"Arjun," India's Mythical Warrior, Is Nearing Reality

An Arjun prototype during trials.

by 1LT Adam Geibel

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.

While the United States had supplied M48 and M47 "Pattons" to Pakistan, the Soviet Union has been the primary supplier of MBTs to India since the '60s. At that time, two armored divisions fielded about 900 T-55s. These served well in both the 1965 and 1971 wars with Pakistan, but both belligerents recognized the limitations of existing designs. This sparked the India-Pakistan MBT race.

In addition to sequential upgrades of models already in their inventories, both countries embarked on indigenous MBT designs. India's "Arjun" and Pakistan's "Al Khalid" have soaked up millions of defense dollars, with little more to show for the dual efforts then a handful of prototypes and pre-production models of both tanks.

Arjun Development History

At the end of the 1971 war, the Indian army realized the limitations of their tank fleet in the harsh desert conditions of Rajasthan, a northwestern Indian state bordering Pakistan, so they initiated their own MBT design. The first "Arjun" (named after a mythical Hindu warrior prince) concept was laid out in 1974 by the Combat Vehicles Research and Development Establishment (CVRDE) of the Defence Research and Development Organization (DRDO). Based on 1971 battlefield experiences, the Arjun would have a locally-designed, rifled 120mm main gun, a German, MTU-based diesel powerplant (The Indians consider turbine engines fuel guzzlers), and a computerized fire control system with a laser rangefinder.

One of the early Arjun prototypes was unveiled to the public in April 1985 (though it was probably ready to roll at some point in 1983-84), with a number of prototypes undergoing technical testing while desert trials were scheduled for 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 120mm smooth-bore main gun and would use a 1400-hp MTU-based diesel until an indigenous one was ready. Weight would be about 50 tons, and the tank would cost about $1.6 million (U.S.), but development costs rose about 500 percent throughout the '80s. Twenty-six years later, through a development process plagued with delays, the end product visually resembles the German Leopard II, however, unlike the German vehicle, its future is in doubt.

According to Indian Defense Minister Sharad Pawar, there were 12 prototype Arjun MBTs "in an advanced stage of development" as of October 1991. At that point, the first production Arjuns were projected to be in service by 1995. Years of firepower and tactical tests on the firing ranges in desert and semi-arid conditions followed, until the Indian Army considered the results "excellent." Indications were that the Indians were ready for production decisions. Then the Pakistani's announced in 1985 a deal with the Ukraine to purchase T-84s, This announcement caused another flurry of activity in the Indian tank development community.

On 9 January 1996, the Arjun was formally unveiled and cleared for mass production. 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 Choudhury pointed out that, while some of the tank's parameters needed to be "further fine-tuned," they have enough confidence to plan Arjun variants — mobile assault guns, an observation post vehicle, an air defense (gun or missile) version, a recovery vehicle, an engineer vehicle, and bridgelayers. New bridgelayers and recovery vehicles were necessary, given the Arjun's substantial weight increase over the T-72M1 series.

Technical Background

The 59-ton 15th Variant can achieve a maximum speed of 70 kph (55 mph) and cross-country speed of 40 kph with its 1400-hp powerplant. The Arjun's hydropneumatic suspension can be hardened or softened, according to the terrain, and the 1,610-liter fuel tank allows for a cruising range of 200 km (120 miles).

The semiautomatic transmission, hydrodynamic torque converter, retarder, and integral system are local designs (the designers seek to produce from 70 to 80 percent of the tank's parts in-country.). The service brake consists of a hydraulically operated, high-performance brake disc that is incorporated into the final drive.

To ensure crew survivability, production versions will have the indigenously-researched and developed 'Kanchan' composite armor, an automatic fire detection and suppression system, and an NBC protection system designed and built by the Bhabha Atomic Research Center.

The tank exerts a ground pressure of .84 kg/cm square and can climb a gradient of 35 degrees (necessary for crossing Rajasthan sand dunes). Since the river-strewn Punjab area "ditch cum bund"' defenses caused innumerable problems during the 1971 War, the Arjun can cross

1.4-meter-deep channels and 2.43-meter trenches.

The rifled 120mm gun, which includes a muzzle reference system, is made of ESR steel and is fitted with a thermal sleeve and fume extractor. All main gun rounds use a semi-combustible cartridge case with increased energy propellant for higher muzzle velocity and greater penetration characteristics. In addition to the usual suite of rounds, an anti-helicopter round is under development as well. Onboard ammo is stowed in watertight containers (indicating possible wet-stowage).

The Arjun's fire control system includes a laser rangefinder, ballistic computer, thermal imaging night sight, stabilized panoramic sight for the tank commander, and a secondary telescopic sight. (One source had this system based on the Vijayanta's Mk 1B FCS developed by Bharat Electronics, but this was probably an earlier prototype).

The gunner's main sight includes daylight, thermal sight, and laser rangefinder channels. The common sighting head mirror is stabilized in elevation and azimuth. The daylight sight has dual magnification while the thermal imager provides a night vision facility to the gunner and the commander.

The LRF (integral to the gunner's sight) has a range of nearly 10 km and a thermal imager (which can "see"' at around 5.5 km, recognize a target at 3.1 km and identify targets at 2.5 km). The Arjun fire control system's ability to fire on the move during the night is a major step forward for Indian armored forces.

The commander's panoramic sight provides 360-degree surveillance without the TC moving his eyes from the sight and also without disturbing the lay of the turret. The field of view is stabilized with the help of a two-axis rate gyro mounted on the platform of the head mirror.

Apparently, improvements were deemed necessary even after the Arjun design profile was accepted again in July 1996, an acceptance which would have allowed production to commence when funding became available. However, some elements of the chosen version fell far short of army specifications.

On 27 August 1996, the Defense Production and Supplies Secretary ordered 15 pre-production tanks from the Heavy Vehicles Factory, Avadi (at which point, one Indian media estimate placed the project cost at $112 million (U.S.).

At least one Arjun fielded by the 43rd Armored Regiment participated in the 48th Republic Day parade on 27 January 1997. Field trials were again declared completed and series production was to start in early June '97.

As of mid-year, around 15 prototypes of the Arjun Mk.1 MBT had already been built, with the last being the basis for the production model.

However, the list of faults after 20 years of development was not encouraging. In addition to numerous technical modifications to its fire and gun control systems (the commander's periscope 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 (108° F). The DRDO has been considering scrapping the current Arjun fire control system in favor of whatever is accepted for the T-72M1 upgrade program. Since the Arjun extends beyond the official width limit on either side of a standard Indian flatbed rail car, strategic transport would be extremely difficult. This would also require that India refurbish large sections of her rail network, as well as acquire new rolling stock. (This is nothing new in the annals of tank development, as the Germans had this same problem when fielding the 'Tiger' Mk VI during World War II.)

The MTU powerpack derates at high temperatures, and ammunition stowage had to be reduced in order to increase engine cooling, however, plans remained in place to acquire 1,500 engines up until mid-'97).

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 technology transfer of the imported engine, gun control system, and fire-control system have been tied up with most vendors (like MTU and Holland's Oldelft, which makes the LRS 5 fire control system) to produce components in India in a phased manner.

Defects noticed during the user trials of the Arjun Mk.1 MBT, including overheating of the engine in Rajasthan desert areas, had supposedly been "by and large overcome" while other complaints were being addressed. CVRDE has mostly rectified the other problems in the hydro-pneumatic suspension.

While the Heavy Vehicles Factory at Avadi will handle the actual manufacture, several Indian subcontractors are responsible for subsystems. The production of 100 Arjun Mk.1 MBTs is expected to start by late 1997 at an estimated cost of $2.8 million (U.S.) each, although the Army feels that the 100-tank lot might take more than five years, given the capacity at the Avadi factory and its commitments to various sectors of the armed forces. The first production tank should be ready by 1998.

Meanwhile, cost estimates continue to increase. DRDO later stated that the 120 tanks to be built over the next five years would cost $4.2 million (U.S.) each, representing about a 2,000 percent increase in project cost since 1974. Another cost estimate places the figure at $5.6 million each per tank by 2001, given a purchase of 124 tanks to equip two regiments. This escalating estimate does not include the cost of ammunition, spare parts, and engineering support for the Arjun's in-

ARJUN Mk 1 (15th Prototype Model)

Weight: 59 tons (58.5 tonnes)
Length (gun forwards): 10.19m
Width (w/ skirts): 3.85m
Height (w/o 12.7mm AAMG): 2.32m

Engine: 1400 HP MTU 838 Ka 501Diesel (some reports of 1500 HP)
Transmission: Semi-automatic with 4 forward and 2 reverse gears. (also reported as ZF automatic)
Fuel: 1610 ltrs

PERFORMANCE

Max Speed: 72-70 kph (55 mph)
Cross Country Speed: 40 kph
Cruising Range: 200 km (120 miles)
Ground Pressure: .84 kg/cm Square
Ground Clearance: .45m
Slide Slope: 60%
Climbing Gradient: 35x
Trench: 2.43 m (also given as 3m)
Vertical Obstacle: .9m
Ford: 1.4 m

ARMAMENT

Main Gun: 120mm, stabilized w/MRS (APFSDS, HE, HEAT, HESH and smoke)
12.7mm AA Gun
7.62mm Coax
2 x 9 Smoke Grenade Launchers
LRF Range: 10 km
Sights: Thermal (Max Rng 5.5 km)
Active and Passive Defensive Systems: "Arena" a possibility, probable Laser Warning System

duction into the army. One reported government-sanctioned figure for Arjun development and the upgrade of the nation's T-72M1s (with most going to the Arjun) at $1.12 billion (U.S.), 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 defense needs, some officials were skeptical over deadlines being maintained by the factory and subcontractors. The result would be not only a cost escalation due to the effects of inflation but also an adverse impact on defense preparedness. Detractors think that (baring drastic changes) the country's progressively shrinking defense budget, coupled with the persistent technical problems, would delay any serious Arjun serial production until 2002/2004.

In early August, General Choudhury promised officers and soldiers of the 13th Armored 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, thus jeopardizing the Arjun project's success.

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

Footnotes

The Soviet Union has been the primary supplier of MBT's to India since the '60s, but since 1990 the supply of spare parts from Russia has been questionable (the Indian Air Force's MiG fleet is also suffering from this problem). Local production started in 1979 as a response to the Arjun's slow development and to stimulate supporting industries in India's economy. The DRDO has also produced versions of the BMP-2 and the "Ajeya" (a T-72M1). There have been plans to retrofit India's "Ajeya" fleet with the "Arjun's" updated FCS as time and funds permit, starting in 1986-87.

Furthermore, in May 1997 the Russians offered the "Arena" active defense system to India. Presumably, the Arjun could be fitted with this suite as well.

* One source claims that, as of 1997, there exists a total of 17 prototypes and 20 pre-production vehicles, with the first pre-production vehicle delivered in 1988.