (total of 12 flights). The purpose of the flights was to carry out space-borne astrophysical research including observations of Supernova SN1987a which is best observed from the Southern Hemisphere.

The Black Brant rockets reached an altitude between 250-320 km, and the scientific payloads were recovered by parachute approximately 180-240 km from the launch site. Extensive local support was provided to NASA in the conduct of the trials including use of preparation facilities, range safety tracking and payload recovery.

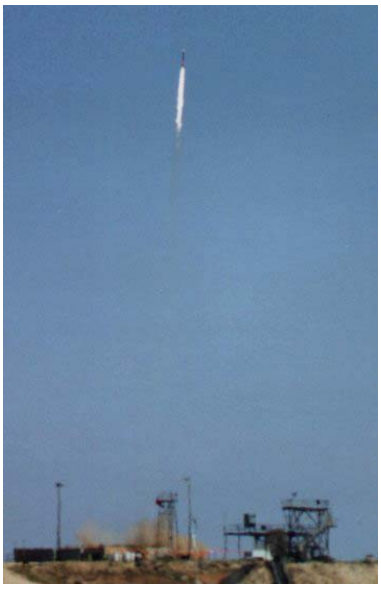
3.6 HyShot Sounding Rocket Trials

The HyShot program is led by the University of Queensland (UQ) and is aimed at testing advanced scramjet hypersonic propulsion. The program entails the launch of UQ scramjet engines on Terrier-Orion sounding rockets provided by DTI Associates. The rockets reach an apogee of over 300 km and a down-range distance of approximately 400 km. Activation of the scramjet engines occurs during re-entry at an altitude of approximately 35 km and a speed of around Mach 7-8.

During the second HyShot flight on 30 July 02, the UQ group achieved the first ever demonstration of in-flight supersonic combustion. The flight data is being compared with test results obtained using the same scramjet engine in the UQ shock tunnel facility.

Further flights in the HyShot series are planned in collaboration with Defence and international partners. AOSG is providing support for the HyShot trials including launch sequencing, radar tracking and safety management.

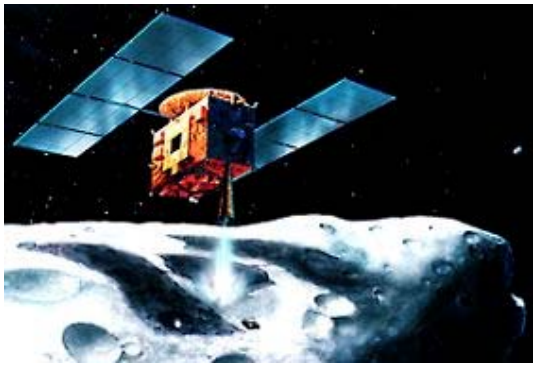
3.7 ASRI Sounding Rocket Trials



The Australian Space Research Institute (ASRI) has conducted numerous sounding rocket trials at Woomera since 1992 including the launch of the ASRI-developed liquid-fuel AUSROC-2, as well as small solid fuel 'Sighter' and 'Zuni' rockets (pictured). The latter rockets, with diameters of 75 mm and 125 mm respectively, reach altitudes of around 5-7 km and are used for experimental and educational purposes under ASRI's Small Sounding Rocket Program. Regular flights are carried out from Launch Area 9 with payloads being constructed by ASRI, university groups and school students.

ASRI is presently developing an upgraded version of the AUSROC-2 liquid fuel rocket and also a new solid fuel sounding rocket (Wagtail) for use at Woomera. Details concerning ASRI's programs can be found at www.asri.org.au.

3.8 Hayabusa Re-entry Capsule Mission



The Hayabusa deep space mission is being conducted by JAXA and is aimed at rendezvousing with a distant asteroid (Itokawa) and returning a small sample of primordial material to Earth. JAXA has selected the WTR as the landing site for the Sample Return Capsule which will undertake a high speed re-entry from interplanetary space and descend by parachute in a targeted landing area within the WTR.

The Hayabusa spacecraft was launched on 9 May 2003 from Kagoshima Space Center. Following an approximately four year round trip to the asteroid, the spacecraft will return to Earth, with landing of the Sample Return Capsule scheduled for mid-2007. Advance trials to simulate the capsule landing and location are planned by JAXA in 2006. Approval for the landing has been progressed by Australian Government entities, including the Space Licensing and Safety Office and Department of Defence.

3.9 Astronomical Observations

The remote desert location, extremely dark sky, excellent atmospheric clarity, quiet electromagnetic environment and available support infrastructure renders the WTR as a favourable location for conducting sensitive astronomical observations. The foremost astronomical facility within the WTR is the Cangaroo Gamma-Ray Telescope operated by the Universities of Adelaide and Tokyo. Cangaroo operations commenced in 2000 with a single telescope comprising a 10 metre dish made up of individual parabolic mirror segments and an array of photomultipliers at the focus. The telescope detects faint Cerenkov light produced by extremely energetic gamma-rays striking the upper atmosphere, resulting in an 'extensive air shower' of charged particles and photons. The telescope records gamma-rays emitted by violent objects in the universe such as pulsars, black holes, supernova remnants and active galaxies.

Following the success of the initial telescope, three additional telescopes have been commissioned at the Cangaroo site. The four telescopes are linked to provide a large increase in gamma-ray detection sensitivity. Additional details concerning the Cangaroo telescope array can be found at www.physics.adelaide.edu.au/astrophysics/index.html and http://icrhp9.icrr.u-tokyo.ac.jp.

3.10 Vehicle Testing

The WTR is being used on an increasing basis by Australian and international car manufacturers for testing pre-release vehicles and components (eg through Test Trak who provide local consultancy support; refer to www.test-trak.com). The WTR has a variety of sealed & unsealed road surfaces that can be used for hot environment (October to March), maximum speed and vehicle dynamics testing as well as a range of calibration tasks.

Woomera offers a number of unique and compelling advantages for vehicle testing including secure confidential roads and test facilities that are closed to the public, 24 hour / 7 day emergency services (Ambulance, Fire and Rescue), 2.5 km airfield runway for high-speed trials, full workshop capability, comprehensive communications services (including GSM mobile) and excellent 4-star accommodation and restaurant for vehicle teams.

4 SUMMARY REMARKS

The foregoing sections highlight the extreme versatility of the WTR for undertaking a diverse range of Defence and Commercial ground, air and space programs. Other activities, not specifically referenced above, are also undertaken or are proposed at the WTR including satellite launch programs, high altitude balloon trials, live firings of long-range cruise missiles and testing of Unmanned Combat Aerial Vehicles (UCAVs). Future manned suborbital space tourism flights in the WTR are also conceivable following the success of the X-Prize flights in the United States. Detailed information concerning the attributes of the WTR, available facilities and services, and how to use the WTR are contained in sections 2-6 of the WTR Capability Brief.