

Arjun MBT: Mighty Warrior Or A Mere Mortal?

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[Arjun is the name of the mythological warrior from India's battle epic, the Mahabharata. The discourse that the God Krishna, who in human form is Arjun's charioteer, gives to him on the battlefield when he, Arjun, revolts at the thought of killing his own kin, is possibly the best philosophical discussion anywhere of a soldier's duty. The discourse is known as the Baghavad Gita.]

Relations between India and Pakistan have been in a state of simmering hostility since the 1971 War, which was characterized by some intense armor battles on both the Eastern and Western fronts.

At the end of that war, the Indian army realized the limitations of their tank fleet in the harsh desert conditions of Rajasthan so they initiated their own indigenous MBT design. The Combat Vehicles Research and Development Establishment (CVRDE) of the Defence Research & Development Organization (DRDO) laid out the first MBT-80 proof-of-concept vehicle in 1974.

Three decades later the end product strongly resembles the Leopard II, though its development process was plagued with delays.

May had criticized DRDO for its failure to deliver a credible tank to IA after so many years of research. As one of the prominent writer said "DRDO has produced a lemon after all this years of research."

Since now the future of Arjun is looking quiet promising, it would be prudent to provide the reader with details of all that went through to make Arjun from a 'lemon' to a fearsome MBT (Main Battle Tank).

History

Based on 1971 battlefield experiences, the Arjun (previously called MBT-80) has a rifled 120mm main gun designed by DRDO, a diesel powerplant (turbine engines are considered fuel-guzzlers) and a digital fire control system with a laser range finder. One of the early 'Chetek' prototypes was unveiled to the public on Indian Republic Day, 26 January 1984.

Another public rollout followed in April 1985, after which the name 'Arjun' became the official name. A number of prototypes (five, with an ultimate goal of 20 preproduction vehicles) undergoing technical testing were scheduled for desert trials that summer. Indian Army Chief of Staff Gen A.S. Vaidya and Dr V.S. Arunachalam (Scientific Advisor to the Defence Minister) presided at the ceremony, announcing that they planned to have the Arjun in service by the end of the decade.

At the time, it was reported to have a German MTU-based 1400 HP diesel (until an indigenous one was ready), with a weight of 'about' 50 tons (actually 52, though the sketch concepts were around 40-45 tons) and a price tag of US \$1.6 million (2 crore rupees, to total 15.5 crore for the whole project). The locally-developed engine, which was expected to deliver 1300-1500 HP from, only delivered 500 with its turbocharger fitted. However, in 1984 the DRDO was claiming that the transmission was Indian, not German. The tank's 'brains' were a modified Tank Fire Control System (TCFS), which was an upgrade project for the Vicker's Vijayanta based on the Marconi SFCS600, linked to a Barr & Stroud Tank Laser Sight and IR8 Thermal Imager.

The project was further spurred by Pakistan's announcement to fit Royal Ordnance 105mm L7 Main Guns to their Type 69 fleet in December 1985 as well as China's assistance in developing the Type-85 based MBT-2000 (named Al-Khalid) at the end of the 80's.

Meanwhile, Arjun development costs continued to rise, from October 1980 Rs. 56.55 crores to Rs 280 crores in May, 1987. The DRDO conducted the first technical trials in 1988. According to Indian Defence Minister Sharad Pawar, as of October 1991, there were 12 prototypes Arjun MBT's 'in an advanced stage of development'. General B.C. Joshi, the former Army Chief (now deceased), foresaw two Armoured Regiments of 45 Arjuns apiece, but insisted that 10 imperatives be met in 1994 before the Army could accept the tank.

In 1993 the first six prototype tanks were handed over to the 43rd Cavalry Regiment for troop trials at Rajasthan's Mahajan range. Accuracy trials from mid-1994 indicated an erratic first hit ratio that ranged from 20-80%, though this was supposedly reduced to 90% during subsequent troubleshooting. At that point, the first production, Arjuns were projected to be in service by 1995.

Years of fire-power and tactical tests on the firing ranges in desert and semi-arid conditions followed, until the Indian Army considered the results 'excellent'. The Pakistani deal with the Ukraine to purchase T-80UD/T-84's announced in the fall of 1995 caused another flurry of activity in the Indian military community.

At that point, the Arjun had just failed field trials in June. More were set for August and November but observers figured that the US \$ 100 million programme has progressed too far to be easily terminated.

On 9 January 1996 the Arjun was formally unveiled and cleared for mass production in a ceremony presided over by Prime Minister P. V. Narasimha Rao. According to Scientific Adviser to the Defence Minister, Dr. APJ Abdul Kalam, the Indians consider the Arjun comparable to the M1A2 Abrams, Leopard 2 and Leclerc.

However, Army Chief of Staff Gen. Shankar Roy chowdhury pointed out that, while some of the tank's parameters needed to be 'further finetuned', they have enough confidence to plan Arjun variants; mobile assault guns ('self-propelled platforms' or self-propelled artillery), Observation Post Vehicle and Air Defence (Gun or Missile), recovery, engineer and bridgelayers. New bridgelayers and recovery vehicles would be necessary, given the Arjun's substantial weight increase over the T-72M1 series. Most of India's roads are in the 40 ton military classification range, save for national highways' 70 ton range.

The 59-ton (58.5 tons) 15th Variant can achieve a maximum speed of 70 kph (55 mph) and cross-country of 40 kph with its 1400 HP powerplant. The Arjun's hydropneumatic suspension can be hardened or softened, according to the terrain and the 1610 litre fuel tank allows for a cruising range of 200 km (120 miles).

The 15 Pre-Production Series (PPS) tanks were supposed to be supplied to three armoured regiments for testing in 1996, but it wasn't until 27 August that the Defence Production and Supplies Secretary ordered them from the Heavy Vehicles Factory, Avadi (at which point, one Indian media estimate placed the project cost at US \$ 112 million or 400 million Rupees).

However, the Indian Defence Ministry's publicised cost for these 15 tanks was US \$ 38.2 million (R1.62 billion).

At least one Arjun fielded by the 43rd Armoured Regiment participated in the 48th Republic Day parade on 27 January 1997. Delivery of the prototype lot was completed in April, field trials were again declared completed and series production was to start in early June '97.

However, the list of faults after twenty years of development was not encouraging. In addition to unspecified but numerous technical modifications to its fire and gun control systems (the Commanders Periscopic Sight, the Laser Warning Sight and the Muzzle Reference Sight have been found 'unreliable'), the fire control system in particular has been found unable to perform in temperatures above 42 degrees Celsius. The DRDO has been contemplating scraping the current Arjun FCS in favour of whatever is accepted for the T-72M1 upgrade programme.

Since the Arjun extends 6cm beyond the official 3cm limit on either side of a standard Indian flatbed railcar, strategic transport would be extremely difficult. This would also require that India refurbish large sections of her rail network, as well as acquiring new rolling stock (This is nothing new, as the Germans had this problem with the 'Tiger' Mk VI in World War II). Its width and weight, Indian Rail to charge the Army over-dimensional consignment (ODC) costs, which are 150% over normal costs. The Indian Ministry of Defence allocated US\$ 3.9 million (R165 million) to develop three Arjun-capable flatbed rail cars wagon by January 1999.

The German MTU MB 838 Ka-SOI 1,400 hp diesel engine and transmission derated at high temperatures, with an estimated 20-25% powerloss from engine to drive sprocket while operating in desert temperatures of 45-500 Celsius. Ammunition stowage had to be reduced in order to increase engine cooling and the 15th PPS can not fire over the engine deck at 00 elevation because of the bulky cooling pack. This powerpack choice also resulted in bulges in the hull side walls.

The problems with the hydropneumatic suspension can possibly be linked to the Arjun's difficulty in climbing sand dunes and other obstacles easily, with a sharp drop in speed in its attempt to do so. Furthermore, the inert gases needed would be another item added to the supply trains.

As of mid-year, the 15th Arjun Mk I was to be the basis for the production model 4. The defects noticed during the user trials of Mk.1, including overheating of the engine in Rajasthan desert areas, had been 'by and large overcome' and certain

other complaints were being addressed. CVRDE has mostly rectified the other problems in the hydro-pneumatic suspension.

Another problem in the Arjun's development was that more than half the components (FCS, engine, transmission unit, tracks, thermal sight, night sight) are imported, with the design components 1970's and 80's vintage.

Furthermore, the technology transfer agreements for the imported engine, gun control system, fire-control system had most vendors (like MTU and Holland's Oldelft, which makes the LRS 5 Fire Control System) producing components in India in a phased manner.

The production of 100 Arjun Mk.1 MBTs was expected to start by late 1997 (during the Ninth Defence Plan) at an estimated cost of US\$ 2.8 million [Rs. 10 crores] each. The Army, however, feels that the 100-tank lot might take more than five years, given the capacity at the Avadi Heavy Vehicles Factory near Chennai and its commitments to various sectors of the armed forces. The first production tank was promised by 1985.

A later claim by DRDO stated that it needed up to (Rs 1,800 crores) to produce 120 tanks over the next five years, with each one costing US \$ 4.2 million [Rs 15 crores] (about a 2,000 % increase in project cost since 1974).

Another cost estimate figured that the Arjun will be over Rs 26 billion by 2001 for two or three regiments (124 tanks), totaling around US \$5.6 million (Rs 200 million) per tank. This escalating estimate does not include the cost of ammunition, spares and engineering support for the Arjun's induction into service, which is estimated at over (Rs 5 billion).

One reported Government-sanctioned figure for Arjun development and T-72M1 upgrade (with most going to the Arjun) is US \$1.12 Billion (Rs 40 billion) spread out over the next three to five years.

Despite promises made by the Finance Minister, Mr. P. Chidambaram, that lack of funds would not come in the way of India's defence needs, some officials were skeptical over deadlines being maintained by the production and subcontractors which might result not only in cost escalation but also affect defence preparedness. Detractors think that (barring drastic changes) the country's progressively shrinking defence budget, coupled with the persistent technical problems, would delay any serious Arjun serial production until 2002/2004.

In early August, 1997 General Shankar Roy Chowdhury, Army chief of staff, promised officers and soldiers of the 13th Armoured Regiment that the Arjun would enter production soon. Less than two months later, DRDO was shaken by the desertion of scores of military scientists and engineers lured to the more lucrative private sector, jeopardizing the success of the Arjun project.

As of 18 September, the Indian Parliament approved a \$6.9 Billion (250 billion Rupee) Five-Year Defence Budget. In this 1997-2002 budget, some 40 Billion Rupees has been allocated for the Ajeya rebuild programme, and another 1 Billion Rupees for the first 100 Arjuns.

Yet BG D. R. Gole went on record in October saying that the Arjun's Fire Control System has a 20-80% First Shot hit ratio. The DRDO blamed this on the test crew from the 43rd Cavalry, whom they accused of having a mindset leftover from the T-72M1's (which cannot fire on the move). Before official acceptance, the Army wants the tank lightened, fitted with an internal APU and reactive armour.

In mid-November, DRDO chief A.P.J. Abdul Kalam told a closed-door meeting of his ministry's Parliamentary Consultative Committee that the Arjun had been tested for 20,000 km and cleared for 'limited series production'.

Before a crowd at the National Defence Academy in early December, the Army Chief of Staff Gen. Ved Prakash Malik denied that Arjun's induction into the army was being delayed and added that some unspecified tests and improvements had to be carried out before the army could accept them.

By early May, 1998, the US decision to impose sanctions on India could possibly have jeopardized the Arjun's further development, since some US companies were supplying elements of the main gun-sighting and fire-control systems for the Arjun tank. There was also speculation as to whether Germany would stop supplying MTU engines. Arjun Executive Board (AEB) narrowed their choices for an FCS to Thomson CSF and Elbit of Israel (which could also be used in the T-72M1 'Rhino'). The imported components used in the Arjun rose from 27% in the 1987 to 60% in PPS. (Pre-Production Series) enhancing the costs substantially.

The Comptroller and Auditor General's report on the Summer 1997 trials, released in mid-1998, noted six premature transmission failures and frequent overheating of the transmission fluid, probably because the imported transmission assembly had been overloaded.

Teething problems

Even after crores had been spent on the project the future of Arjun looked very bleak since Army was not ready to accept Arjun until most of the problems had been sorted out. Pakistan acquired 315 T-80U from Ukraine and this was a cause of concern for Army, which needed a similar if not better MBT to counter T-80U. They turned to T-90S from Russia, which was considered superior to T-80U. Field trials of T-90S began in 1999. At \$ 3 million apiece, it was worth it. To many it looked like the last nail in Arjun's coffin. Arjun's list of problems read something like this:

- Old & inefficient MTU engine which heated up frequently making Arjun unsuitable for deployment in Rajasthan.
- To counter overheating, a cooling pack was installed which reduced the ammo capacity & affected gun depression.
- Failure to develop an indigenous 1500 hp engine.
- Problems with the FCS.
- Poor operational mobility due to its excessive weight and width.
- Problems with the commander's periscope sight, laser warning sight and muzzle reference sight.

- Transporting Arjun was a problem, as the 58-tonne tank protrudes 6cm beyond the permissible 3cm limit on either side of tank transporters used for India's current MBT, the T-72M1.

Back from the dead

If Arjun resembles something most from mythology, it is the bird which rises from its own ashes – the Phoenix. DRDO was raring to go ahead and eliminate all the flaws that Arjun had and give a potent fighting machine to the Indian Army. They started solving all the problems one at a time.

- DRDO fixed the problems with mobility & engine heating.
- DRDO teamed up with Israeli companies to develop a digital FCS. This FCS was extensively tested by Indian Army & duly accepted.
- Development of new & better optics by BEL.
- The MoD has allocated \$3.9 million to build three transporter types to move Arjun.

In addition to this Arjun achieved many goals. Some of them are listed below.

- Chromium lined barrel increases the barrel life & also the muzzle velocity of the shell.
- Arjun's armor was tested in combat like conditions and fared very well. It also withstood direct fire of APFSDS, HEAT, HESH & various RPG rounds as per the latest trials on September 2003.
- LAHAT ATGM has been test fired from Arjun. This trials were successful.
- Never before seen crew protection levels in tanks used by Indian Army. Crew protection is paramount and slight changes have been made here. The ammo storage is in the turret bustle but is modulated and separated from the crew by armor, so that if hit by RPG or top-attack ATGM, crew remains safe.
- Integrated GPS & BMS (Battlefield Management System). These systems have touch screen for rapid access.
- A new Active Area Defense System (AADS) from Elbit.
- Estimated cost of \$ 4 million per piece.

Future

Future of Arjun looks very bright. DRDO is more confident now. Spin-offs from Arjun project have been many. Army has extensively tested a howitzer mounted on Arjun chasis named 'Bhim'. Another is Arjun turret mounted atop T-72 chasis. It is named Tank-Ex by DRDO (some people also call it Karna).

So now Arjun has really turned into a mighty warrior and is a fitting reply to all those who have criticized DRDO for nothing but "a bunch of jokers".