

Army spoilt for choice

in tank quest

Ian Bostock

Now that the Australian Army's search for an improved tank capability has been endorsed, it is appropriate to conduct a paper evaluation of the materiel solutions currently under consideration to fulfill this essential requirement.

At time of writing (late November), no decision had been announced as to the government's preferred option for a new tank capability. If, however, a source selection is made in the interim, the following will still be of relevance in comparing the chosen platform with the other two systems on offer.

M1 Abrams

Currently in service in four countries, including some 8000 in use by the US Army and US Marine Corps (USMC), the M1 Abrams is widely considered an excellent main battle tank (MBT) in all the key areas: protection, mobility and firepower. It would appear that from a platform perspective the M1 Abrams is at least as capable as the Leopard 2 and Challenger 2.

Protection: Recent combat experience in Iraq would suggest that the M1 Abrams is very well protected and able to survive kinetic energy projectile attack during close combat across a variety of battlespaces. The M1 Abrams was the spearhead of the US advance into the Iraqi interior — an operational environment as complex as any — and it survived under medium- to high-intensity conventional warfighting conditions and some asymmetric attacks about as well as can be expected. No other armoured fighting vehicle (AFV) used by the US afforded the same level of battlefield protection.

The well-sloped glacis plate and frontal turret armour seem sufficient to prevent penetration from RPG fire and 23mm cannon fire from any angle. And, of course, it should do that and more at a combat weight of 65 tonnes (M1A1 version). The rear-mounted engine grille is reportedly vulnerable to armour-piercing rounds fired from cannon of 25mm calibre and above, but then again, how often does a tank (used in a combined arms battlegroup and supported by mechanised infantry as the Australian Army would) come under attack from behind?

The deal...

It is understood that the model on offer to Australia is the M1A1 AIM (Abrams Integrated Management). This upgrade has seen the oldest M1A1s (around 770 vehicles in all) rebuilt to an 'as new' standard. The AIM program seeks to improve fleet readiness and reduce life-cycle costs. These vehicles are digitally capable and thus also referred to as M1A1D ('D' for digitised).

It should come as no real surprise given strategic circumstances and the excellent relationship between the two countries, that the Americans are offering the M1A1 AIM Abrams at 'mate's rates', thereby negating the typically higher unit cost of the type over the Leopard 2 and Challenger 2.

From the information available, the Americans are proposing the closest thing to a true package deal, which includes not only the gun tanks but extensive provisions for local in-service logistic support, ensuring that the capability is actually able to be deployed and sustained on operations, a distinct weakness within 1st Armoured Regiment currently.

As in all late-generation MBT, the turret roof of the M1 Abrams remains vulnerable to overmatch from top attack anti-tank guided weapons, of which there exist numerous types in widespread use.

Given that the Australian Army tends not to use its tank force for tank-on-tank missions, precisely how much emphasis should be placed on the M1 Abrams' ability to absorb punishment from enemy tank guns needs to be accorded the proper priority. However, it is significant to note that its base level frontal armour proved impervious to Iraqi tank (T-54/55 100mm gun; Type 59 100mm gun;

T-62 115mm gun; Type 69 100mm gun and T-72 125mm gun) fire during the 1990–91 Gulf War.

M1A1 Abrams tanks produced after 1988 incorporate significantly improved armour consisting of steel-encased depleted uranium in vital areas.

The M1 Abrams' armoured side skirts are a stand-out feature of this vehicle and appear to be at least 60mm thick. Unlike the rubber-armoured skirts fitted to Army's current Leopard AS1, these skirts are all armour and would clearly be effective in stopping AP heavy machine (HMG; 12.7-14.5mm) rounds and RPG fire from close range.

Firepower: While it is common knowledge that the 120mm tank gun equipping late generation Western tanks is superior in every ballistic sense to 105mm ordnance in the tank-on-tank role, a chief concern for Army will be to ensure it has access to a variety of 120mm ammunition natures better suited to providing direct fire support to infantry than high explosive anti-tank and armour-piercing fin-stabilised discarding-sabot (APFDS) rounds. These include high explosive squash head and canister rounds; the latter proved so devastating against enemy infantry in Vietnam.

One firepower advantage the M1 Abrams has over the Leopard 2 and Challenger 2 is the secondary armament array at the crew's disposal. Together with the standard M240 7.62mm machine guns mounted alongside the main gun and at the loader's hatch, a 12.7mm M2 Heavy Machine Gun (HMG) weapon station is installed in front of the commander's station. With a 360-degree, electrically-powered traverse and 1000 rounds of 12.7mm ammunition stowed on board, the crew is able to engage a wider selection of targets of opportunity without resorting to use of the main armament — particularly crew-served weapon teams, exposed infantry, soft-skinned and light armoured vehicles. American crews fighting in Iraq found the versatility of the M1 Abrams' secondary armaments highly effective, particularly when ranges were too short to use the main gun or when its use was restricted due to collateral damage considerations.

Total main gun ammunition loads stowed onboard the M1 Abrams and the Leopard AS1 are 40 x 120mm rounds and 59 x 105mm rounds respectively.

Mobility: There have been no adverse reports concerning the mobility of the M1 Abrams, at least none that this author knows about. Like all modern tracked AFV it is safe to say that the M1 Abrams enjoys superb cross-country mobility across a variety of terrain types.

Of more interest to the Australian Army is how well the M1 Abrams will perform in the varied but typically confined terrain of Australia's immediate region of interest. Clearly, there are those who believe that a tank of this weight cannot traverse the jungle and tropical terrain encountered across our region (in spite of Australia's success at operating the 50-tonne Centurion in Vietnam). But it should be borne in mind that the M1 Abrams is a highly manoeuvrable platform with a good power-to-weight ratio (better than that of the Challenger 2 but not as high as the Leopard 2A5) and will be operated by a unit (1st Brigade's 1st Armoured Regiment) noted for its expertise in operating in close country.

Those who have operated with tanks in the bush will know

that most tank movement is carried out deliberately and cautiously and that difficult terrain or obstacles are approached with a view to ensuring both the crew and vehicle come out the other side. It is impossible to leave the human factor out of any discussion on tank mobility, since it is the expertise (or otherwise) of the crew that often determines where a vehicle will or will not go. It has been the author's experience that young AFV drivers invariably acquire an affinity with their vehicles and learn how to get the most out of them as a mobility platform. Whichever tank is selected for Australia, the drivers and crew commanders will quickly get to understand the limits of that vehicle and know where they can and cannot go with it. Just as crews operating ASLAV and M113 have already learnt to do and those to be allocated the new Bushmaster will soon discover.

While the M1 Abrams is wider than Army's legacy Leopard AS1 (by about 25cm overall), it will make mince meat of 'track bashing'. Same goes for the Leopard 2 and Challenger 2.

Interestingly, the 406 M1A1 Abrams of the USMC are fitted with a deep-water fording kit for amphibious operations and additional tie-down points for ship-to-shore movement in landing craft.

Deployability: With the new tank (regardless of type) likely to be in service within 12–24 months at the very latest, the way in which the ADF's existing infrastructure and support equipment will accommodate and cope with the introduction of a larger and heavier tank will become an issue. Army will most certainly need new low-loader tank transporters. Each tank squadron will need new recovery vehicles able to lift and winch the new tank. Rail-rolling stock will need to be assessed as to its ability to carry heavier tanks, where vehicle width will also be a factor. Same goes for rail and ground infrastructure such as tunnels, bridges, crossing points and road surfaces around base and training areas.

Despite being the heaviest tank under consideration (the Challenger 2 is longer and the Leopard 2 is wider), the M1 Abrams is, in fact, no less deployable than the Leopard 2 or Challenger 2, as has been widely assumed in the mainstream media. Whether a tank weighs 55 or 65 tonnes is of little relevance; it's the support equipment and infrastructure a deployable force has in place that makes the difference. Compatibility with the RAN's existing amphibious transport vessels is certain to be one area where remedial work will need to be undertaken. Again, this will be irrespective of which tank is selected. For example, the rear ramp of an LPA is rated to only 50 tonnes. Basically, this enables the ramp to support a 50-tonne load unsupported (i.e. relying on its support chains and own structural strength). Given that the last of the LPA (probably *Manoora*) is not due to pay off until 2017, this will need to be rectified. From an engineering perspective, it is understood that beefing up the structural strength of the ramp is achievable; the RAN recently made similar changes to ensure the LPA stern ramp could support the 42-tonne Leopard AS1.

Perhaps more difficult to achieve will be any design changes that may be required to the Army's six new amphibious watercraft carried by the LPA, the first of which is currently

under construction by ADI Limited at its Newcastle yard. These medium landing craft were designed to be able to carry a single Leopard AS1 tank and so have a maximum payload capacity of around 50 tonnes. Just how adaptable the design is to modification to support the extra weight of the chosen new tank is unclear, but no doubt some form of contract change proposal will be required before work can commence on the remaining five craft. This will inevitably incur a slippage to the right in the construction/delivery timetable, but will be entirely necessary if the newly equipped 1st Armoured Regiment is to be deployable by sea using RAN assets.

There is some (consistent and persistent) suggestion within Army itself that the infrastructure of the kind found across Australia's immediate region of interest cannot support road traffic of the size and, in particular, the weight of the M1 Abrams. Concurrence with this theory varies depending upon with whom one talks, but clearly washaways during monsoonal wet seasons, which presented a hazard to light AFV in East Timor (both ASLAV and M113), will also prove troublesome to tank movement. It could be argued that until a heavy MBT unit is actually deployed to such environments, the jury will probably remain split down the middle over this issue.

Supportability: This is an area where the M1 Abrams has it all over the other two contenders, with the enormous production quantities in US service alone resulting in unbeatable economies of scale for the original equipment manufacturer (General Dynamics Land Systems) and associated sub-contractors, and therefore M1 Abrams users. The depth of supporting industrial infrastructure, investment in research and development, ongoing product improvement and the reliability of suppliers are unmatched.

The US offer of the M1 Abrams to Australia is understood to involve a fully optioned package that includes open and ongoing access to US Army and USMC M1 Abrams upgrades and rolling technology insertion programs out to 2020 and beyond. This will enable the Australian Army to tap into the product improvement initiatives for the US M1 Abrams fleet throughout life-of-type — picking and choosing those most applicable to our strategic circumstances and capability requirements, including those implemented as a result of the most recent combat experiences.

The AGT 1500 1500hp gas turbine engine — or more strictly speaking its poor fuel economy — continues to be a weakness of the M1 Abrams. Feedback from experienced tank commanders in 1st Armoured Regiment suggests that the fuel consumption of the gas turbine is so heavy that a dedicated fuel tanker vehicle will be required within each tank squadron to ensure that the gun tanks have adequate tactical endurance. The fact that the engine uses aviation fuel (kerosene) and not diesel, like the M113-equipped artillery forward observers and logistics echelons, and tank variant recovery vehicles, attached to each sub-unit formation no doubt presents a challenge that will take some figuring out, not least of which when vehicles in a tactical setting move to get refuelled at a forward arming and refuelling point.

According to General Dynamics, there are moves afoot to improve the fuel efficiency of the M1 Abrams' gas turbine through component modification. German engine maker MTU markets a drop-in replacement diesel engine for the M1 Abrams that has been trialled, but this has yet to be adopted by any user. It could be an option, however, for the Australian Army as part of a future upgrade. While production of the AGT 1500 engine ceased in 1992, a stockpile is maintained.

Industrially, General Dynamics has a significant local presence in Australia, which would auger well for the provision of through-life support of the capability.

Leopard 2

Current German Army plans call for the existing Leopard 2 fleet to be rationalised down to 852 tanks by 2006. This is to consist of 350 of the latest 2A6 variants and 502 of the older, non-modernised, 2A4 models.

With the Leopard 2A5/A6 currently the dominant MBT design in Europe, further development will likely continue via the recently established Leopard 2 Working Group formed by Germany, the Netherlands, Norway, Sweden and Switzerland, which have a combined total of around 580 Leopard 2A5/2A6s in service. Spain, which plans to introduce 219 Leopard 2A5s, may also join the group. In March 2002, Greece signed up for 170 Leopard 2A6s.

Protection: Even the oldest Leopard 2A4 enjoys better all-round armour protection than the Leopard AS1, particularly over the critical hull and turret front and sides. The Leopard 2A5 features additional passive armour on the front hull sides and in a wedge-shape over the turret front and gun mantlet. The Leopard 2A6 has the same armour package but a new 120mm, 55-calibre smoothbore gun, which grants increased engagement ranges and lethality against enemy armour.

The deal...

The 2A4 is believed to be the baseline Leopard 2 version under consideration. It is available in large numbers from surplus stocks, and so is the cheapest with regard to unit cost. The upgraded 2A5 and 2A6 variants are also on the list, with 70 ex-Dutch Leopard 2A6s recently becoming available, although Norway and Turkey have both expressed early interest in snapping these up.

The newest Leopard 2A4 vehicles (Batch 8) were manufactured between January 1991 and March 1992. The Leopard 2A5 was modernised during 1996–97, while 2A6 versions were upgraded very recently, some less than 12 months ago. Any deal for surplus Leopard 2 tanks would likely be a government-to-government arrangement.

It is interesting to note that while the Leopard 2 user community has clearly embraced the need to up-armour its tanks in the face of modern threats, the M1 Abrams' armour has remained unaltered since introduction of the M1A1 version more than a decade ago. Does this signify a higher level of baseline armour protection in the M1 Abrams over other competing tank designs? An underbelly add-on armour kit for the Leopard 2A6, to provide improved protection against anti-tank mines, is under development.

The latest variants of the Leopard 2 MBT family (particularly that entering service with the Swedish Army) are fitted with add-on armour, which is at the forefront of MBT armour technology development in Europe. This is provided almost exclusively by German firm IBD Deisenroth Engineering.

Firepower: The Leopard 2A4 and Leopard 2A5 sport the same 120mm smoothbore gun as the M1 Abrams. The Leopard 2A6 upgrade, however, includes replacement of the old 44-calibre ordnance with the new high velocity 55-calibre 120mm gun from Rheinmetall.

The secondary armament of all variants of the Leopard 2 gives away its design origins in the middle of the Cold War when the Soviet tank threat predominated. As such, only a 7.62mm coaxial machine and 7.62mm MG3 machine gun mounted at the loader's hatch are fitted. This cannot be considered ideal for a vehicle tasked with providing intimate fire support for infantry as any Leopard 2 acquired by Australia would be. The total number of 120mm rounds carried on board is 42.

Mobility: The Leopard 2 family of MBT, like the Leopard 1 series before it, is highly mobile and more than a match for either the M1 Abrams or Challenger 2 in this area. Typically sound German automotive and mechanical engineering has resulted in a platform with no known mechanical or performance deficiencies.

Of note is the lower ground pressure figures of both the Leopard 2A4 and 2A5 (0.83kg/cm² and 0.89kg/cm² respectively) compared to those of Challenger 2 (0.90kg/cm²) and M1A1 Abrams (1.08kg/cm²). This infers a slight advantage in cross-country mobility over soft ground or sand for the Leopard 2A4/2A5. As an aside, Army's current Leopard AS1 has a ground pressure of 0.88kg/cm².

Deployability: Coming in around five tonnes lighter than the M1A1 Abrams, there is likely to be little difference in the nature and scope of challenges encountered in introducing into service a late variant of the Leopard 2. Contrary to media reports, Army will still require new tank transporters, recovery vehicles and modifications to its existing infrastructure and the RAN will have to modify the LPA ramps and perhaps the new Army watercraft.

Supportability: It is claimed that from a logistics standpoint there is some commonality between the Leopard AS1 and Leopard 2, although this is difficult to see considering the two were designed some 10–15 years apart and are separated by light years in terms of capabilities. Engines are from the same manufacturer (MTU) but from a different series. Transmissions are from different manufacturers.

Despite feedback from some members of 1st Armoured

Regiment to the effect that there is a degree of cross-over between the overall design and workings of the Leopard AS1 and Leopard 2 series that would help alleviate the initial training burden and facilitate a rapid transition between the two types, complete re-training of instructors, vehicle crews and maintenance/support personnel would still be necessary. So too would the acquisition of new training simulators and the modification of live fire gunnery ranges to cater for and exploit the longer engagement ranges inherent in the 120mm ordnance.

One area of concern with adopting the Leopard 2 is the possibility, however remote, of the German government withholding, interrupting or otherwise interfering with the provision of spare parts and logistic support should it take issue with the ADF's intended use of an Australian force deployed offshore equipped with Leopard 2. Although this assumes that spares holdings of mission essential items would be so low that non-delivery of a single shipment would jeopardise a 1st Armoured Regiment deployment and/or its ability to sustain combat operations.

As far-fetched as such a proposition may sound, it does have considerable precedent. Not the least two examples of which include the time when Sweden refused to supply ammunition for the Australian Army's Carl Gustav 84mm recoilless rifles for use in Vietnam, and the threatened French boycott of logistics support for the RAAF's Mirage fighters during the same period.

Challenger 2

The UK's only MBT, the Challenger 2 has a solid reputation and reportedly performed very well during recent combat operations in Iraq. Receiving the last of its 386 vehicles in February 2002, the British Army intends to keep its Challenger 2s in service until at least 2025. Oman operates 38 Challenger 2s.

The deal...

The only known surplus Challenger 2s available are those earmarked to be made redundant under British Army plans for a family of Future Rapid Effects Systems vehicles. This is to involve a total of around 40 vehicles; not enough to equip 1st Armoured Regiment with or without an Army Reserve tank squadron. It is unclear when the 40 surplus Challenger 2s will become available.

While the baseline Challenger 2 is a fine tank, it is understood that to bring the vehicle up to the E (export) configuration should a user wish to do so, would cost around A\$2.3 million per unit. This would make for an expensive upgrade option considering the improvements in some areas are marginal.

Protection: There are no known accounts of any Challenger 2 being penetrated by enemy fire in Iraq, except for a blue-on-blue incident where a Challenger 2 crew mistook another Challenger 2 for enemy.

Based on photographs and footage of Challenger 2s operating in Iraq fitted with additional armour, the British Army clearly feels the need to improve the protection levels of the vehicle's baseline armour. This add-on armour consists of explosive reactive armour 'bricks' over the nose (known as ROMOR A) and ceramic/composite passive armour panels on the glacis plate and hull sides. It is the same armour kit installed on British Challenger 1 tanks during the 1990–91 Gulf War. Presumably this provides an even higher level of protection on top of the Challenger 2's still largely classified Dorchester baseline armour (a more advanced form of the composite Chobham armour) in those areas of the tank most susceptible to enemy fire. The weight penalty this extra armour incurs is estimated at several tonnes.

Firepower: The Challenger 2 is armed with a L11 120mm rifled gun. While a superbly lethal weapon in itself, the British Army now acknowledges the drawbacks of adopting rifled tank gun technology, an area where little or no research and development resources are being directed and ammunition is becoming increasingly expensive. In an effort to achieve better interoperability with its allies (particularly the US), the British Army seems certain to retrofit its Challenger 2 fleet with a 120mm smoothbore

gun. However, those Challenger 2s to be made surplus under the current transformation plans will still have the 120mm rifled gun, leaving the new owners with an ordnance orphan. The total number of 120mm rounds stowed onboard the Challenger 2 is 50.

Mobility: From all accounts the Challenger 2 is a highly mobile tank, with no known deficiencies in this area. Its power-to-weight ratio is sufficient to enable all-up weight to be increased (due to the fitting of extra armour) without a significant degradation in performance.

It must be said that like the M1 Abrams and Leopard 2, the modest maximum range of the Challenger 2 is a limiting factor in its operation as part of a fast moving and far-ranging armoured battlegroup. For the two former vehicles this is another leftover from the tank warfare-centric approaches taken to design of Western MBT during the 1970s and 1980s. But with a design history dating back only about 15 years, the Challenger 2 should possess better endurance than it does.

According to the British Ministry of Defence's 'First Reflections' lessons learnt report from Iraq, the Challenger 2 achieved an availability rate of more than 90 per cent. ♦

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At a glance

M1 Abrams

Manufacturer: General Dynamics Land Systems, USA

Users: USA, Egypt, Saudi Arabia, Kuwait

Combat Weight: 63 tonnes (M1A2), 65 tonnes (M1A1)

Max. Road Speed: 68km/h

Max. Road Range: 450km

Combat Pedigree: 1990–91 Gulf War; Balkans (peace enforcement); Iraq (ongoing)

Unit Price: Approximately A\$7 million (new)

Comment: Aside from its very thirsty gas turbine engine, the M1 Abrams is hard to fault. If one was to judge the type of tank Australia should procure based on whichever platform a potential enemy would least like to face, the M1 Abrams would probably be it.

Challenger 2

Manufacturer: Alvis Vickers Defence Systems, UK

Users: United Kingdom, Oman

Combat Weight: 62.5 tonnes

Max. Road Speed: 56km/h

Max. Road Range: 450km/h

Combat Pedigree: Balkans (peace enforcement), Iraq (ongoing);

Unit Price: Unknown, but the cost to upgrade to the E (export) standard is around A\$2.3 million per tank.

Comment: While an outstanding AFV, it is quite possible the Challenger 2 has been thrown into the mix of MBT under consideration simply to give the impression of an even contest and that a wide selection of types were evaluated.

Leopard 2

Manufacturer: Krauss-Maffei Wegmann, Germany

Users: Germany, the Netherlands, Sweden, Norway, Spain, Greece

Combat Weight: 60 tonnes (2A5/A6), 55 tonnes (2A4)

Max. Road Speed: 72km/h

Max. Road Range: 500km

Combat Pedigree: Balkans (peace enforcement)

Unit Price: Less than A\$2 million per tank for used 2A4 models

Comment: A fine tank in whatever version is offered. Would, however, make sense to acquire the latest version now rather than face the need to upgrade in the near future.