



FINANCIAL CONFLICTS BETWEEN DRDO AND INDIAN DEFENCE: A CASE OF MAIN BATTLE TANKS – ARJUN

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ABSTRACT

Agility and specificity are two important concepts of any defence structure. Even the defence structure can be reduced in the field of air and water but on the lands the 'boots' (soldiers) are most important and it cannot be reduced. To tackle the conflicts of internal and external these boots are more important, hence to protect these boots sophisticated technology is more important. When it comes to the external these boots are protected by heavy armaments such as main battle tanks and allied vehicles. Hence DRDO – Defence Research and Development Organisation is in a steady business of invention and up-gradation of the existing and futuristic technologies for the better protection of the soldiers. Hence the DRDO has given a better technological support in form of Main battle tank of India – ARJUN. But the financial conflicts between the purchaser – Indian army and the producer – DRDO has given this business a wider gap. Hence the zone of buffer area has to be filled. Hence this paper intervenes the highlights of the DRDO and Indian defence comparing the existing tank business in the world.

KEYWORDS: Main battle tanks, defence business, DRDO, Indian defence etc.

INTRODUCTION

The intense development of threats with the change in the diplomatic relation and to keep a wide range of gap between the defence and threats it is very important to have a certain advance and agile technologies which can tackle the problems in the near coming future. Hence the up-gradation and systematic positioning of the weaponry is most important. Hence the defence research and development organisation are presently working in this area. The most important in any defence area is the defence of land which are mainly guarded by the soldiers and hence to give proper protection and coverage for these soldiers life, systematic machines which comes in the name of 'TANKS' are mainly needed. Hence every nation which is having the capacity to produce is in the process of production of these death machines. India is also one of such which stood in the line of purchases and which has just shifted from there to the place of producer. Hence they have come with the result called Arjun which is the main battle tanks for the defence. Since DRDO is the birth place of this main battle tank which has the 'tag of native' comes with the customised version which is exactly suitable for the Indian terrain. But the main concern for the Indian army which is ready to purchase these tanks is the cost. Hence this cost factors has given a wide gap between the DRDO and the Indian defence which has become a difficult to fill because of several factors and hence this paper has expressed the concern of Indian defence on DRDO to reduce the cost and the defence of the coated price of DRDO because of several factors. This paper has also highlighted the cost of production of the tanks around the world.

LITERATURE REVIEW

A main battle tank (MBT), also known as a battle tank or universal tank, is a tank that fills the heavy direct fire role

of many modern armies. They were originally conceived to replace the light, medium, heavy and super-heavy tanks. Development was spurred onwards in the Cold War with the development of lightweight composite armor. They are still supplemented in some armies with light tanks. Today, main battle tanks are considered a key component of modern armies. Modern MBTs seldom operate alone, as they are organized into armored units which involve the support of infantry, who may accompany the MBTs in infantry fighting vehicles. They are also often supported by surveillance or ground-attack aircraft.

The concept of the medium tank gradually evolved into the MBT in the 1960s, as it was realized that medium tanks could carry guns (such as the US 90 mm, Soviet 100 mm, and especially the British L7 105 mm) that could penetrate any practical level of armor at long range. The World War II concept of heavy tanks, armed with the most powerful guns and heaviest armor, became obsolete because they were too expensive and as (if not more) vulnerable as other vehicles to attack. Likewise, World War II had shown that lightly armed and armored tanks were of limited value in most roles. Even reconnaissance vehicles had shown a trend towards heavier weight and greater firepower during World War II; speed was not a substitute for armor and firepower.

An increasing variety of anti-tank weapons and the perceived threat of a nuclear war prioritized the need for additional armor. The additional armor prompted the design of even more powerful cannons. The main battle tank thus took on the role the British had once called the 'Universal tank', exemplified by the Centurion, filling almost all battlefield roles. Typical main battle tanks were as well armed as any other vehicle on the battlefield, highly mobile, and well armored. Yet they were cheap enough to be built in large numbers. The first Soviet main

battle tank was the T-64(T-54/55 and T-62 then considered "medium" tanks) and the first American MBT was the M60 Patton. The adoption of ceramic armor as well as greater armor coverage necessitated by attacks from above by combat aircraft such as helicopters also resulted in an effective counter to nuclear explosion radiation. By the late 70s to 90s, MBTs were manufactured by France, West Germany, Britain, India, Japan, the Soviet Union, Sweden, Switzerland, and the United States.

MAIN BATTLE TANK OF INDIA: ARJUN

The Arjun is a third generation main battle tank developed by India's Defence Research and Development Organization (DRDO), for the Indian Army. The tank is

named for Arjun, a character in the Indian epic, Mahabharata.

The Arjun features a 120 mm main rifled gun with indigenously developed APFSDS ammunition, one 7.62 mm coaxial machine gun, and a 12.7 mm machine gun. It is powered by a single MTU multi-fuel diesel engine rated at 1,400 hp, and can achieve a maximum speed of 70 km/h (43 mph) and a cross-country speed of 40 km/h (25 mph). It has a four-man crew: commander, gunner, loader and driver. Automatic fire detection and suppression, and NBC protection systems are included. All-round anti-tank warhead protection by the newly developed Kanchan armour is claimed to be much higher than available in comparable third generation tanks.



Picture 1: Arjun: main battle tank of India

In March 2010, the Arjun was pitted against the T-90 in comparative trials and performed well. Subsequently delays and other problems in its development from the 1990s to the 2000s prompted the Indian Army to order vast numbers of T-90S tanks from Russia to meet requirements that the Arjun had been expected to fulfil. Army placed an order for an additional 124 Arjun Mk-I tanks on 17 May 2010 and 124 Arjun Mk-II Tanks on 9 August 2010.

The Arjun entered service with the Indian Army in 2004. The tanks were first inducted into the 43rd Armoured Regiment, Indian Army Armoured Corps, which was later built up to regiment strength in 2009, while the latest induction has been into the 75th Armoured Regiment on 12 March 2011.

TECHNICAL DATA

Armament

Main armament is a The120mmcalibre rifled gun together with the newly developed super FSAPDS ammunition, can defeat any contemporary armour used in tanks. The electro slag-refined gun steel tube is auto-frett aged to withstand higher gas pressures. A thermal jacket prevents irregular temperature distribution on the tube due to weather influences. Aco-axial 7.62 mm machine gun for anti-personnel targets and a 12.7 mm machine gun for anti-aircraft as well as ground targets have been provided as secondary weapons. The superior armour-defeating capability of the indigenously developed Fin-stabilized Armour Piercing Discarding Sabot (FSAPDS) ammunition

and 120 mm calibre rifled gun give Arjun MBT an edge over contemporary world-class tanks. A computer-controlled integrated Fire Control System (FCS) with day-cum-night stabilised sighting system guarantees a very high First-round-hit Probability (FRHP) and reduced reaction time to bring effective fire on targets. Mounted either side of the turret is a bank of nine forward-firing smoke grenade dischargers, the upper layer having five tubes and the lower layer four.

Protection

Arjun has an all-round protection from antitank ammunition achieved by the newly developed Kanchan armour to a degree much higher than available in the present generation tanks.

Propulsion

Low ground pressure, high power-to-weight ratio, and adoption of new design concepts in engine, transmission, suspension and running gear make MBT Arjun a highly mobile and agile weapon platform. The remarkable mobility characteristics of Arjun, which also add to its protection, are the result of:

- High performance diesel engine.
- Robust and effective automatic transmission system.
- High flexible hydro-pneumatic suspension.
- Optimised running gear with high shock energy absorption capability.

The engine and transmission are provided by German companies MTU and Renk respectively. The water-cooled engine generates 1,400 hp and is integrated with an Indian turbocharger and epicyclic train gearbox with four forward

and 2 reverse gears A local transmission is under trials and it is envisioned to ultimately replace the Renk-supplied unit The tracks which were being supplied by German company Diehl are now being manufactured by L&T. The cooling pack has been designed for desert operations. The Arjun has a lower ground pressure than the lighter T-72, due to its design. Suspension is of the hydropneumatic type. The aluminium alloy rubberised track blocks have rubber-bushed pins, the track tensioners have a built-in overload protection.

Accessories

Ergonometry, using anthropometric data of Indian troops, has been given due importance while designing the

fighting and driving compartments to fully exploit the outstanding features of the weapon system. Hydropneumatic suspension provides excellent ride comfort to crew eliminating fatigue on extended runs. Arjun has excellent fording capabilities. It can ford 1.4m without preparation and wade through a depth of up to 2.15 m. The Arjun has an NBC system designed and built by the Bhabha Atomic Research Centre (BARC). To further enhance battlefield survivability, the Arjun has an automatic fire detection and suppression system. Ammunition is also stowed in watertight containers to reduce the risk of fire.

Specifications

Armament	Armor
One 120 mm gun, one 7.62 mm MAG coaxial machine gun, one NSVT 12.7 mm anti-aircraft machine gun, 2 x 9 smoke grenade launcher	Composite armour
Country users	Weight
India	58,500 kg
Designer Country	Speed
India	70 km/h maximum speed on road, 40 km/h cross-country
Accessories	Range
Laser range finder, automatic fire detection and suppression system, computer firing system, night vision, NBC protection system	450 km
Crew	Dimensions
4	Length, 10.19 m; Width, 3.84 m; Height, 2.32 m

REASONS OR NEED FOR THE PRODUCTION

According to a recent report published by the Stockholm International Peace Research Institute (SIPRI), India has become the largest defence importer during the period between 2007-2011, thus overtaking China, which fell to the fourth position. During this period, India alone accounted for 10 per cent of global arms imports. Also, no prizes for guessing the country that provided us with most of the defence equipment. Russia, our all-weather friend, supplied us with 80% of our defence imports, the most well-known (and expensive) among them being the T90 MTB, Sukhoi-30 MKI, MiG-29K fighter aircraft, nuclear aircraft carrier Admiral Gorshkov and nuclear powered Akula -II submarine. Also, imports of such magnitude are not a one-off thing. India, for the next decade at least, will continue to remain the top importer due to a fledgling defence-industrial base (DIB) and a high defence expenditure, which has been deemed necessary because of the Sino-Pakistani threat.

Hence because of these threats, the weaponry are the most important to protect the country. In this context the self-building of the weaponry such as main battle tank such as Arjun is because of two reasons.

Replacing the aging and existing main battle tanks

India already possesses the main battle tanks which are of foreign origin such as The *Vijayanta* (main battle tank was built in India based on a licensed design of the Vickers Mk.1. The first 90 vehicles were built by Vickers in the UK. Production continued at the Heavy Vehicles Factory

in Avadi until 1983 with 2,200 being built (other sources give much lower numbers: 1,600-1,800), **T72** (The T-72 is a Soviet-designed main battle tank that entered production in 1970. These tanks were also bought by India in the modified version).

To become self-sufficiency in weaponry production

Since India is importing the main battle tanks which are mainly from Russia. And also the majority of the defence weaponry comes from Russia; hence it is nothing but the total dependence on Russian weapon supply. Hence we have already have T-90 main battle tanks which is of Russian origin. **T-90** (The T-90 is a Russian third-generation main battle tank that is a modernisation of the T-72 (it was originally to be called the T-72BU, later renamed to T-90). It is currently the most modern tank in service with the Russian Ground Forces and Naval Infantry.). India bought 310 T-90S tanks from Russia, of which 120 were delivered complete, 90 in semi-knocked down kits, and 100 in completely knocked down kits.

Since majority of the weapons are imported. The main battle tanks which India possesses are having been imported in the core form or in the form of partial technology transfer or obtaining licence for production. Hence to have a partial end for the importing of this weaponry which is of high cost and to build its own weaponry which is cost efficient it is necessary to build its own, the production of such defence items became necessary.

OBJECTIVE

1. to analyse the cost of the Arjun tank with that of other tanks
2. to analyse the reasons for the cost escalation
3. to analyse the efficiency of the Arjun tank
4. to compare the efficiency of the tank with other tanks especially with that of Pakistan and china in terms of cost per unit

Cost analysis of Arjun tank with that of other tanks

The army could clear the indigenous Arjun Mark II main battle tank (MBT) for frontline service after trials next year, but a question mark hangs over the Arjun’s prohibitive cost. Heavy Vehicle Factory, Avadi (HVF) has

already built 124 Arjun Mark I tanks for the army at Rs 18 crore per tank. But on 29th August, Defence Minister AK Antony sprung a bombshell when he announced in Parliament that, “The likely estimated (sic) cost of each MBT Arjun Mark-II... will be approximately Rs 37 crore.”

This is twice the price of the Russian T-90 and not much cheaper than USA’s M1 Abrams, the world’s most advanced MBT. On 1st July 11, the US Congress was notified that Egypt would buy 125 Abrams tanks for \$1.3 billion — i.e. \$10.4 million, or Rs 54 crore, per tank. A comparative analysis of the some best tanks of the world has been given in the table

Specifications	Abrams M1A2	Leopard 2	Leclerc	T-90S Bhisma	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

Reasons for the cost escalation of the Arjun tank

The development of the few tanks cost much but it can be reduced when the army places a large order. During a visit to HVF and to the Central Vehicles R&D Establishment (CVRDE), which has developed the Arjun, Business Standard was explained that the cost of the Arjun is easily reduced. If the army places a larger order the price will drop by 30 per cent.

P. Siva kumar, Director of CVRDE, explains that 50 per cent of the cost of the Arjun Mark I went on three imported components —the gunner’s main sight (GMS) from OIP Systems, Belgium; the gun control equipment (GCE) from Bosch, Germany; and the power pack (engine and transmission) from Renk, Germany — which together cost Rs 12 crore. Ordering just 124 pieces left little leeway to beat down that price. Hence talking just 124 tanks, there

is a problem. Bring an order for 500 tanks. They can go for ToT (transfer of technology) for the foreign parts. The cost of labour in Germany is the highest in the world. DRDO can build 70 per cent cheaper in India. If purchase of the power pack of the Arjun for Rs 7.5 crore then DRDO can produce it in India for just Rs 4-5 crore.

For an army with more than 3,500 tanks, including 2,400 obsolescent T-72s that are crying out for replacement, ordering just 124 Arjun Mark IIs seems unduly cautious. But the army has little incentive to reduce cost. Though the generals are now willing to order more Arjuns, they are placing their orders piecemeal. Since most of the Arjun's 10,000 components are outsourced, the size of the order is a crucial determinant of what price they are supplied at. Another reason for the Arjun Mark II's rising cost becomes obvious at the Arjun production line at HVF, where the army is collecting the last of 124 Arjuns that were cleared for production in 2008. Just as the Rs 50 crore Arjun line has hit its stride, it must shut down for at least two years since another order can come only after the Arjun Mark II trials next year.

EFFICIENCY OF THE ARJUN TANK

Arjun tank is considered as the most delayed and at every step a well-equipped designs and accessory have been added. To know the ability of any tanks three key factors have to be considered. And the three key factors adjudge the quality of any MBT. They are mobility, weapon systems, and battle survivability. Hence the three key factors of the Arjun main battle tanks are as described below

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.

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.

4. Efficiency of the tank with other tanks especially with that of Pakistan and china in terms of cost per unit and other factors

Main battle tanks	Arjun (India)	Al Khalid (Pakistan)	T99 (china)
Production history			
Designer	CVRDE, DRDO	Norinco, Factory 617 Heavy Industries Taxila (HIT)	Norinco
Designed Manufacturer	March 1974–present Heavy Vehicles Factory, Avadi	1990–99 Heavy Industries Taxila (Al-Khalid) Norinco (Type 90-IIM)	2001 - present Norinco
Produced Number built and variants	2004–present 124 (124 Mk-I and 124 Mk- II ordered)	2001–Present Al-Khalid, Al-Khalid I, Al- Khalid II (under development)	200+ (T99, T99G, T99A1, T99A2)
Specifications			
Weight	58.5 tonnes (57.6 long tons; 64.5 short tons)	48 t (53 short tons)	~54 tonnes for Type-99G ~57 tonnes for Type-99A1 ~58 tonnes for Type-99A2
Length	10.638 metres (34 ft 10.8 in)	10.07 m (33.0 ft)	11.0 m
Width	3.864 metres (12 ft 8.1 in)	3.50 m (11.5 ft)	3.5 m
Height	2.32 metres (7 ft 7 in)	2.40 m (7.9 ft)	2.37 m
Crew	4 (commander, gunner, loader and driver)	3	3 (4 originally based on the Type 98 prototypes without autoloader)
Armor	steel/compositeKanchan armour.	Composite armour, RHA, ERA	Classified, Al₂O₃ , ERA , composite
Main armament	120 mm rifled tank gun LAHAT anti-tank missile HEAT, APFSDS, HESH Rounds	125 mm smoothbore gun, 39 rds	125 mm smoothbore tank gun, L/51 compatible with Chinese 140 mm guns or 155 mm for Type 99KM
Secondary armament	HCB 12.7 mm AA MG Mag 7.62 mm Tk715 coaxial MG	7.62 mm coaxial MG, 3000 rds 12.7 mm external AA MG, 500 rds	Type 85 heavy machine gun 12.7x108 mm commander's machine gun, 7.62 mm coaxial machine gun
Engine	MTU 838 Ka 501 diesel 1,400 hp (1,040 kW)	KMDB 6TD-2 6-cylinder diesel 1,200 hp (890 kW)	liquid-cooled diesel 1,500 hp (1,100 kW); 2,100 hp for Type 99KM
Power/weight	23.9hp/tonne	26 hp/tonne	27.8 hp/tonne; 28 hp/tonne for Type 99KM
Transmission	Renkepicyclic train gearbox, 4 fwd + 2 rev gears	SESM ESM500 5-speed automatic	
Suspension	hydropneumatic	Torsion bars, hydraulic dampers	torsion bar
Ground clearance	0.45 metres (1 ft 6 in)		
Fuel capacity	1,610 litres (350 imp gal; 430 US gal)		
Operational range	450 kilometres (280 mi)	500 km (combat range)	600 km (373 miles)
Speed	72 km/h (45 mph) Road 40 km/h (25 mph) Cross country	72 km/h	80 km/h (50 mph)
UNIT COST	₹18.2 crore (US\$ 3.8 -4 million)	US\$ 2-2.3 million	US\$ 2 million

CONCLUSION

The main battle tanks are the important assets to any ground force. But most of the army equipment is of foreign design and license produced in India but efforts are on to progressively design and manufacture equipment indigenously. About 41 Ordnance Factories under control of Ordnance Factories Board manufacture most of Army equipment like small arms, ammunition, combat vehicles, artillery, etc. but still the best agile defence vehicles are not yet build. Still India is lagging behind the US and Russia. Even though the products are produced, these products are not cost free. Hence the financial clashes always happen between the purchaser (Indian army, navy, air force) and seller (DRDO). But it is also better to keep the self-produced products. Since requirement is in small quantity and the products which are offer by the foreign players are of better one compared to Indian. Hence the quality has to be improved in the area of agile, sophistication and easy to handle.

BIBLIOGRAPHY

1. [http://www.armyrecognition.com/india_indian_army_tanks_heavy_armoured_vehicles_uk/arjun_mk-](http://www.armyrecognition.com/india_indian_army_tanks_heavy_armoured_vehicles_uk/arjun_mk-i_main_battle_tank_technical_data_sheet_specifications_information_description_intelligence.html)
2. <http://voices.yahoo.com/tank-match-india-vs-pakistan-2587356.html?cat=15>
3. <http://voices.yahoo.com/china-vs-india-main-battle-tanks-7263698.html>
4. <http://ajashukla.blogspot.in/2011/11/large-orders-can-make-arjun-tank.html>
5. http://en.wikipedia.org/wiki/Equipment_of_the_Indian_Army
6. "Main Battle Tank Arjun" at <http://www.drdo.com/products/mbt.htm>
7. http://en.wikipedia.org/wiki/Al-Khalid_tank
8. http://en.wikipedia.org/wiki/Main_battle_tank
9. <http://www.army-guide.com/eng/product41.html>