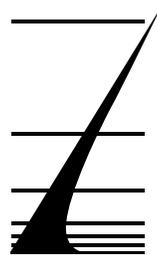


The Market for Tanks

Product Code #F650

A Special Focused Market Segment Analysis by:



FORECAST INTERNATIONAL

Analysis 1

The Market for Tanks

2011-2020

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PROGRAMS

The following reports are included in this section: (**Note:** a single report may cover several programs.)

Al-Khalid
C1 Ariete
Chinese Tanks
Karan
M1 Abrams
M-95 Degman
Merkava
PT-91 Twardy
T-72
T-84
T-90
Type 88
Zulfiqar

Introduction

The international market for main battle tanks continues to exhibit a dynamic relationship between its upper and lower product tiers. Indeed, this relationship continues to act as the defining characteristic of this market.

Two Product Tiers

The upper tier of the international market for main battle tanks consists of the state-of-the-art designs with correspondingly high unit prices (more than \$5 million). We expect new production of high-end tanks (Ariete 2, Karan, and Merkava Mk 4/Mk 5) to remain relatively low, accounting for 19.51 percent of all production, worth 31.57 percent of the market, through the forecast period.

The lower tier of the international market features cheaper, more widely available tanks (mostly designs of the former Soviet Union). In terms of sheer numbers, Pakistan's Al-Khalid, the Russian Federation's T-90 (including India's licensed T-90S) and the Type 98 of the People's Republic of China will continue to dominate the market, accounting for 57.83 percent of all new tanks rolling out worldwide, worth 47.53 percent of the market, through 2020.

Historical Perspective. Since its introduction during the First World War, the tank has developed in response to evolving, and often divergent, threat scenarios and tactical doctrines. Each generation of tanks, therefore, represents its particular tactical environment.

World War I: First Glimmer

The first generation of tanks lumbered onto the battlefields of World War I as essentially infantry support platforms, providing protection for infantrymen crossing the "no man's land" between opposing trench lines. On September 15, 1916, the distinctive, rhomboid-shaped British Tank Mk 1 became the first tank to enter combat, during the Somme campaign. Throughout the war, the British ultimately fielded 2,350 tanks; the French employed about 4,000 tanks of various designs. In contrast, only 20 Stürmpanzerwagen A7V tanks of the Imperial German Army ever saw active service.

Despite the doctrinal role of tanks as infantry support platforms, World War I witnessed the first glimmer of the offensive potential of this new weapon system. During the battle of Cambrai (November 1917), a force of 400 British tanks penetrated the German Hindenburg line, capturing 8,000 German troops and 100 artillery pieces.

Although this ground-breaking employment of massed armor ultimately had little effect on the outcome of the battle, the lessons were not lost on one observer from the U.S. Army, (then) Capt. George S. Patton, Jr. Soon after, Patton established the U.S. Army Tank School at Langres, France. On September 26, 1918, he led the first U.S. Army tank unit, the 304th Tank Brigade (equipped with 144 Renault FT17 light tanks), into its first combat action at St. Mihiel.

World War II: Coming of Age

Twenty years later, the reconstituted German Wehrmacht became the first army to fully grasp the offensive potential of the tank. The German Panzer became the centerpiece of the first true combined arms offensive doctrine, the so-called Blitzkrieg, which overran Europe during 1939-40 and penetrated deep into the western Soviet Union in 1941.

In response, the Allies had to rapidly develop new tanks and tactical doctrines to deal with the German threat. With this response, we find a fundamental divergence of concept between the German Wehrmacht and the Allied forces (primarily the United States and the Soviet Union) in terms of tank design.

Firepower & Armor

Overall, the German second-generation Panzer design philosophy exhibited an emphasis on firepower and armor protection over mechanical reliability and maneuverability. Beyond the more numerous Panzerkampfwagen Mk 4 (PzKpfw 4) medium tanks, the state-of-the-art Panther, Tiger, and King Tiger tanks epitomized this design concept.

Simplicity & Sheer Numbers

In contrast, both the United States and the Soviet Union favored fielding numerically superior forces of relatively simple, mechanically reliable, and highly maneuverable medium tanks (notably the M4 Sherman and the T-34/85). While U.S. and Soviet tanks were at a severe disadvantage in one-on-one engagements with German Panthers, Tigers, and King Tigers, the Americans and Russians were ultimately able to overwhelm the Germans with sheer numbers of tanks. In short, the U.S. and the USSR opted for quantity over quality.

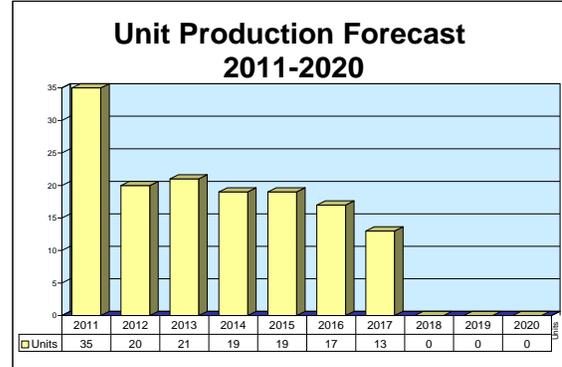
Two operations during the Second World War serve to clearly illustrate the doctrinal shift in tank employment since 1918:

- In July 1943, 2,700 Panzers (primarily Tiger and **Continued...**)

Type 88

Outlook

- Serial production of K1A1 ongoing for ROK Army procurement; modernization and retrofit programs update K1 tanks to K1A1 configuration
- K2 prototype reportedly entered initial trials in 2008; LRIP may commence this year
- Turkey plans to acquire 250 K2/Altay tanks
- Forecast reflects K1A1 serial production for ROK Army procurement



Orientation

Description. A main battle tank.

Sponsor. The Republic of Korea Ministry of National Defense, through the ROK Army, sponsors the development and ROK Army procurement of the Type 88-series main battle tank.

Licensees. None

Status. Development through serial production and modernization/retrofit.

Total Produced. Through 2010, we estimate the prime contractor produced 1,095 Type 88 (K1) tanks,

including five prototype/developmental tanks and one K1-M tank. The prime contractor has thus far produced 406 Type 88A1 (K1A1) tanks.

Application. Armored mobile weapons systems, optimized for high-speed offensive and breakthrough operations, as well as defensive fire support.

Price Range. In 2002 U.S. dollars, original K1 tanks carried a unit price of \$4.21 million.

In 2011 U.S. dollars, the K1A1 tank reportedly maintains a unit price of \$4.72 million.

Contractors

Prime

Hyundai Rotem	http://www.hyundai-rotem.co.kr , 8-12F, 231 Hyundai Motor Group Bldg, 231, Yangjae-Dong, Seocho-Gu, Seoul, 137-938 Korea, South, Tel: + 82 2 3464 1114, Fax: + 82 2 3464 7580, Prime
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Subcontractor

Elbit Systems Ltd	http://www.elbitsystems.com , Advanced Technology Center, PO Box 539, Haifa, 31053 Israel, Tel: + 972 4 831 5315, Fax: + 972 4 855 0002, Email: elbit-systems@elbit.co.il (K1A1 Gunners Sight Thermal Imaging System)
General Dynamics Canada	http://www.gdcanada.com , 3785 Richmond Rd, Ottawa, K2H 5B7 Ontario, Canada, Tel: + 1 (613) 596-7000, Fax: + 1 (613) 596-7396, Email: info@gdcanada.com (K1A1 Digital Ballistic Computer)
Israel Military Industries Ltd (IMI)	http://www.imi-israel.com , PO Box 1044, Bialik St 64, Ramat Hasharon, 47100 Israel, Tel: + 972 3 548 5619, Fax: + 972 3 548 6125, Email: imimrktg@imi-israel.com (105mm Tank Gun Ammunition)

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Kollmorgen Electro-Optical	http://www.eo.kollmorgen.com , 347 King St, Northampton, MA 01060 United States, Tel: + 1 (413) 586-2330, Fax: + 1 (413) 586-1324, Email: sales@eo.kollmorgen.com (Gunner's Articulated Auxiliary Sight)
MTU Friedrichshafen GmbH	http://www.mtu-online.com , Maybachstrasse 1, Postfach 2040, Friedrichshafen, 88040 Germany, Tel: + 49 7541 90 0, Fax: + 49 7541 90 5000, Email: info@mtu-online.com (MT 871 Ka 501 Diesel Engine)
Raytheon Integrated Defense Systems	http://www.raytheon.com , 50 Apple Hill Dr, Tewksbury, MA 01876 United States, Tel: + 1 (978) 858-5000, Fax: + 1 (978) 858-9414, Email: IDS@raytheon.com (Gunner's Primary Tank Thermal Sight)
Rheinmetall Defence	http://www.rheinmetall-defence.com , Rheinmetall Platz 1, Düsseldorf, 40476 Germany, Tel: + 49 211 473 01, Fax: + 49 211 473 4727, Email: info@rheinmetall-defence.com (120mm Rh 120/55 Tank Cannon)
Sagem	http://www.sagem-ds.com , Le Ponant de Paris, 27, Rue Leblanc, Paris, 75015 France, Tel: + 33 1 58 11 78 00, Fax: + 33 1 58 11 78 50 (VS 580-13 Panoramic Sight)
Samsung Thales	http://www.samsungthales.com , 17-20th Fl, Daechi Bldg, Daechi 4-dong 899-11, Seoul, Gangnam-gu, Korea, South, Tel: + 82 2 3458 1114, Fax: + 82 2 3458 1188, Email: jjsun00.kim@samsung.com (E-O System Integration)
Watervliet Arsenal	http://www.wva.army.mil , 1 Buffington St, Watervliet, NY 12189-4050 United States, Tel: + 1 (518) 266-5111, Email: swantek@wva.army.mil (M256 120mm Smoothbore Tank Gun)
Zahnradfabrik Friedrichshafen AG	http://www.zf.com , Graf von Soden Platz 1, Friedrichshafen, 88046 Germany, Tel: + 49 07541 77 0, Fax: + 49 07541 77 908000, Email: postoffice@zf.com (LSG 3000 Automatic Gearbox)

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

Crew. Four: commander, gunner, loader, and driver.

Armor. The Type 88 series tank features a modern, composite/stratified, Chobham-type armor. Some areas of this armor suite may exhibit a spaced-armor configuration.

Dimensions. The following data reflect the original K1, mounting the 105mm M68 tank gun. The dimensions of the K1A1, mounting the 120mm M256 tank gun, are in parentheses where different.

	<u>SI Units</u>	<u>U.S. Units</u>
Length	9.67 m	31.73 ft
Width	3.59 m	11.78 ft
Height	2.25 m	7.38 ft
Combat weight	51.1(54.5) tonnes	56.78 (60.08) tons
Fuel capacity	1,000 liters	265.95 gal

Performance. The maximum speed and range data reflect use on a paved road.

	<u>SI Units</u>	<u>U.S. Units</u>
Maximum speed	65 kmph	40.37 mph
Maximum range	440 km	273.2 stat mi
Step	1.00 m	3.28 ft
Trench	2.74 m	8.99 ft
Slope	35%	35%
Gradient	60%	60%
Fording	1.20 m	3.94 ft

Type 88

Engine. Motoren- und Turbinen-Union MT 871 Ka 501 supercharged, liquid-cooled, V-8 diesel engine. This powerplant generates 882.65 kilowatts (1,183.6 hp), with the following power-to-weight ratios:

- Type 88 (K1): 17.27 kilowatts per tonne (20.84 hp/ton).
- Type 88A1 (K1A1): 16.2 kilowatts per tonne (19.7 hp/ton).

Both tanks feature a 24-volt electrical system, with six 12-volt 100-ampere-hour batteries.

Gearbox. Zahnradfabrik Friedrichshafen LSG 3000 automatic gearbox, with four forward and two reverse gear ratios.

Suspension and Running Gear. A hybrid suspension system, with six roadwheels and three track return rollers on each side. The drive sprocket mounts to the rear of the tank hull. The middle four roadwheels feature improved-design torsion bars; the first and sixth roadwheel stations feature hydro-pneumatic units.

The tank employs a remotely operated track tensioning system with two settings, allowing the tank to "kneel" so that the main armament can achieve a 10° depression angle.

Armament

K1 Main Armament. Watervliet Arsenal 105mm M68A1 rifled tank gun. A license-produced version of the RO Defence (now a component of BAE Systems) L7, this ordnance was standard for the M60 series and the original M1 Abrams main battle tanks.

The M68 features a thermal sleeve and muzzle reference system. The turret drive is electrohydraulic, with manual backup. The K1 carries 47 rounds of 105mm ammunition.

K1 Secondary Armament. One 12.7x99mm (.50 cal) M2HB heavy machine gun on the turret roof at the commander's cupola; one coaxially mounted

7.62x51mm NATO (.308 Winchester) M240 machine gun; one pintle-mounted M240 on the turret roof at the loader's hatch. Each side of the turret mounts a six-round M239 smoke-grenade launcher.

The K1 carries 2,000 rounds of 12.7x99mm (.50 cal) ammunition and 8,600 rounds of 7.62x51mm NATO (.308 Winchester) ammunition.

K1A1 Main Armament. Watervliet Arsenal 120mm M256 smoothbore tank gun. A license-produced version of the Rheinmetall Defence Rh 120/44, this ordnance is standard on the M1A1/A2 Abrams main battle tanks. The K1A1 carries 32 rounds of 120mm ammunition.

K1A1 Secondary Armament. Same as K1.

Fire Control. The Type 88 series tank originally employed the Hughes Aircraft two-axis fully stabilized day/night gunner's primary sight, incorporating a neodymium-yttrium-aluminum-garnet laser rangefinder. Subsequently, the program adopted the Raytheon Systems Gunner's Primary Tank Thermal Sight (with a carbon dioxide laser) as a production cut-in. This stabilized sight features three magnification options (8x, 3x, and unitary) in the day channel and a binocular-based thermal imaging system for night use.

The gunner's station also features a Kollmorgen Electro-Optical articulated auxiliary sight. The commander's station mounts a VS 580-13 independently stabilized two-axis panoramic sight, by Sagem Défense Sécurité SA of France.

The Type 88-series fire control system slaves the fully stabilized main armament to the gunner's sights; the gunner's sights, in turn, link to a digital ballistic computer by General Dynamics Canada (formerly Computing Devices of Canada). This component integrates inputs from several sensors, including a cross-wind sensor. The Raytheon fire control system, which is similar to that of the M1 Abrams, enables the Type 88 series tank to fire on the move.

Variants/Upgrades

Variants. The basic K1 design has thus far spawned three variants:

Designation

Type 88M (K1-M)

Description

Specifically designed for the Malaysian new tank requirement, the Type 88M lost out to the Polish PT-91 Twardy in 2002 for that contract.

K1 ARV

Armored Recovery Vehicle. Developed in conjunction with MaK System Gesellschaft, this ARV employs technology from the MaK Bergepanzer 3 program; it is one of the few ARVs that can recover a 50+ tonne tank. The ROK Army placed an initial order for 90 vehicles, with a follow-on order for 59 vehicles. The ROK Army also placed an additional follow-on order for an undetermined number of K1 ARVs.

Type 88

Designation K1 AVLB

Description

Armored Vehicle-Launched Bridge. This military-load-class 66 AVLB, similar to the British Number 8 tank bridge, features an overall length of 22 meters (72.18 ft). Hyundai's (now Rotem's) Changwon facility integrates the BAE Systems-produced bridge components with the Type 88 chassis. This AVLB completed developmental testing in 1992; production of 56 units is under way.

Modernization and Retrofit Overview. Even though the Rotem Company (a component of the Hyundai Group) has only recently completed the K1 production run, the contractor has already begun a comprehensive upgrade program. As an interim upgrade, the ROK is procuring improved 105mm ammunition from Israel Military Industries Ltd (IMI) for the M68A1 main gun.

K1 Upgrade to K1A1

In 1988, the ROK initiated a program to integrate a 120mm smoothbore tank gun with the Type 88 platform. In this regard, the contractors benefited from the fact that the original Type 88 development team had designed the Type 88 turret to accept 120mm ordnance from the outset. By 1994, the actual integration was under way. The ROK Ministry of National Defense selected the Watervliet Arsenal 120mm M256 tank gun, a license-produced version of the Rheinmetall Defence Rh 120/44, for integration with the K1 tank.

With the integration of an upgraded fire control suite for the new 120mm ordnance, the developmental and test

programs were essentially complete by mid-2001. The upgraded tank design carries the designation Type 88A1 (K1A1).

Our research indicates that in addition to retrofitting over 1,000 existing K1 tanks to the new A1 standard, the ROK Ministry of National Defense intends to procure between 400 and 700 new-production K1A1 tanks. The K1A1 is currently in serial production.

The ROK Ministry of National Defense is considering other midlife modernization and retrofit options for the Type 88 series, including:

- Further upgrades to the fire control suite
- A sealing capability to enhance fording performance
- Improved fire detection and suppression systems
- An improved turret race ring to improve the slew rate
- A new track assembly with replaceable components



K1A1 Main Battle Tank

Source: ROK Army

Program Review

Background. In 1977, the Republic of Korea initiated plans to replace M47 and M48 tanks with an indigenous main battle tank as part of the ambitious (equivalent to \$40 billion) Yulgok Project to modernize the ROK armed forces.

Seeking Foreign Expertise

Despite desires by the ROK to produce an indigenous design, the relative lack of experience in tank design and production within the Korean industrial base prompted the ROK to seek out U.S. assistance in the project. To that end, the ROK and U.S. governments signed a Memorandum of Understanding on July 6, 1978.

In response to the ROK Ministry of National Defense Request for Proposals, AAI Corporation, Chrysler (now General Dynamics Land Systems Division), and Teledyne Continental (also now a General Dynamics component) submitted bids for the program. In 1981, the ROK accepted the Chrysler design. Although obviously based on the General Dynamics M1 Abrams main battle tank, the Chrysler design is about 25 percent smaller; it also employs a conventional diesel powerplant in place of the M1 Abrams AGT 1500 vehicular gas turbine.

Olympian Effort

Chrysler produced the first two pre-prototype tanks for the initial test and evaluation program; Hyundai produced five prototype tanks in 1983-84 for operational tests. Serial production of the ROK Indigenous Tank, also known as the XK1 (later K1), began in 1985. The K1 has replaced all 1,200 M47/M48 tanks in the first-line inventory.

In 1986, the tank received the designation Type 88 in honor of the 1988 Summer Olympic Games, which took place in the ROK capital of Seoul.

The Rotem Company, a component of the Hyundai Group, has assumed all MBT production responsibilities from its parent company. As such, Rotem is the only producer of main battle tanks in the Republic of Korea.

Description. The Type 88 series tank (like the M1 Abrams) features a conventional layout, with the driving compartment forward, fighting compartment in the middle, and powerpack to the rear.

Korea's Compact Abrams

The Type 88 series turret exhibits a significantly lower profile than the M1 Abrams, resulting in an overall

vehicle height approximately 2 feet (0.61 m) shorter than the M1 Abrams.

The driver sits to the left front of the hull. The driver's station features a single-piece hatch cover and three periscopes; the center periscope is interchangeable with a passive night-driving instrument. In the turret, the commander and gunner sit to the right of the main armament; the loader sits to the left. The commander's station includes a single-piece hatch cover. The fire control sights and periscopes afford an all-around vision capability.

Standard equipment on the Type 88 series tank includes:

- A crew compartment heater
- A bilge pump
- The VRC-12 radio
- A nuclear, biological and chemical (NBC) protective suite (M13A1 particulate filter and the M8A1 alarm unit)
- A fully automatic fire detection/Halon extinguishing system
- A remotely controlled track adjusting system
- The VIC-1 intercommunication system

K2: The Next Generation

In 1996, the ROK Ministry of National Defense awarded Hyundai a study contract for the next-generation tank, designated K2. Since that initial contract award, the Rotem Company has assumed responsibility for the K2 development program (along with all Korean MBT production) from its parent company.

Initial reports suggest the three-man K2 design represents essentially an improved K1A1, with the following main features:

- The Rheinmetall Defence 120mm Rh 120/55 main gun, with an automatic loader
- A stabilized day/night thermal imaging system, with independent modules for the commander and gunner to provide a true "hunter-killer" capability
- An advanced electronics suite, including a "soft-kill" active protection system, GPS/INS navigation, and an IFF transponder
- A 1,119-kilowatt (1,500-hp) MTU diesel engine

Type 88

- A Renk automatic gearbox, with five forward and three reverse gear ratios
- A hydro-pneumatic suspension system

The ROK Army expects the K2 to be capable of a maximum road speed of 70 kilometers per hour (43.5 mph) and a fording depth of 4.1 meters (13.45 ft).

Actual development of the definitive K2 design – also known as the Korea Next-Generation Main Battle Tank (KNMBT) – commenced in 2003. Open-source reporting indicates the initial K2 prototype began testing during 2008. The Forecast International Weapons Group believes serial production could commence as early as this year.

Related News

South Korea Approves Increased Defense Budget – The South Korean Parliament has approved a 2011 budget of KRW309.5 trillion (\$274.5 billion), despite strong resistance from the opposition parties. This dissent took the form of a physical confrontation in which members of the opposition Democratic Party tried to prevent members of the ruling Grand National Party from entering Parliament. The confrontation reportedly left one ruling party lawmaker slightly injured. The Grand National Party holds a solid majority with 172 seats in the 299-member Parliament. Of the 157 lawmakers who voted, 149 approved the budget, two voted against it, and six abstained.

The vote increases the defense budget by KRW142 billion (\$124.7 million) to deploy more weapons systems on the islands in waters off the west coast, to strengthen combat capabilities in general, and to improve evacuation facilities for residents on the islands. These moves follow the recent artillery skirmish between South Korea and the Democratic People's Republic of Korea (DPRK).

Parliament also approved a government plan to send about 130 combat troops to the United Arab Emirates (UAE) to help train special forces there. The troops will be dispatched in January 2011 on a two-year mission. The South Korean government hopes that this commitment will help strengthen military and other ties with the UAE. (Xinhua, 12/10)

South Korea Targets Defense Exports – The South Korean government aims to expand its export of defense equipment to \$4 billion by 2020. The Presidential Council for Future and Vision has laid out a draft on how to develop an export-oriented defense industry, create more jobs, and promote research and development. The goals are to reach \$10 billion in annual production and \$4 billion in annual exports, create 50,000 jobs in the industry, and become one of the world's top seven countries in defense technology and exports by 2020.

The council proposes handing over R&D for all weaponry except strategic weapons such as missiles, cyber warfare devices, and reconnaissance satellites to private companies by 2015. At present, South Korea's defense R&D has been dominated by the Agency for Defense Development, which distributes production orders to private contractors. The council said the R&D budget for core technologies should be expanded and that priority must be given to drawing up detailed measures – including tax cuts – to support defense firms. A consultative body led by the ministers of defense will also draw up plans to increase defense exports.

Korea's weapons exports amounted to only \$2.5 billion in 2008, accounting for a mere 0.5 percent of the world's \$55 billion market, despite efforts by the Defense Acquisition Administration to increase the country's share of this market. The problem is the relatively high cost of Korean equipment. Korea failed to export T-50 Golden Eagle supersonic advanced trainer jets to Singapore and the United Arab Emirates due to their higher costs compared with similar Italian jets. Korea's K2 Black Panther tanks are equipped with a 120mm main gun and cutting-edge electronic devices, but are more expensive than U.S., British, and German competitors. (*The Korea Herald*, 10/10)

Turkey Continues with Planned Arms Purchases – While other European nations are eyeing defense budget cuts, Turkey will move ahead with new arms procurement programs. Turkey's strategic location is driving these purchases, the government said. Turkey is spending \$16 billion on defense in 2010.

Acquisition will include such equipment as unmanned air vehicles and Mine Resistant Ambush Protected vehicles to help in its fight against Kurdish rebels. Other purchases will be of combat aircraft, helicopters, tanks, and submarines. (*Hurriyet*, 8/10)

North Korea Designs New Tank, Operates UAV over Maritime Border – North Korea continues to develop weapon systems on its own, including working on a new tank. The M2002 Popping (Tiger Storm) tank appears to be a modernized Russian-designed T-62 tank. This new armored vehicle is equipped with a laser range finder, anti-aircraft machine guns, and a modern fire control system, according to North Korea.

In addition, a North Korean unmanned air vehicle was seen on a surveillance mission near its sensitive sea border with South Korea. This is the first time a North Korean UAV has been seen over the border. The UAV reportedly hovered over North Korean waters at a very low altitude, flying some 20 kilometers north of the Yeonpyeong islands. (*Global Times*, 8/10)

South Korea Sees North as 'Main Enemy' – The South Korean government has decided to revive the military operation concept of seeing North Korea as its "main enemy." The decision to revive this assessment is part of a package of actions taken in response to the North Korean sinking of the corvette Cheonan in March.

In addition, South Korea plans to hold a series of anti-submarine drills in the area where the Cheonan was sunk as part of additional joint exercises with the U.S. South Korea has also cut off all trade with North Korea and forbidden North Korean vessels from transiting South Korean waters. About a third of North Korea's trade is with the South, with most of the balance being with China.

There is much more to this series of actions than is apparent. The North threatened that if it were directly blamed for the attack or subjected to penalties for carrying it out, then it would wage "total war" against the South. Now, it has been both directly blamed and subjected to severe economic penalties. The South has called its bluff, leaving the North to either do what it said and attack (and die), or backing down and suffering a major reverse. In addition, it faces the utter humiliation of acknowledging the wrong that was committed, which hands the South a major diplomatic, moral, and cultural victory. Despite all of its bellicosity, it is most unlikely that the North Korean elite is all that keen on doing any of those things.

The first reaction from the North has been to sever all relations with South Korea. This will involve freezing inter-Korean relations, abrogating the agreement on non-aggression between the two sides, and completely halting the inter-Korean cooperation. The work of the Panmunjom Red Cross liaison representatives will be completely suspended and the South Korean personnel in the Kaesong Industrial Zone will be expelled. Finally, the passage of South Korean ships and airliners through the territorial waters and air on the North side will be totally banned.

It is unlikely that North Korea will leave the situation there. The time-established pattern of North Korean actions is to lash out viciously against anybody who does not comply with their demands. Such actions have included the assassination of leading Korean politicians, the bombing of Korean airliners, and attacks on South Korean land and sea targets. It is all too likely that similar attacks will be launched in the near future. The South Korean government has stated that it will not tolerate any provocative act by the North and will maintain the principle of proactive deterrence. "If our territorial waters, airspace, or territory are violated, we will immediately exercise our right of self-defense," said President Lee Myung-bak. (*The Korea Herald*, 5/10)

South Korea Building Smaller but Stronger Military – South Korea may be shrinking the size of its military, but the force it deploys will be much stronger. South Korea will equip its military with high-tech weaponry, including new tanks and guided missile systems, to compensate for a reduction in overall strength.

The improvement in the combat capability of the South Korean military began in 2005 and will take place over a 15-year period. (*The Korea Times*, 3/10)

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Funding

The Republic of Korea Ministry of National Defense, through the ROK Army, funds the development and ROK Army procurement of the Type 88-series main battle tanks.

Contracts/Orders & Options

In November 2006, the Republic of Korea Ministry of National Defense awarded Elbit Systems Electro-Optics Elop Ltd (Haifa, Israel) a contract worth \$19 million to supply thermal imaging kits for the K1A1 gunner's periscopic sight. Under the terms of the contract, Samsung-Thales (Seoul, Korea) will act as the in-country prime contractor for the installation and testing of the units.

Type 88

On June 25, 2007, Turkey announced plans to acquire and initiate licensed production of South Korea's next-generation K2 Black Panther main battle tank. On July 29, 2008, Otokar Otobus Karoseri Sanayi AS (Istanbul, Turkey) signed a Tank Technology Cooperation Agreement worth \$400 million with Hyundai Rotem. This agreement calls for K2 technology transfer in support of Turkey's Altay main battle tank.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1977	Concept development
Jul	1978	ROK-U.S. enter program cooperation agreement
Early	1981	ROK accepts Chrysler design
	1981-1983	Prototype testing in the U.S.
Dec	1983	First prototype deliveries in ROK
Jul	1985	Type 88 completes developmental testing
	1985	K1 serial production
	1988	Development of K1A1 begun
May	1996	ROK accepts first K1A1 for operational testing
Oct	2005	ROK publicly reveals XK2 (KNMBT) program
Jun	2007	Turkey announces plans to procure K2 main battle tank
	2011	Serial production of K1A1 ongoing; retrofit of K1 to K1A1 configuration continues; development of K2 ongoing

Worldwide Distribution/Inventories

Export Potential. Although the Republic of Korea is aggressively marketing the K1A1 on the international market, most of the major components are of U.S. origin, requiring U.S. approval of any international sale. To date, the Republic of Korea has yet to announce any successful deals for the transfer of Type 88 series tanks to other nations. Given the glut of main battle tanks on the international market, prospects for K1 and K1A1 export sales are not especially promising.

On June 25, 2007, Turkey announced plans to acquire and initiate licensed production of South Korea's next-generation K2 Black Panther main battle tank. To date, no contract details regarding these plans have emerged.

Country. Republic of Korea (1,094 K1, 406 K1A1, and one K1-M).

Forecast Rationale

The Republic of Korea continues fielding Type 88A1 (K1A1) main battle tanks via two methods. New-production K1A1 tanks continue rolling off the Rotem Company production line for ROK Army procurement. The prime contractor also maintains a modernization and retrofit program, upgrading existing ROK Army K1 tanks to the K1A1 configuration.

Our research indicates the ROK Army intends to procure between 400 and 700 new-production K1A1 tanks, in addition to retrofitting some 1,000 K1 tanks to the A1 configuration. This will provide the ROK Army with a modern, fully standardized armor force.

Making the Big Leagues

The Type 88-series main battle tank represents the Republic of Korea's entry into the big leagues of the international MBT market. The K1A1 is a fully modern

fourth-generation MBT design, comparable to the M1A1 Abrams. While clearly exhibiting its U.S. design origins, the Type 88 series established an indigenous tank production, modernization, and design (with the K2 KNMBT program) capability within the Republic of Korea.

Export Potential

The Rotem Company, which inherited the Type 88-series production line from Hyundai Precision & Industries Company, continues to aggressively promote the Type 88 series on the international market.

While the K1 and K1A1 have virtually no immediate prospects for export sales, the developmental K2 has already scored on the international market. On June 25, 2007, Turkey announced plans to acquire and initiate licensed production of South Korea's next-generation

K2 Black Panther main battle tank. On July 29, 2008, Otokar Otobus Karoseri Sanayi AS (Istanbul, Turkey) signed a Tank Technology Cooperation Agreement worth \$400 million with Hyundai Rotem. This agreement calls for K2 technology transfer in support of Turkey's Altay main battle tank.

Current Focus on K1A1

For all intents and purposes, we consider the original K1 program to be dormant; all effort now centers on K1A1 production, as well as retrofitting K1 tanks to the K1A1 configuration.

Our forecast reflects ongoing serial production of K1A1 main battle tanks for ROK Army procurement. The prime contractor completed production of the original

K1 in 2002. We expect the K1A1 serial production run for ROK Army procurement to continue through 2017.

We also expect to see K1A1 production drop to a significantly lower base sustainment level, coinciding with the anticipated ramp-up to serial production of the next-generation K2.

Given the lack of credible details regarding either ROK Army or Turkish procurement of the K2, we do not yet include a production forecast line for this next-generation main battle tank.

As our forecast only reflects new MBT production, it does not include the ongoing retrofit of K1 tanks to the K1A1 configuration. The outlook also does not reflect the K-1 ARV and AVLB production runs.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Hyundai Rotem												
K1A1 <> Korea, South												
	406	35	20	21	19	19	17	13	0	0	0	144
Total	406	35	20	21	19	19	17	13	0	0	0	144

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