

IPCS Special Report 23
June 2006

ARJUN: INDIA'S MAIN BATTLE TANK (MBT)
FROM T-80 TO GENERATION NEXT

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Three decades after the first MBT-80 proof of concept vehicle was unveiled, five Arjun tanks, along with T 72 and T 90 tanks, will be handed over to the Army in June 2006. This batch constitutes the first delivery of the order of 124 tanks placed by the Indian Army. While flagging off the Bogie Flat Arjun Tank (BFAT) in Bangalore on 27 May 2006, Chief of Army Staff General JJ Singh said that the tanks were expected to be inducted into the Army after the field trials. The three decades that have gone into producing an MBT, that is acceptable to the Army, are dotted with adverse publicity. To begin with, the locally developed engine failed to perform to expectations. This was followed by the unsatisfactory performance of the fire control system, that produced an erratic first hit rate ranging from 20-80 percent. Apart from its heavy weight, the tank was also larger than the tanks that can be transported by standard Indian railcars: it extends 6 cms beyond the allowed 3 cm on other side of the railcar. All this meant an extension of the project beyond the mandated timeframe and budget. Nevertheless,

despite stinging criticism, the DRDO has finally managed to roll out a tank that started out as a MBT-80 but resulted in something equaling the top MBTs of the world – Abrahms, Leclerc and Leopard.

A comparison of the Arjun tank's specifications, with the acclaimed MBTs and the best MBT in Indian possession (Bhishma), reveals that Arjun is not only on par with them, but better than them in firing capacity and battle survivability.

Three key factors adjudge the quality of any MBT. They are mobility, weapon systems, and battle survivability. Lets see how the Arjun fares.



MOBILITY

To begin with, though the weight of the tank is often cited as a failure, in actuality, the tank is not very heavy as compared to other tanks in its category. Despite its weight, it has very low ground pressure which will prevent the tank from 'sinking in the sand' as widely criticized. The M1A2, heavier than Arjun by more than 10

tons and with much higher ground pressure, performed remarkably well in the desert sands during the first Gulf War. The Arjun tank is not only more agile than the T-90S Bhishma, with a maximum speed of 72 km/h, but also exerts less ground pressure, thereby significantly reducing the chance of 'sinking' in.

Specifications	Abrams M1A2	Leopard 2	Leclerc	T-90S Bhishma	Arjun
Crew	4	4	3	3	4
Combat weight	69.54 tons	60.79 tons	54.5 tons	46.5 tons	58.5 tons
Ground Pressure	15.4 PSI	11.8 PSI	13.5 PSI	12.5 PSI	11.9 PSI
Engine	1500 hp turbine	1500 hp diesel	1500 hp diesel	1000 hp diesel	1500 hp diesel
Max road speed	68 km/h	72 km/h	71 km/h	65 km/h	72 km/h
Cross-country speed	48 km/h	40 km/h	50 km/h	45 km/h	40 km/h
Protection against Nuclear, Biological and Chemical Warfare	yes	yes	yes	yes	yes
Armament					
Main gun	120 mm M256 smoothbore	120 mm M256 smoothbore	120 mm smoothbore	125 mm smoothbore	120 mm rifled
Ammunition Type	APFSDS	APFSDS-T	APFSDS and HEAT	APFSDS and HEAT	APFSDS, HEAT and HESH
Co-axial machine gun	7.62 M 240 machine gun	7.62 mm machine gun	7.62 mm machine gun	7.62 mm PKT	7.62 mm PKT
Machine gun	.52 Cal M2 machine gun	7.62 anti-aircraft machine gun	12.7 mm machine gun	12.7 NVST machine gun	12.7 NVST machine gun
Thermal Imager	Yes	Yes	Yes	Yes	Yes
Rangefinder	Laser	Laser	Laser	Laser	Laser
Price	\$ 5.4 mn	\$ 4.5 mn	\$ 4.5 mn	\$ 2.8 mn	\$ 4 mn

WEAPONS

The main armament is a 120 mm rifled gun. This is in contrast to the 120 mm smoothbore gun sported by other tanks in this category. The crucial difference with the rifled gun is that it can fire APFSDS (Armor Piercing Fin Stabilized Discarding Sabot), HEAT

(High Explosive Anti Tank) and HESH (High Explosive Squash Head) projectiles. A smoothbore gun can fire only APFSDS and HEAT projectiles but not HESH ones.

What is so special about HESH? HESH rounds have a high explosive content

that spreads itself on the surface of the target upon impact. It does not possess the armor piercing ability of the HEAT or APFSDS projectiles. However, the shock wave it creates upon impact travels through the armor and results in metal parts inside the compartment to spall off and fly damaging weapon systems, igniting fuel and ammunition in its way and particularly causing injury and death to the crew members. It has been argued that current armored fighting vehicles with composite or layered armor are safe against HESH as the shock wave is not carried inside. In addition, there exists some level of controversy over whether the reactive armor found on most MBTs effectively counters the shockwave or adds to the blast and shock effect. However, the Defence Research and Development Organization (DRDO) claims that the HESH ammunition, designed by it, has the ability to strip off the explosive reactive armor (ERA) and incapacitate the crew severely. Apart from having a deadly effect on previous generation tanks, it also has its use against fortifications. In the Arjun tank, the HESH is the secondary ammunition and is aimed against soft targets, tanks and fortifications; APFSDS projectiles are the primary anti-tank ammunition

Another feature that sets the Arjun apart from other tanks is its ability to fire while on the move. The computerized fire control system currently aboard Arjun has been jointly developed with the Israelis. The tank has a thermal imager apart from a laser finder for target designation. However, significant among Arjun's firepower is its ability to fire the LAHAT (Laser-Homing Anti-Tank) missile. The LAHAT, designed and developed by the Israeli Aircraft

Industries' (IAI) MBT division, has already been successfully tested on the Arjun. It has a range of upto 8 kms, much beyond the conventional capability of 2.5 km and beyond visual range. The tank's fire control system includes the laser designator which will project a laser beam on the target. The special feature is that the target designation can be done by another tank, or a ground laser designator, and the target need not necessarily be in the line of sight to the platform firing the missile. The missile weighing 13 kgs has a high penetration capability and there are no known defenses for armored vehicles against LAHAT.

BATTLE SURVIVABILITY

The Arjun tank uses the indigenously designed and developed 'Kanchan' composite armor which is designed to provide protection superior to similar armour on other tanks. The 'Kanchan' armour has been successfully tested against fire from APFSDS, HEAT and HESH ammunitions. Experts who saw the MBT in the DEFEXPO 2004 did concede that the build appeared "much stronger than that of T-72 or T-90S."



The integrated fire and explosion suppression system aboard Arjun is state-of-the-art technology with infrared detectors, that can detect and suppress hydro-carbon fuel/explosion within 200 milliseconds in the crew compartment and within 15 seconds in the engine compartment. Arjun uses

the Halon fire extinguishing system, similar to the one in the Abrams MBT, which can automatically activate within 2 milliseconds of either a flash or a fire. The tank also has protection against nuclear, biological and chemical weapons.

However, the specialty of the tank lies in its battlefield management system (BMS) which facilitates tactical command as well as control and communications between one tank and the rest of the team. A touch screen BMS for quick access, and an integrated Global Positioning System, enhances the efficiency of the tanks.

Like most tanks in this category, the Arjun tank also accommodates four crew members. While a three member crew with autoloaders could have increased the rate of fire from the currently 6-8 rounds/minute, a four member crew helps the crew to undertake more maintenance related work with less fatigue.

Finally, the indigenously developed hydro-pneumatic suspension provides excellent crew comfort that prevents fatigue despite extended runs.

Currently, more than 50 percent of the Arjun tank's components are imported. According to the DRDO, this is likely to go down as production progresses. Few technological changes are also on the cards to increase operational capability.

In the final tally, the Arjun tank emerges as the best tank in India's possession. Together with 'Bhishma,' the Arjun tank is set to form 30 percent of the state-of-the-art tanks that India plans to have. The discouraging developmental phase of the Arjun project not only discredited the capability of the DRDO to produce an

MBT, but also gave rise to the skepticism that the purchase of the T-90S from Russia was designed to kill the Arjun project. The successful completion of the Arjun project aims to put to rest these concerns. While the DRDO does deserve credit for the project, the army too could be given some credit, for it can be argued that if not for the uncompromising and scathing criticism from the Army, the Arjun would have ended up as an obsolete T-80 tank and not a state-of-the-art next generation tank.

REFERENCES

1. "Main Battle Tank Arjun" at <http://www.drdo.com/products/mbt.htm>
2. <http://www.drdo.com/pub/techfocus/feb02/arjun.htm>
3. <http://www.drdo.com/products/mbt.htm>
4. <http://www.drdo.com/pub/nl/may2004/newdev.htm>
5. http://www.outlookindia.com/pti_news.asp?id=228516
6. B Harry, "DEFEXPO 2004 Part I" ACIG Special Reports, 8 February 2004 at http://www.acig.org/artman/publish/article_416.shtml
7. <http://www.defenseupdate.com/directory/lahat.htm>
8. <http://encyclopedia.thefreedictionary.com/High%20explosive%20squash%20head>
9. http://www.battelfield.ru/guns/defin_2.html
10. Vishal Kansagra, "Arjun MBT: Mighty Warrior Or A Mere Mortal" Orbit, June 2004
11. Adam Geibel, "Arjun Mk I - India's MBT-70 or White Elephant?" at <http://www.defencejournal.com/nov98/arjun.htm>
12. Nitin Venkatesh, "Tank EX: DRDO new tank" *Bharat Rakshak Monitor*, vol 4 (5) March-April 2002

13. <http://www.globalsecurity.org/military/world/india/arjun.htm>
14. Rahul Bedi, "DRDO designs new main battle tank" *Deccan Herald* 16 April 2004
15. R K Radhakrishnan, "Arjun Roll Out from Avadi Factory Today" *The Hindu*, 7 August 2004
16. "DRDO promises to slash Arjun's import content" *The Indian Express*, 1 September 2004
17. "First Arjun tanks to roll out next month" *The Hindu*, 28 May 2006
18. "Field trial of Arjun tanks in the next month or two: Army chief" *The Hindustan Times*, 28 May 2006