



AN INTERVIEW WITH MR. LEVENT ŞENEL ON TURKISH LAND PLATFORMS

# DEFENCE TURKEY

VOLUME 7 ■ ISSUE 37 ■ YEAR 2012

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**TURKISH  
LAND FORCES:  
A BRIGHT STAR  
IN PEACE**



## AN OVERVIEW ON TURKISH LAND PLATFORMS

**FNSS INCREASE ITS POWER WITH JOINT  
PRODUCTION**

**AN ARTICLE ON ARMoured LAND VEHICLES  
AND TURKEY**

**THE FIRST PROTOTYPES OF ALTAY TNMBT  
DEMONSTRATED THEIR MOBILITY**

**RADAR AND ELECTRONIC WARFARE SOLUTIONS  
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6



14



22



24



50





56



58



60



68



72



6

Turkish Land Forces:  
A Bright Star in Peace

14

Turkey Strengthens its  
Land Systems Capabilities

22

The First Prototypes of Altay TNMBT  
Demonstrated their Mobility

24

FNSS Increase its Power  
with Joint Production

30

An Overview on  
Turkish Land Platforms

50

Changing Enviroments, Changing Threats,  
Changing Strategies Armoured Land  
Vehicles and Turkey

54

HEMA to Unveil its Long  
Awaited Armoured Vehicles at  
Idef 2013

55

Globika by Global Teknik

56

T129 ATAK  
Advanced Attack and Tactical Reconnaissance  
Helicopter

57

YDS : A Global Brand Preferred by  
World's Leading Armies

58

Solution for Performance Increase  
and Lifetime Enhancement of Altay Tank Electronic,  
Electro-Optic Systems and Leopard 2A4

60

Land Forces and Havelsan

62

Radar and Electronic Warfare in  
Land Platforms

66

TASMUS-G System

68

An Unmanned System Solution from  
Aselsan: "Bomb Disposal Robot"

70

Water and Fuel – Wherever You Go

72

Remote Weapon Station



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## A Strong Land Forces, A Strong Land Platforms Industry

Ayşe AKALIN  
Publisher & Editor in Chief



The stable and predictable threat environment of the Cold War era has been replaced by the present day multi-dimensional and unpredictable threat/risk environment with uncertainties. Today's revolutionary developments in Information Technologies and multi-dimensional risks triggered by reorganization strategies have added to the well-defined military threats of the Cold War era. Security concept mainly perceived as military security before the Cold War era has gained a more profound meaning with the end of Cold War; therefore, political, social, economic and environmental issues have been incorporated into this concept. The changing security environment and technological developments require Land Forces Command to have a force structure which is flexible enough to adapt to such developments.

In this regard, Turkish Land Forces Command has adamantly been sustaining its efforts to meet the requirements of 21st century with continuous progress perspective while it has been maintaining a force structure capable of facing the threats and risks in today's environment. By the time the ongoing and prescribed modernization projects are realized, 2020's will have been a landmark in Land Forces Command's force development and modernization. While the conducted studies have presently been exploited to put forward short and medium term measures, plans for long term prospects have been made by envisioning the combat environment of 2050's.

In parallel with these improvements in Land Forces, Turkish Land Platforms Industry has strengthened its capabilities and technology to meet the changing requirements due to changing threats.

Today, Turkish companies dealing with land platforms are capable to design develop and produce various types of vehicles with no major technical support from foreign sources. National Main Battle Tank ALTAY, Tactical Wheeled Armoured Vehicles, Amphibious Armour Combat Earthmover, Amphibious Assault Bridge and Armoured Mine Resistant Ambush Protected Vehicles (Kirpi) are the local development projects conducted by SSM.

It is obvious that Turkish Land Platforms Manufacturers have taken achievements not only in Turkey but also in different markets. FNSS succeeded the largest ever defence export last year in a single project achieved to date by a Turkish defence industry. On the other hand Otokar exports its vehicles to many countries.

Consequently, It is foreseen that 2020's will be landmark both for Turkish Land Forces and Turkish Defence Industry for a better future

Enjoy this issue....■





# Turkish Land Forces **A Bright Star in Peace**



### **2020's: A landmark in Turkish Land Forces Command's force development and modernization**

The stable and predictable threat environment of the Cold War era has been replaced by the present day multi-dimensional and unpredictable threat/risk environment with uncertainties. Today's revolutionary developments in Information Technologies and multi-dimensional risks triggered by reorganization strategies have added to the well-defined military threats of the Cold War era.

Security concept mainly perceived as military security before the Cold War era has gained a more profound meaning with the end of Cold War; therefore, political, social, economic and environmental issues have been incorporated into this concept. The changing security environment and technological developments require Land Forces Command to have a force structure which is flexible enough to adapt to such developments.

In this regard, Turkish Land Forces Command has adamantly been sustaining its efforts to meet the requirements of 21st century with continuous progress perspective while it has been maintaining a force structure capable of facing the threats and risks in today's environment.

In accordance with its vision and mission, Land Force's objective for the 21st Century is to attain a force structure with high survivability and combat power against all kinds of threats and risks and thereto has superior technology, information and training systems, which is full-armed with national and high tech weapons; is capable of performing uninterruptedly in all kinds of environment and under all conditions as an efficient and sustainable structure which is compatible with mobile, modular, national and international forces in joint and combined operations and finally trained to meet the needs of the modern age with a network enabled capability.

By the time the ongoing and prescribed modernization projects are realized, 2020's will have been a landmark in Land Forces Command's force development and modernization. While the conducted studies have presently been exploited to put forward short and medium term measures, plans for long term prospects have been made by envisioning the combat environment of 2050's.



In the immediate and foreseeable future, It is aimed to organize a Land Forces Command constituted by professional, modular, ability-based, cyber-threat proof units having the joint effort perspective besides decisiveness for achievement and thereto are capable of taking precautions against all kinds of hybrid threats likely to be faced in the combat

environment and thereby able to adapt to the requirements of the modern warfare. It is all well aware of the fact that all these considerations and developments focus on human beings. Its overriding objective is to meet the security needs of the Great Turkish Nation without hesitation under the auspices of Turkish Armed Forces.



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### Restructuring for a Better Future

Restructuring is a continuous activity maintained to ensure deterrence of Land Forces Command against the changing threat perceptions and risks and to use the allocated resources in the most economical way possible by following the changes and developments carefully around us. In that sense, Turkish Land Forces Command attaches great importance to modernization activities. The aim is to become more effective through downsizing by using technology.

Within this frame; The modernization of M60 tanks as M60 T tanks has been completed. Besides, the procurement of Leopard 2A4 tanks that have the same qualities with the 3rd generation tanks has been mostly completed in order to meet the need until modern tank production with national capabilities is possible. Within this frame, modification of fire control systems is continuing.

The mobility of maneuver units has been improved by establishing Armored Combat Vehicle Battalions in 2011 in order to use the existing Armored Combat Vehicles in battlefield in the most effective way.

With the aim of obtaining qualitative rather than quantitative superiority, the

capabilities of fire support vehicles have been improved with the new Firtina howitzers that have been taken into the inventory in addition to the present ones. With this modernization activity the old generation towed artillery weapons are being taken out of the inventory.

Development phase of the long range munitions need of Firtina and Panter howitzers was completed with the help of Mechanical and Chemical Industry Corporation as the main contractor. A contract regarding mass production has been signed and it has been planned that deliveries begin as of 2012.

Land Forces is aiming to meet the need of utility helicopter by national capabilities and resources in the long term as in ATAK project. For that purpose the Light Original Helicopter Project was started in 2010.

The Partially Protected Vehicles Against Mines procured in order to reduce the effects of IEDs/mines and provide a better protection for the personnel during motorized deployments in Counter-Terrorist Operations have been put into use as of March 2011. Delivery process of these vehicles is continuing.

Mechanical mine clearing vehicles

procured in 2010 in order to clear the mines laid are still being tested in the area; and according to the test results the project will be redirected.

Light alloy fixed bridges have been procured and put into use in order to increase the capability of rapid and secure movement through the obstacles during operations.

Ground reinforcement equipment has been taken into inventory in order to increase the mobility of wheeled and track laying vehicles in soft ground conditions.

Thermal cameras and thermal binoculars have been procured and put into use in order to increase the surveillance capabilities of border units and base areas in difficult/night conditions; likewise, Pilot Night Vision Goggles have been procured and put into use in order to increase the night vision capability of pilots.

Under the Tactical Wheeled Vehicles Project, most of the new generation cargo vehicles were received and distributed to the units. Delivery of the remaining vehicles is proceeding.

With the advent of new technological developments, Land Forces' efforts to equip its units with modern systems and equipments in



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terms of intelligence, reconnaissance, surveillance and target acquisition are well underway. Its efforts on procurement and widespread use of unmanned air vehicles (UAVs), which can be used by any unit in Land Forces Command, have continued during 2011. Integration of the received UAV systems into Land Forces Command's intelligence systems has been completed.

Land Forces Command's efforts regarding its priority intelligence objective, which is to use information and space technology for intelligence, to make an a single integrated system of all intelligence means and to enable to gather all target information in one centre and distributing from this centre in order to create a real time picture of the battlefield in its units' responsibility areas starting from the border area, will continue in the coming period as well.

Its studies are not limited to modernization activities. The following important developments on about manpower, training, logistics and organizational activities are also well underway:

Regarding to personnel recruitment, education and employment in Turkish Military Academy (TMA) and NCO Vocational School of Higher Education, in order to educate the future instructors, procedures for enabling the personnel in junior ranks to be chosen as instructors in TMA and NCO Vocational School of Higher Education, easing the way for instructors to publish academic articles and attend academic activities have been completed and put into action.

In order to train the specialist personnel thoroughly, to meet the needs of military branches and to meet the national and international standards imposed on all higher education organizations within the context of Bologna Process, a Multiple Degree Program will be applied at TMA. Starting from 2012-2013 Academic Year, Electronic Engineering, Mechanical Engineering, Civil Engineering, Business Administration, Public Administration, and in 2013-2014 Academic Year, Computer Engineering and Sociology departments will be opened in addition to the currently applied System Engineering Program. The programs to be opened at the TMA and the current programs in NCO Vocational School of Higher Education are



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“Kalekol” New Turkish border outposts, including high security feature was established by TOKI in Van Başkale near to Iran Border. The new outposts are furnished with bullet-proof glasses, high technology equipments, observation towers, evacuation tunnels and 15 meters high towers.

prepared in accordance with Higher Education Academic Evaluation and Quality Development Commission (YÖDEK) criteria.

In addition to vocational education and courses, Land Forces Command continues to send its officers meeting the necessary criteria to graduate programs at Turkish and foreign universities in order to meet the requirements for expert military personnel who can work at operational and strategic headquarters.

Some of its specialized sergeants have to leave Turkish Armed Forces before getting retired due to age-in-grade. With the aim of uplifting the vocational morale and motivation of such personnel some arrangements have been made, after which it has become possible for them to be employed as a civil servant in public institutions, primarily in Ministry of Defense and Turkish Armed Forces until the time they deserve to get their pension rights.

Nowadays, regional and global operational needs and counter-terrorism requirements have increased the importance and priority level of commando and border units. Commando brigades are especially one of the most important elements of counter-terrorism in Turkey.

In the context of professionalization of commando brigades, all commando branches have been professionalized. In addition to commando branches, there have been ongoing efforts especially to employ specialist sergeants as the drivers of vehicles and users of latest technology weapons in

mechanized and armored units.

In ensuring border security, it is planned to utilize technology more, employ professional personnel and use different organizational models according to regional features.

In the light of experiences gained from professionalization of commando brigade branch personnel, contractual soldier procurement activities have been started in 2011 in accordance with law numbered 6191 in order to fulfil the requirement of trained personnel in border unit cadres of Turkish Armed Forces. With the contractual soldiers in service, border units are expected to have a more effective structure.

For the purpose of training personnel (Officer/NCO/ Specialized Sergeant/Rank and File) who are more effective in anti-terrorism and have high level of training, Internal Security Training and Exercise Center was established in 2007, and for the purpose of singlehanded and more effective training of the personnel deployed to border units, Land Forces Border Training Center was established in 2010. Evaluations on these centers are positive.

In order to fulfil the border station facility requirements of Land Forces, the construction of 31 border stations have been completed and the





construction of 96 stations is underway. Moreover, for the accommodation of units assigned in the Interior Security Area, various containers have been supplied.

All measures are taken by its units to protect civilian population against ricochets during fires and/or contact with unexploded ordnance after fires in the firing range. In addition to this, national and international military publications are reviewed to improve its measures to be taken in existing firing ranges and new firing range projects are developed in line with recent technical developments.

Land Forces Command's logistics system now has a more contemporary structure with major changes.

While conducting all these activities and services at Land Forces Command, first priority has always been on personnel. Maintaining high morale and motivation of the personnel and their families is the primary objective. Along with the employment of personnel with appropriate quality and quantity, in order to have a modern armed force which is able to take timely measures for global and regional developments, planning and executing activities for the self development of personnel are proceeding.

### Land Forces 2014 Model

Throughout this process, while standing by the planning principles, the revisions are being made in line with the rapid developments experienced in the security environment, without being bound by time considerations. Those cadres and organizational structures which have lost their functionality in the targeted Force Structure have either been cancelled, changed or renewed. As a

result, while saving quantity (in the last five years there has been a saving at around 10-12 %), enhanced effectiveness is also ensured in terms of quality. In this context, Land Forces 2014 Model" has been replaced by an effective "Land Forces Model" based on quality rather than quantity, ability rather than threat.

Turkish Defence Industry has made a significant breakthrough to meet requirements Of Turkish Land Forces Command

The primary objective of Turkish Land Forces Command is to fulfill the modernization requirements by exploiting domestic defense industry capabilities. In this context, large scale major modernization projects such as main battle tank, attack helicopter, rocket/ missile projects, air defense systems, tactical wheeled vehicles and engineering projects are planned to be procured by domestic development model. Thereby what is aimed at is to meet the defense needs by using national systems independent from foreign bidders on one hand and to improve the technological and production infrastructure for the prospective needs of domestic defense industry by means of these projects on the other hand. Under the present circumstances, it has been considered that defense industry has made a significant breakthrough as a system by means of design, development and production of the main weapon systems. It is supposed that important contributions can be made to Turkey's economy in the near future by improving cooperation in high technology based projects that are being conducted in the international area, in parallel with meeting modernization needs by domestic production

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## **Turkey Strengthens its Land Systems Capabilities**

Mr. Levent Şenel , The head of Land Systems Department of SSM informed us about Turkish land systems programmes, latest status of Altay Project, studies on National power-pack development project, logistics, export activities and future plans.



**Defence Turkey: Mr ŞENEL, first of all we would like to thank you for taking your time for this interview. As known, Turkey has taken significant steps during the last decade in land vehicle platforms thanks to SSM's leadership as well as Turkish defence companies' devoted studies. Also, Turkey has become one of the most important countries in the world that makes platform design and integration as well as transfers technology to third countries. Could you please make an evaluation for us on where we stand now and our capabilities achieved so far?**

Only a decade ago, Turkish Land Platforms Industry was only capable of producing limited variants and limited number of vehicles under license, such as AFVs, 4x4 Land Rovers etc. Therefore we strictly depended on foreign suppliers, especially on the complex land systems.

Today, however, I can proudly say that almost all of the projects carried out by SSM Land Platforms Department are local development projects. Main contractors are Turkish companies; platforms and systems are designed and qualified by Turkish engineers; domestic capabilities and infrastructure are utilized for design, qualification and production. Tactical Wheeled Armoured Vehicles, Amphibious Armor Combat Earthmover, Amphibious Assault Bridge, Armoured Mine Resistant Ambush Protected Vehicles (Kirpi) are perfect examples for the local development projects conducted by SSM. On top of all these projects, I have to underline the most important one, National Main Battle Tank Altay Project.

Main Battle Tanks (MBT) are considered as the most sophisticated land vehicles. Modern MBTs are equipped with various types of electronic sub-systems as well as advanced mechanical and hydraulic sub-systems. In addition, all those major sub-systems are mounted together and work in a harmony on a unique high armoured platform after an advanced engineering optimization. Altay Program – I would like to name it as a program because it includes many high scale sub projects such as fire control system, main gun and armour development – is such an indigenous development program that shows the level where the Turkish Land Platforms Industry has reached. The main contractor Otokar has already started

52 AAAB vehicles are planned to be delivered to the Land Forces Command in the mid of 2013.



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testing the first prototype of Altay. Once we start the serial production and delivery of Altay MBT to Turkish Army, I will proudly state that Turkey is one of the few countries in the world who develop and produce her own MBT. This will be demonstrating and proving the maturity level of Turkish Land Platforms Industry.

Today, Turkish companies dealing with land platforms are capable to design, develop and produce various types of vehicles with no major technical support from foreign sources. They are initiating these activities without waiting any order from SSM or Turkish Land Forces (TLF) and marketing their systems internationally. For example, FNSS succeeded the largest ever defence export last year in a single project achieved to date by a Turkish defence industry. I would like to underline that FNSS will not only export their Pars vehicles but also provide technical support and assistance to Malaysian engineers.

Otokar designs and manufactures various types of armoured vehicles like Arma, Kaya, Cobra, etc. and exports them to tens of countries and users in the world. This example is so important that foreign users feel confidence on these systems even though some of those have not been delivered to Turkish Army yet. Otokar is currently scheduling to provide Cobra vehicles to Kazakhstan within the scope of an agreement.

On the other hand, Aselsan successfully modified and qualified a foreign MBT –Leopard 2 A4– equipping it with the sub-systems which were developed and designed by Aselsan engineers. At this point, I would like to remind that Aselsan was invited to Finnish Leopard Modernization Project Tender last year and was very close the win the competition against the strongest companies of the world.

To sum up, our industry is capable of developing, designing, qualifying and serially producing their own wheeled and tracked land platforms and the variants. In parallel, they compete against well-known foreign companies all over the world to export both their products and know-how technologies.

**Defence Turkey: Are the Turkish National Main Battle Tank (TNMBT) preliminary prototypes of Altay Project, which is amongst the most important projects of Turkey to be produced within the specified schedule? Is there any delay anticipated? Could you please brief us on the current status of the Program?**

In July 2008, we signed Altay Project Phase I Contract with Otokar, which covers the design, development, production, test and qualification of the Turkish National Main Battle Tank (TNMBT) Prototypes.

According to Project Implementation Schedule, Phase I of the Project lasts for 78 months and

Leopard 2 A4 Next Generation prototype was firstly unveiled at IDEF exhibition in 2011.



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consists of the following 3 stages:

Stage I: Conceptual Design

Stage II: Detailed Design

Stage III: Prototype Development, Qualification and Acceptance

In principle, the successful completion of Phase I will be followed by Phase II which is the Serial Production of TNMBT.

The Project includes local design and development of many critical subsystems, which will enable the Turkish Defence Industry to acquire new technologies and capabilities, and reduce foreign dependency of Turkey in this field significantly.

Main subcontractors of Otokar during this project are as follows:

Aselsan, shall design and develop subsystems such as Fire Control System and Command Control Communication Information System. MKE, shall produce 120mm L55 Main Gun System. Roketsan, shall design, develop and produce Modular Armour Package. MTU/RENK, shall develop and produce 1500hp Euro-Power-Pack. Additionally, Hyundai-Rotem of Republic of Korea shall provide technical support and assistance in required areas.

Conceptual Design Stage of the Project was successfully completed and System/Subsystem detail design activities have been on-going in accordance with the Project Implementation Schedule. Production of preliminary prototypes and infrastructure investment studies are also being carried out in parallel to the detail design and production activities.

In the Altay Project, two preliminary test prototypes, Mobility Test Rig and Firing Test Rig will be developed and tested. According to the test results of these Test Prototypes, the design of Altay tank will be upgraded and Detailed Design Stage will be completed.

Yet already, Mobility Test Rig is developed and test activities are being conducted. Furthermore, Firing Test Rig production is on-going properly in accordance with the Contractual Schedule. At the end of this year, we are planning to commence the firing tests.

In substance, I can proudly claim that our national main battle tank, Altay, is on the way to become the best battle tank in the world.

**Defence Turkey: In July 2012, BMC, HEMA Endüstri and Tümosan submitted their proposals for the tender regarding the indigenous**

**design of power-packs planned to be used firstly at Altay Main Battle Tank and then at other land, aerial and marine platforms; development of various types of diesel engine and transmission mechanisms; prototype production as well as test and qualification studies. The evaluation phase is still on-going. What are your primary expectations on such indigenous development project? What are the studies being conducted to minimize possible risks?**

The studies, aimed for the national development of a power-pack for military vehicles have been ignited with the "Land Vehicles Industry Day" dated June 2008. Until then, we have carried out several activities in order to identify the capabilities and infrastructure of the industry. Our efforts have been accelerated with the decision of Defence Industry Executive Committee to initiate the "National Power-Pack Development Project" in 15 December 2010. Today, our efforts reached to the official tender and our evaluation team has been working hard to finalize the evaluation process.

Our primary aim of and expectation from the Project is to develop an indigenous power-pack for Altay tank. In the near future, with the capabilities gained through this project, it is also targeted to develop various types of power-packs for the needs of other land/marine vehicles and civil applications.

We are all aware that this program will be one of the most challenging projects that SSM has ever had. It bears lots of foreseen and unforeseen risks. In order to reduce the risk level that potential contractors of the project may face, we encouraged them to take technical assistance from an experienced third party. So,

some foreign engineering companies showed interest to this project model and started to work with the local main contractor candidates. However, this does not mean that the local companies can obtain an already developed power-pack from those engineering companies. We have strongly drawn the red lines and stated in the Request for Proposal (RFP) document that all the design activities should have been handled in Turkey, with the assistance of foreign engineers where necessary.

**Defence Turkey: Turkish Land Forces' evaluation phase of requirements within the scope of Special Purpose Tactical Wheeled Armoured Vehicle Project is still in progress. Could you please inform us on the current status of the Project?**

An operational study is being carried out by TLF to analyse whether a common platform can be used together for the special purpose tactical wheeled armoured vehicle and weapon carrier vehicle projects. After the study is over, the requirements will be conveyed to SSM.

**Defence Turkey: Could you please brief us on the latest status of Weapon Carrier Vehicle Project and Mine Clearing System Project?**

Three years ago, we had received the bidders' proposals and were very close to finalize the assessment for the Weapon Carrier Vehicle Project. This project was defined by TLF separately than the Special Purpose Tactical Wheeled Armoured Vehicle at that time. Later, TLF wished to work on this project to redefine the requirements and the evaluation process was stopped.

Mine Clearing System Project is being reviewed by TLF from operational point of view. The revised requirements have not been passed to SSM yet.

MTR prototype testing process is be conducted by Otokar in Tank Test Center



© Otokar



Under the present circumstances, Altay tank appears to be the best solution taking into consideration the positive progress recently experienced in the project and the successful production of Altay first prototype, so called Mobility Test Rig (MTR). MTR has already gone through more than 2000 km field testing.

**Defence Turkey: Could you please inform us on the current status of the other projects being carried out by Vehicle and Special Projects group as well as Tank and Tracked vehicles group?**

Most of the projects commenced by my Department are the first of its kind in Turkish Armed Forces inventory. Among these, I can talk about Amphibious Assault Bridge, Mobile Surgical Hospital, Wheeled Tactical Vehicles and Mine Resistant Ambush Protected Vehicles Projects.

Amphibious Assault Bridge is a

special project which is produced by few countries in the world. This vehicle is designed, verified and produced by FNSS Company based on a 8x8 Pars vehicle chassis in a considerably short time, using domestic sources. Serial production phase is on-going and deliveries started already. Deliveries of all the bridge systems to TLF are planned to be completed by the mid-2013. The project is composed of 4 bridge systems; each system consists of 12 vehicles that makes 150m long bridge, plus 4 vehicles for training purposes. In sum, we shall deliver 52 vehicles to TLF in total.

The Amphibious Armoured Combat Earthmover is also a national development project in accordance with the contract with FNSS. These engineering vehicles are planned to be operated together with Amphibious Assault Bridge systems to prepare the coast of the rivers for easier operation.

The qualification of prototype vehicle was successfully completed in June 2012 after conducting some tough tests such as amphibious operation to cross a running river, excavating, levelling, shovelling up, endurance, mobility and system level EMI/EMC tests. Currently, vehicle acceptance tests are being conducted in FNSS facilities and we are expecting to finalize the delivery of all 12 vehicles in the early 2013.

Mobile Surgical Hospital was especially difficult project for us, considering the importance of required medical expertise which did not exist in SSM. Thanks to the medical doctors and specialists from Health Command and STM giving support to the project team and also thanks to the performance of main contractor Gama that allowed us to complete the project successfully and deliver the mobile hospital to the Health Command in

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MRAP contract was signed on March 2009 between SSM and BMC. Within the scope of project, 468 vehicles will be delivery to TLF.

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time. Delivery and warranty period is completed. This hospital can be transported anywhere, be made ready to use in a few hours for all kind of medical operations not only for military purposes but also for natural disasters when and where necessary.

Mine Resistant Ambush Protected Vehicle is the outcome of a successful national development project. The vehicle is named Kirpi and produced by BMC. Kirpi is a combat proven vehicle. The first delivery was in March 2011 and 273 vehicles have been delivered to TLF until now. Deliveries are expected to be completed in early 2013.

Other tactical wheeled vehicles that we procure from BMC are 2,5 ton; 5 ton and 10 ton troop & cargo transport vehicles. We also procured 3/4 ton command & control, personnel transport vehicles from OTOKAR in parallel. Only some 2,5 ton vehicles are left to be delivered in the coming months. All of the other vehicles are already in the service of TLF.

We have been procuring the NBC Mobile Field Laboratory from Indra, Spain. Because we would procure only one laboratory system, we invited also foreign contenders for the tender. This system has passed the qualification and certification tests successfully and is prepared for acceptance tests. We expect to deliver the laboratory to TLF shortly.

We have also been carrying out a demonstration activity of a modified Leopard 2 A4 tank through an additional agreement between SSM and Aselsan. A Leopard 2 A4 tank has been equipped with the electronic systems that will be used on Altay Tank such as tank firing control system, electrical gun and turret system, remote control weapon system, etc. and currently this modification is being tested by Aselsan on the field including the firing tests. And I can undoubtedly say in advance that the recent impressions are pretty satisfactory.

**Defence Turkey: We have realized that a special emphasis is made at**

**SSM's 2012-2016 Strategic Plan on the test infrastructure requirement to achieve indigenous product development. What would you like to say about the on-going studies and planned incorporations for the establishment of an Automotive and Mine Testing Facility to meet also the civil and international automotive industry test requirements?**

In order to meet the Altay project test requirements, we planned some investments regarding the armour development activities through our contract with Roketsan. Small calibre ballistic tests can be conducted in Roketsan Elmadağ facilities while armour tests with high calibre ammunition are to be conducted within allocated part of Şereflikoçhisar Military Test Range, to be maintained and managed by Roketsan. This test range includes also mine testing facility. Some other important infrastructures for tests exist in the main contractor facilities, especially in Otokar, FNSS, BMC, Aselsan companies. Some of

The emergency service and surgery units of the MIYI can become functional within 1 hour and 15 minutes



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İSBİR ELECTRIC INDUSTRY CO. is an establishment of Turkish Armed Forces Foundation

Mr. Levent Şenel has seen with Altay FTR prototype in Otokar facilities.



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them were invested by means of SSM contracts, while some others were gained by those companies within their own budgets. I should express that TÜBİTAK, The Scientific and Technological Research Council of Turkey, is another important source regarding test facilities.

Since I was appointed as the Land Platforms Department Head, I have been following very closely the studies for establishing a test range to meet the civil automotive industry test requirements. These studies were carried out by Automotive Manufacturers Association until 2011, then Ministry of Industry took a decision these studies to be coordinated by TSE, Turkish Standards Institution. This project requires a serious investment including a very large test field to be provided by the government. We shall contribute to this test centre project with the military land vehicles test requirements. When it becomes operational, I believe this test centre will meet the most of the test requirements of civil automotive industry and some of the military land vehicles industry, as well as serving for international demands. That will provide a big cost saving for Turkish companies not being obliged to pay for foreign test centres.

**Defence Turkey: The performance of depot/factory level maintenance and modernization of procured systems by local companies who are the producers of such systems is a critical issue for the sustainability of the sector. In the near future, an infrastructure to deliver cost-efficient logistical solutions is planned to be developed. Making some pilot implementations for the activation of life-cycle management and performance based logistics**

**through contracts is taken part in the Strategic Plan. Within this context, what are the studies being carried out by your Department? Is logistic contract standard going to be included as an addition in the existing standard contracts of your Department in the near future? What are your studies as per this issue?**

In "SSM 2012-2016 Strategic Plan", some objectives have been assigned to SSM Land Platforms Department regarding the logistic support for the systems developed and delivered by Turkish industry. In accordance with the mentioned objectives, SSM organization has been restructured and the pilot projects have been defined for logistic support. Currently, logistic standards and guidelines are being prepared by the relevant unit named "Logistic Planning and Coordination Division" in SSM.

Altay and Kirpi Projects were defined as two of those pilot implementations. We, Department of Land Platforms, are preparing to sign logistic contracts with the main contractors of Altay and Kirpi Projects based on performance based support if possible.

**Defence Turkey: We see that Turkey's primary market targets on the basis of platforms are Middle East, Far East, African Countries and Turkic Republics. Could you please share with us 2012 market status and achieved export figures? Are there any other regions that we plan to increase our presence and efficiency in 2013 except for current markets?**

This question actually enters into the expertise and responsibility area of our International Cooperation Department. To the best of my knowledge, military and aviation export reaches up to

USD 960 Million, according to Turkish Exporters' Assembly. New export opportunities in Middle-Eastern and North African countries have arisen in 2012 as a result of "Arab Spring". Furthermore, some activities in order to find new markets in Mid-Asia Turkic Republics and Far-East have been conducted and serious gains have been achieved. In this respect, some studies for export aiming Gulf Countries, Kazakhstan, Turkmenistan, Malaysia, Indonesia, Philippines, Libya and Egypt have been carried out. Our activities intended for those areas will also be increasingly continued in 2013. In addition, it is foreseen that



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Mr. Ayşe Akalın, Publisher of Defence Turkey Magazine; Mr Levent Şenel, The Head of Land Systems Department of SSM



Fire Control Systems of Altay project are carried out by Aselsan in its facilities



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our efficiency in Sub-Saharan African countries will increase in 2013.

**Defence Turkey: What are the collaborations made with platform producers for the export version studies of the land vehicle platforms' components from the beginning of the development phase? Do you have any determined roadmap related on this issue?**

In land platform projects, this is one of the most crucial points on which we cogitate. Systems and some critical sub-systems, which are especially designed to meet the Turkish Land Forces Command requirements, sometimes are expensive and not very appropriate for the export purposes. Therefore we encourage the main contractors from the beginning that an export version of the system is to be studied and developed. Turkish industry currently has lots of variants in wheeled platforms. We have been planning to generate alternative designs for Altay Main Battle Tank and other special platforms in the future. We are also willing to export our modernization skills which we gained through the modernization projects of M60, Leopard I and Leopard II Tanks. For instance Turkish Fire Control System Leopard II Tanks attracts users of Leopard around globe and is a part of our road map for exporting our indigenous defence systems.

To sum up, considering the alternative design for export is the reality of today's conditions and we fully encourage Turkish defence industry in this manner.

**Defence Turkey: We have already known that one of the priorities given by SSM is to ensure specialization in the sector. What are the studies being performed for the establishment of long-term**

**strategic alliances between platform producing main contractors and qualified sub-contractors having design capabilities, small enterprises, research institutions and universities?**

Coordinating the research institutions and universities including SMEs (small and medium enterprises), is a common strategy of SSM Project Departments as stated in the SSM's official project management guidelines.

Today, specialization is an essential element of defence sector and small firms are willing to participate in national defence programs which grant them a long lasting work-share in specific areas and a good reputation in the eyes of defence industry actors. On the other hand, universities and research institutions are encouraged to participate in defence programs since they have already been working on areas which we desire to improve. So, utilizing the scientific outcomes of the studies conducted will be supporting the sector in terms of acquiring the needed technology in the fastest way possible. This also grants economic opportunities to universities which make them be able to increase their R&D budgets and this sequence becomes a cycle between defence industry and universities enabling us to sustain a well-organized partnership.

Today universities take part in Altay Program mainly on armour development studies. We have also tried to draw on the past studies of ITU, Istanbul Technical University, in the areas of power pack development. ITU also helped us in design and development phases of amphibious platforms such as Amphibious Armour Combat Earthmover Project and Amphibious Assault Bridge by providing data from the studies

conducted in their labs.

**Defence Turkey: Would you like to give any further messages to Defence Turkey readers?**

Turkish defence industry has been improving very rapidly in the recent years. I can proudly state that especially the platform manufacturers have almost reached the maturity level in comparison to the world's most advanced industries. However, complex and critical sub-systems will still be demanding serious attention for local development in the coming years and this will be more difficult than developing a platform because it will require a higher technology level. I hope that future will witness the times when the inventory of Turkish Land Forces Command will be a composition of mostly local products. Especially, I would like to stress on Altay project which I believe it to be one of the most striking Turkish defence projects of all times. Hopefully the next interview, we find opportunity to talk about the serial production, TLF operation and export activities of Altay MBT. Future is promising for Turkey.



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# The First Prototypes of Altay TNMBT Demonstrated their Mobility

Prototypes of Altay - the first National Main Battle Tank designed and developed mainly by Otokar (major private defence industry manufacturer of Turkey) were introduced to public at Otokar's factory in Sakarya. Prime Minister Recep Tayyip Erdoğan attended "Altay First Prototype" ceremony hosted by Chairman of Koç Holding, Mustafa V. Koç, Chief of General Staff Necdet Özel, National Defence Minister İsmet Yılmaz, Commander of the Turkish Land Forces Hayri Kıvrıkoğlu, Undersecretary for Defence Industries Murad Bayar, President of Koç Holding Defence Industry Group and Chairman of Otokar Mr. Kudret Önen, President of Koç Holding Defence Industry Group and Chairman of Otokar, Vice Chairman of Otokar Halil Ünver and Otokar's General Manager Serdar Görgüç participated in the ceremony.

First prototypes introduced to public reflect the effects of the design and conceptual development of the project started in 2009. In the first prototype, Altay's mobility shall be tested and perfected. The second prototype developed under the scope of the project shall be used for testing Altay's firing capability. Two more prototypes shall be developed using the data obtained from these initial prototypes and thus Altay tank shall

be prepared for mass production. A special demonstration was organized at Otokar's tank testing runway, for the introduction of MTR (the first prototype of Altay that covered more than 2000 km during the tests) and FTR (second Altay prototype) to the visitors attended the ceremony. With the demonstration of mobility tests such as side slope, spinning, acceleration, suspension, stabilization track and off-road driving capacity, it is shown to the audience that it shall be the most modern tank by the time the project is completed.

President of Koç Holding Defence Industry Group and Chairman of Otokar (the prime contractor of Turkey's first national main battle tank Altay) Kudret Önen, expressed his gratification on introducing the very first prototype to public. After briefly mentioning about the first phases of the project, Önen presented information on the future studies: "In order to accomplish the project, a total number of 550 people (260 of which are the employees of Otokar) are working. Together with the Altay team and approximately 100 sub-contractors, we aim to operate in a most time-efficient manner and get the tank ready to mass production by the year 2015". Önen announced that the mobility tests of the first two prototypes would be watched and added: "As Otokar, we are currently

manufacturing our products both for Turkey's use and exporting them around 20 countries of the world. We own the intellectual property rights of all our products that are designed by our own engineers and technological resources as well as manufactured by Turkish labourers. We represent Turkey's power in defence industry; over 25,000 military vehicles that we produced are being used by Armed Forces of the World. We have always accomplished the projects fully and in time and exerted great effort to fulfil each and every mission we assumed. Today, I would like to announce that we will be exhibiting the first two prototypes of Altay. In the first prototype, we shall be testing the mobility of Altay. This first prototype has covered 2000 kilometres by now and the initial results display that we are heading on the right course. In the demonstration of the second prototype, the firing function of Altay shall be tested. We intend to prepare this prototype for the firing tests in the coming months. The results that we obtain from these two prototypes shall constitute the basis for the production and testing of the final tanks and as a result Altay shall be idealized and become the world's most modern tank".

Mustafa V. Koç, Chairman of Koç Holding, stated that he is pleased with





Chairman of Koç Holding, Mr. Mustafa V. Koç

the current state of the national battle tank project that has a prominent role in Turkey's defence industry strategy. Koç also mentioned that Altay constitutes a prestigious project both for Turkey and Koç Holding and added: "Altay shall give impetus to the design, development and production aspects related to land platforms not only with its very existence but also with the related investments, employees and technical experience. In order to become leader in the region, Turkey requires stable government, growing economy and strong armed forces. Being the most modern main battle tank capable to dispose of current and potential threats, Altay shall further strengthen our Armed Forces. Turkey's role, as an influential and leading country in its region, shall be reinforced with the stable governance, growing economy and powerful armed forces and Turkey shall become one of the major battle tank manufacturers. The products developed and manufactured by Turkey's national resources and technology shall assist a sustainable development. Many successful results have been achieved in the defence industry until today with the help of long-term approaches, properly defined visions and strong leadership. As Koç Holding, we have been exerting great efforts to achieve the goals and strategies set in the defence industry for long years, investing and accomplishing the projects successfully. We believe that our defence industry shall reach higher standards in the future by promoting specialization and improving and mastering the technology.

Prime Minister Recep Tayyip

Erdoğan gave a speech in the ceremony as well and reminded the audience of the historical step taken in national defence industry with the signing ceremony of the Altay Project that took place in July 29, 2008 and added: "Today we are proudly witnessing the concrete form of those signatures and decisions. With Altay Project, Turkey is now amongst the limited number of countries that have the capacity to design and produce high-technology main battle tanks. This project would increase our country's prestige and also contribute to our target of reaching a higher level in world defence league. During the signing of the contract in 2008, we determined to complete the project within 78 months and today we have reached the 46th month. I have been briefed on the current status of the project in detail by my fellow workers. I am pleased to be informed that the Critical Design stage of the project shall be in line with the road map. Although I am happy to tell you that both the Chairmen and my colleagues told me that they would be trying to accomplish the project hopefully 1 or 2 years before the set date. This is truly very important for us. Sooner accomplishment of the project shall further strengthen our country". Erdoğan mentioned that all national resources available were utilized to the maximum for Altay Project's development activities and continued: "During the production of Altay Tank, Turkey had the chance to gain significant investments in addition to its current capacity and facilities. Many vital investments that would be serving our country for many years ahead have been made throughout the production period of Altay Tank's prototype. A non-reflective room was established in Otokar facilities for testing electromagnetic security. A testing runway was constructed for the execution of operation and mobility capacities of the tank as well. Also an air conditioning unit was built for the environmental tests. A ballistic protection centre was founded at



Prime Minister Recep Tayyip Erdoğan

Şereflikoçhisar Tank Firing Polygon. Heat treatment ovens are being used in Kırıkkale facilities of the Mechanical and Chemical Industry Corporation. A simulator with 6 axes was established both in Aselsan and Otokar facilities. All these infrastructural investments have the capacity and equipment that is capable to serve many other military-civil projects. Stating that Turkey is now amongst the group of countries competent enough to design and produce battle tanks of high technological standards, he added: "This project would increase our country's prestige and also contribute to our goal of reaching higher steps in the world defence industry". Erdoğan noted that serial production shall be commenced immediately following the successful accomplishment of such detailed and difficult test procedures and added: "We are fully determined to start the mass production without delay and we shall take the required decisions in time".

At the end of the ceremony, Chairman of Koç Holding, Mustafa V. Koç presented prototypes of Altay Tank to Prime Minister Recep Tayyip Erdoğan.





## **FNSS Increase its Power with Joint Production**

Mr. Nail Kurt, General Manager & CEO of FNSS assessed their technologic improvements, vehicles, export activities, capacity use, sub-industry strategies and marketing activities for Defence Turkey Magazine readers.





**Defence Turkey: FNSS has achieved important projects both in Turkey and international platform. Could you please inform us about FNSS capability, product and technologic improvements?**

Although being a privately owned joint venture company, FNSS experienced a different performance record with a vision of serving the Turkish Armed Forces and becoming a global company by exporting its products.

The initial mission of the company was manufacturing land combat systems through technology transfer. Immediately after its establishment, FNSS had focused on product development and export activities as well as investing an important portion of its budget to R&D. Enhancing the engineering capabilities in a short time, FNSS had also invested to the local suppliers and took active part on their training. Today, FNSS has the capability, know-how and experience to design, develop and produce tracked and wheeled armoured vehicles as well as integrating the most complicated sub-systems to land platforms.

Since its foundation, FNSS has been a pioneer in many areas in Turkish Defence industry such as:

- First private defence company
- First complete system export
- United Arab Emirates
- Top exporter in overall defence export
- First in operating a facility abroad
- First technology transfer in defence industry
- Malaysia ACV project
- The largest defence export in a single contract
- Malaysia 8x8 Wheeled Armoured Vehicle project
- The first indigenous development project of Turkish Armed Forces

Amphibious Assault Bridge

FNSS also possesses the AQAP-2110, the highest quality assurance system of NATO and certified by British Lloyd's ISO 9001-2000.

FNSS has also considered vendor base development important and within a very short period of its establishment, it has made training, system, apparatus and machinery investments in over 100 companies to enable them to achieve NATO military specifications' quality level requirements. As a result, FNSS has achieved a local content rate above 80%, excelling its commitment and making a great contribution to the development of Turkish defence industry.

**Defence Turkey: Could you please inform us about FNSS activities and on-going programme?**

FNSS started its activities by manufacturing 1698 Armoured Combat Vehicles to Turkish Armed Forces with 81% local content. The vehicles produced by FNSS were used by the Turkish Forces serving under United Nations Peace Force through Somalia, Bosnia-Herzegovina and Kosovo for miles and gained the appreciation of Turkish soldiers.

In 1997, FNSS realized the first defence system export of Turkey to UAE by selling Armoured Combat Vehicles. We have been providing technical assistance to UAE army regarding the ACVs since that time.

FNSS made an agreement in 2000 for the 2nd package of Armoured Combat Vehicle project composing of the



production of Advanced Armoured Personnel Carriers in collaboration with Undersecretariat for Defence Industries (SSM). All the production and delivery of the vehicles were completed.

Through years, FNSS, realized an export to Malaysia by ACV sale. In addition with this contract, FNSS become the first Turkish defence company that realized technology transfer to outside of the borders of Turkey.

In 2000s, we started developing our own wheeled vehicles and in a very short time we completed the development of our Pars Family of Vehicles. We are providing our wheeled armoured vehicles in 6x6 and 8x8 variants. Pars vehicles are the new generation of Wheeled Armoured Combat Vehicles with special emphasis on Mobility, Protection, Payload and Growth Potential. The vehicles employ the latest design and technologies from commercial off-the-shelf (COTS) which have been Militarized (MCOTS) to meet the performance and durability of modern military operational requirements. In 2007, we signed our first wheeled vehicle program with Turkish Armed Forces, the Amphibious Assault Bridge (AAB) project. AAB project is the first indigenous design and development land vehicle of Turkey. The first 16 vehicles were delivered to Turkish Armed Forces and the serial production is on-going.

Another on-going project for Turkish Armed Forces is Armoured Amphibious Combat Earthmover that we are working in collaboration with SSM. FNSS shall design and develop

amphibious tracked dozers and produce the vehicles for Turkish Armed Forces. The acceptance tests are on-going for the project.

Last year, we signed 2 important contracts; the contract with Aselsan for Low Level Air Defence System project, a 30 tones tracked vehicle, which Aselsan is the main contractor, and the contract signed with Malaysia regarding 8x8 Wheeled Armoured Vehicle. Both projects are carrying on in accordance with the schedule.

**Defence Turkey: Could you please make an evaluation on FNSS' last three years performance in terms of production, capacity use, export, employment and market share?**

The most significant development during the last three years within the Company structure occurred in indigenous design aspect and the number of engineers working at this field has reached over 125. On the other hand, the total number of employees has reached over 600 from 150. If we add the number of personnel working at foreign countries then the number is over 800. These figures proven that the number of employees grew fivefold within the last three years.

We have been making the production of our products through our Company capabilities; however we have also been making subcontracts with sub-industry companies. Roughly, the generated employment will reach to 4,000-5,000 when involved the sub-industry.

We have been using our full capacity in production however we have been outsourcing the part of the production to the countries from where

we have undertaken liabilities as well. For this reason, we have been giving importance to the high utilisation of our production capacity; supporting the sub-industry development of the countries where we operate as per the requirements of our customers and we have been capable of making production even at the countries of our customers by operating facilities. Recently, joint productions in defence field at international market have become an important factor.

Over 2000 armoured tracked vehicles produced by FNSS within the country have taken part in the inventory of Turkish Land Forces. Within this context, FNSS dominates the market. Since the Turkish Land Forces has not realized any procurement of 6x6 and 8x8 armoured wheeled vehicles, yet there is no market created. However, I could affirm that we would become one and only in the field of heavy tactical vehicles through SYHK that we have developed. In terms of defence industry export, FNSS is the export champion of our country. Being leader in the defence platform export from Turkey since 1997, FNSS has also been exporting most of its products for the recent four years. FNSS has also encountered significant changes on its way to become a major export company. In the first years of its establishment, FNSS was performing activities under a licence as sole customer and sole product. The personnel formation was mainly based on blue-collar workforce and supported by a small design engineering department. Today, with its certified R&D Centre, FNSS has become prominent in the international



12 AAAB systems can be coupled and constructed as a 150m long bridge for crossing of vehicles up to MLC100 W.



© FNSS

market through its Pars Wheeled Armoured Vehicle with the design engineering capability comprising over a hundred design engineers and it has developed indigenous designs such as Armoured Amphibious Assault Bridge (AAAB) and Azmim (AAC) in domestic market. Both products have high export potentials.

**Defence Turkey: Could you please enlighten us about your activities on weapon systems?**

FNSS is a highly experienced company in land combat systems in designing and developing tracked and wheeled armoured vehicles. FNSS also design and produce weapon stations. In this content, FNSS developed one man Sharpshooter Turret, which is fitted with a 25-mm Bushmaster cannon and a co-axially mounted 7.62 mm MG. 40 mm / 7.62 mm and 12.7mm / 7.62mm variants of the turret are also available. The weapons are

fully stabilized providing full “shoot on the move” capability and incorporate modern high performance sighting systems. Exporting of those products to various countries still continues.

With advancing technology and customer needs, we are developing an unmanned turret with a 25/30mm machine gun named “Claw” in collaboration with Aselsan. We completed the first prototype and the tests will be conducted within this year. We believe there will be high demand to Claw both in the domestic and international markets.

Within this scope, FNSS will continue to develop and market manned and unmanned turrets in line with the market requirements.

**Defence Turkey: We consider that behind your successful export trend is a sound sub-industry network. Could you please let us know your supply chain approach?**

FNSS has dealt with the concept of sub-industry strategically since its establishment. As per this strategy, the sub-industry is one of the key elements of FNSS’ production potential and the part of FNSS organization.

The sub-industry activities in FNSS should be classified in two phases: The first phase is between 1992 and 2010 for the development of sub-industry and part production with many local producers. The second phase is the period starting from 2010. During this new period, FNSS plans to establish Solution Partnerships with a few number of competent and strong sub-industry companies. The details and objectives of both phases are summarized below.

The first supply phase was initiated by a study in 1992; a broad participation team called A-Team initiated strategic activities in terms of supply. The objective of this phase

Lieutenant General Salih Zeki Çolak and CEO and General Manager of FNSS Mr. Nail Kurt met with Bangladesh delegation at DSA, Malaysia in 2012



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15 Suppliers received their FNSS approved certificates at the ceremony. At the first phase of the certification process, which is realized under three main categories as administrative structuring; quality management system and practices; production and operational capabilities. 15 Suppliers are entitled to receive FNSS Approved Supplier certificates, which are valid for two years.

was to find and develop companies that are able to make production of parts needed by the Company in-time and of good quality. It is notable that the local contribution share was zero when first launched out. At the very first step, the companies making large-scaled production and having sound quality culture were communicated. However, it was not easy to attract producers making part production to automotive industry mainly, through mass production technique to our limited number of needs. For this reason, small-scaled producing companies were reviewed and the investment on bench and machine tools for the selected companies was made; the personnel were trained and a financial support was given. Within a short period of time, many producers were developed for different product categories and the outcome of such study was achieved as 73% from zero local contribution within two years. In

those years, FNSS was proud of the number of sub-industry companies amounting nearly to 250 and announced such pride to all marketing network by various means.

Working with local industrialists has multiple advantages; before anything else, it is easy to work with people of the same mother tongue and having the same culture. The physical proximity is also very important. Access to any sub-industry company located in Ankara takes a maximum of 30 minutes. There is no foreign country restriction on parts procured from local industrialists and thus a strategic advantage is achieved. Such supply method was beneficial in the first years while we were working with licensed and unique/single product.

FNSS, as time passed by, started to develop indigenous products, the licensed products were relinquished and production facilities were commenced to be operated for multiple

projects on various geographical locations. Due to the changing conditions, the need for change in our supply strategies became essential as well in mid-2000. Within this frame, a conference on Solution Partnership was held by FNSS on January 7th, 2010 and many sub-industry companies attended this conference as a proof of such aspiration. The substantial output of the conference was that “the flexible policies are needed based on collaboration as well as sharing liabilities and risks in order to be competitive in defence industry”; and “the need for performing activities as a partner between smart, and skilful sub-industry companies making also designs and prime contractors”. Within this framework, FNSS internally initiated transformation studies on supply process. Firstly, the supply process was redefined and in-house production was also included in the supply chain definition; suppliers were re-classified and a special emphasis was given to supply expertise. The studies were launched with one of our companies selected as a pilot company and the net outcomes to be obtained will be implemented rapidly thus the Solution Partners will be the key element of FNSS in its daily supply practices.

#### **Defence Turkey: How do you evaluate the performance of Turkey in the field of defence industry?**

I can easily say that the defence sector is the twinkling star of our country. I did not say this only in terms of turnover and export volume. I do say it because the defence sector has become the driving force for our country in terms of technological aspect by virtue of further development of coordination amongst universities,







© FNSS

FNSS signed an agreement with the Undersecretariat for Defence Industries (SSM) at the end of October 2000 for the 2<sup>nd</sup> package of Armoured Combat Vehicle project composing of the production of 551 Advanced Armoured Personnel Carriers. The production and deliveries were completed at the beginning of 2005.

industrial and governmental organizations. In current situation, TAF has procuring lots of products and services from local companies instead of procuring from foreign countries as in the past. Besides the advantages of using our own products and being supported by our own companies, there has been an employment increase as well as decrease in the outflow of foreign currency. Thanks to this development, the Turkish defence industry focused on production until mid-2000 has turned towards design focused business model, thus it plays an effective role on significant value-add creation. The Turkish defence industry has substantially become self-sufficient. At the same time, many export projects have been brought in our country through the

special emphasis of Turkish defence companies on export activities; and export activities have become a sine qua non for companies by virtue of incentives, assistances and objectives of mainly of our government, SSM and other related governmental organizations.

**Defence Turkey: Could you please tell us the future of FNSS?**

We planned to capture about 2.5 billion dollars of defence business over the next 10 years. While realizing this amount, we designed our system such a way: to be the local company and preferred supplier by transferring the technology to international customers. As FNSS, we will continue to be respectful, honest and trustworthy to our customers, and feed from these moral qualities. For the next 5 years the

operational excellence is our target. To manage highly complex contracts; multi-projects, multi-product and multi-locations successfully, we believe the information basis shall be vital, and projects shall be managed with a harmony and the supply chain management shall be in its most effective structure. On the other hand, we would like to differentiate in our business development activities over the next 10 years. Therefore we are focusing on large-scale projects that will guarantee the future of FNSS. The biggest pillar of our business development activities is new products. FNSS will invest more and more in research and new product development that will lead us to provide new land platforms to our customers.



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# An Overview on Turkish Land Platforms

by Cem Akalın

## Main Battle Tank

### TNMBT Altay Project

SSM signed Altay Project Phase I contract with Otokar, which covers the design, development, production, test and qualification of the Turkish National Main Battle Tank (TNMBT) Prototypes in 2008. The prime contractor Otokar's subcontractors in this Project are MKE, Aselsan, Roketsan, MTU/RENK and Rotem (South Korea). Within the scope of the Project, MKE designs and produces 120 mm 55L Main Gun System; Roketsan shall

design, develop and produce Modular Armour Package; Aselsan designs and produces Fire Control System and Command Control Communication Information System; MTU/RENK, shall develop and produce 1500hp Euro-Power-Pack. Besides, Rotem – South Korean Company – provides technical consultancy to MKE and Roketsan in this Project. According to Project Implementation Schedule, Phase I of the Project lasts for 78 months and consists of the following 3 stages: Stage I: Conceptual Design; Stage II:

Detailed Design; Stage III: Prototype Development, Qualification and Acceptance. Following the completion of “Conceptual Design Phase” in 2010, the mock-up of Altay tank was introduced to public in IDEF 2011.

The “Preliminary Design Phase” taking part within the scope of the second critical “Detailed Design Phase” was completed within the last quarter of 2011. During this phase, the production of preliminary prototypes was initiated in parallel. In Altay Project, two preliminary test prototypes,





Mobility Test Rig (MTR) and Firing Test Rig (FTR) will be developed and tested. According to the test results of these Test Prototypes, the design of Altay tank will be upgraded and Detailed Design Stage will be completed. MTR prototype was completed in October and the test phase was initiated. MTR covered over 2000 km within a month after the completion of prototype. FTR prototype was completed before the planned date; the firing control system and gun of which was planned to be

mounted at the end of November and set its stall out in the presentation of Altay Main Battle tanks' prototypes at Otokar facilities on November 15th. The firing tests of FTR prototype are planned to be made in the first months of 2013. On the other hand, the tests will be conducted for the two prototypes and the outcomes of trial-and-error and performance verification will apply to the main prototypes. These main prototypes are planned to be produced in 2014 and

2015. The production of all prototypes and implementation of all tests are planned to be completed at the end of 2015. Following the delivery of four prototypes and submission of technical data package to the Undersecretariat for Defence Industries, the Altay Project will be concluded. Depending on the success of the produced prototypes and based on the needs of Turkish Armed Forces and facilities of the period, the mass production in Altay Project will commence in 2016.



### The Future of Main Battle Tank; Altay

Altay is a third-generation main battle tank and it is named in honour of Army General Fahrettin Altay (1880–1974) who commanded the 5th Cavalry Corps in the final stage of the Turkish War of Independence. The front side of the tank will have special modular reactive composite armour protection. Altay will be protected against chemical, biological and radioactive (CBR) attacks. The tank is projected to have a 120 mm smoothbore gun in 360 degree powered traversing turret allowing for unfettered engagement of targets from any angle. TNMBT will use an advanced computerised Aselsan's Volkan-III modular fire control systems (FCS). Aselsan has successfully completed the development and started the serial production of Volkan FCS for Leopard 1 upgrade in 2006. Volkan FCS provides MTB's; High First Round Hit Probability, during day and night under adverse battlefield conditions, even while the tank/target or both are the move. The Volkan system includes the following components; Gunner's mirror stabilised periscope system; Commander's control display; providing the commander with access to thermal and Tv images from the gunner periscope. The commander also has independent view selection and control of the thermal imager.

Tank Command Unit: Providing

the gunner with an interface with the fire- control computer, view/ control of gun laying, access to sensor, range-finder, ammunition and barrel life information, adjustment of stabilisation, line-of-fire and line-of-sight. Fire-Control Computer; Providing ballistic calculation for the main and coaxial guns, automatic super elevation and lead angle determination without removing the line of sight from the target, two axis gun stabilisation, line-of-fire and line-of-sight synchronisation, automatic target tracking and correction for inclination. The system is based on an open architecture design for future

upgrades and the introduction of new ammunition types Ammunition selection unit: With provision for five ammunition types, fire/safe modes and loading/ammo ready modes, Ammunition temperature sensor, Meteorological sensor: Determining wind direction and velocity, barometric pressure and weather conditions Inclinator; Determining yaw and pitch inclination, Turret azimuth and elevation position encoders, Global positioning and north finding system, Driver's image intensifier periscope, Gunner's additional command unit, Power distribution and cabling.







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| Altay MBT        |   |
|------------------|---|
| Weight           | 66.000(est.)  |
| Length           | 7.5 m (hull), 10.3 m (gun forward)  |
| Width            | 3.6 m   |
| Height           | 2.4 m   |
| Crew             | 4 (commander, gunner, loader, driver)   |
| Engine           | Multi-fuel<br>1500hp (MTU)-1800hp (indigenous under development)                                      |
| Max speed        | 72 km/h   |
| Max range        | 430 km  |
| Suspension       | Hydro pneumatic   |
| Main Armament    | MKEK 120 mm 55 calibre smoothbore gun   |
| Coaxial Armament | Aselsan STAMP/II stabilized remote controlled turret<br>12.7 mm heavy machine gun 7,62 mm machine gun |

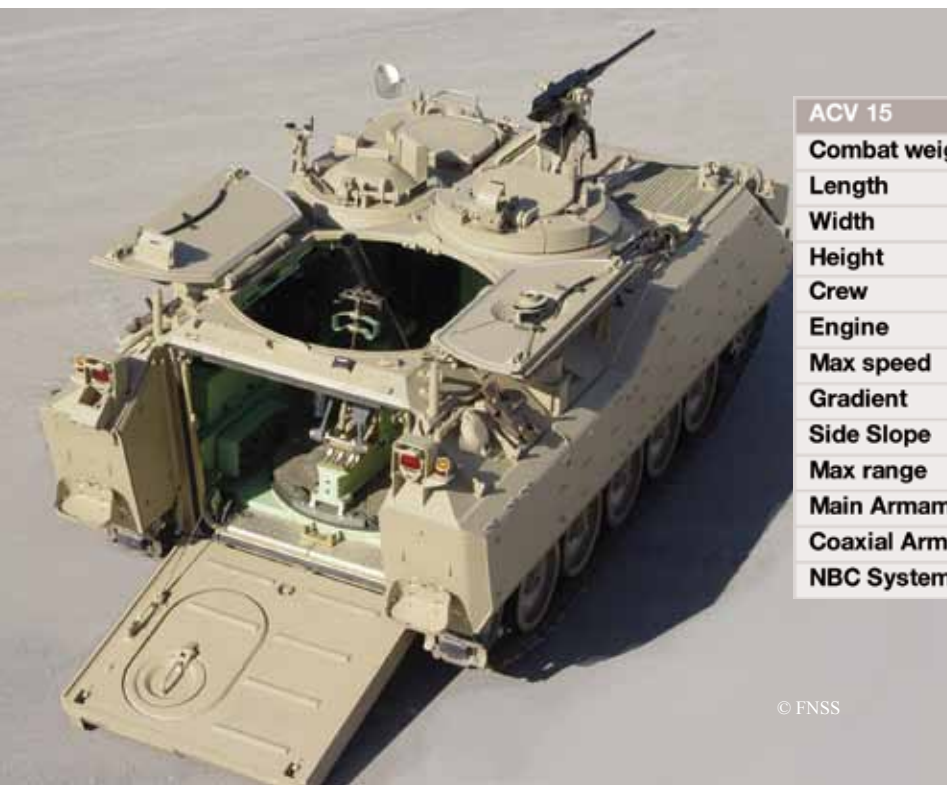
## Tracked ACV

### ACV15

The Armoured Combat Vehicle15 (ACV15) was developed by FNSS to meet the requirement of the Turkish Army for a heavily armoured vehicle in the 13-15t class that is able to operate alongside tanks in a combined arms team. The platform design allows integration of different subsystems to meet different roles. The Advanced Armoured Personnel Carrier (AAPC) chassis forms the base vehicle for all other members of the ACV family, which includes an IFV available with

a variety of weapon stations and turrets up to 90mm, command post, ambulance, repair and recovery and 120mm mortar carrier. The ACV15 is a fully tracked (five road wheels), low-silhouette vehicle capable of high-speed operations in desert conditions, cross-country and on road. Access to the vehicle is through a hydraulically operated ramp, with personnel door, on the rear of the vehicle or through the driver and commander's hatches on the top deck. A large cargo hatch cover is provided in the top deck behind the weapon station opening.

Two armoured fuel compartments are located in the rear of the vehicle for weight distribution and crew safety. The hull is constructed of ballistic aluminium plate. The engine and the driver and commander's compartments in the forward area utilise about half of the space, while a weapon station opening located on the right middle section, and the personnel compartment in the rear, utilise the remaining half. FNSS produced 2,249 ACVs for Turkey and exported others to Malaysia, the Philippines and the UAE.



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| ACV 15           |                              |
|------------------|------------------------------|
| Combat weight    | 14.900 kg                    |
| Length           | 5.26 m                       |
| Width            | 2.82 m                       |
| Height           | 2..88 m                      |
| Crew             | 3+8                          |
| Engine           | Detroit Diesel 6V-53T 300 BG |
| Max speed        | 65km/h on road               |
| Gradient         | 60 %                         |
| Side Slope       | 30 %                         |
| Max range        | 490km on road                |
| Main Armament    | M242 25 mm gun               |
| Coaxial Armament | 7,62 mm machine gun          |
| NBC Systems      | Standard                     |



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## ACV19

The Armoured Combat Vehicle19 (ACV19), developed and manufactured by FNSS, is a family of 15-19t class vehicles derived from the successful FNSS ACV15. Besides offering performance improvements, the ACV19 offers commonality with the ACV15 family. The ACV19 has been sold to the Royal Saudi Land Forces in a tactical command post configuration, and a 120mm mortar vehicle has been built for the Malaysian Army. The primary differences between the ACV19 and ACV15 are a longer hull with six road wheels, heavy-duty final drives and

more aggressive suspension. The AC19 offers a larger volume under armour and more payload capacity than the ACV15, and mobility equal to or better than an MBT. The ACV19 chassis can carry high payloads such as two-man turrets or 120mm mortars, and still provide the same performance as a standard ACV15 without a turret. The ACV19 family includes a Tracked Logistic Carrier (TLC), which retains the front of the vehicle with the driver on the left and power pack on the right, with additional space to the immediate rear for the vehicle commander and one additional crew member; behind the crew compartment is a flatbed with

tie-down points, as well as drop sides and drop tailgate, which can be quickly removed if required. The TLC can carry a maximum payload of 6t. It has an HIAB 182R hydraulic crane fitted on the roof of the crew compartment to assist in loading and unloading cargo. This can be operated by remote control up to 1m away and can lift 1.6t at a reach of 3.3m. The ACV19 chassis features a unique, spaced laminated armour system combining steel and aluminium technology to provide a high level of protection against direct KE threats. The hull provides protection against mines.



© FNSS

### ACV 19

|                         |                                     |
|-------------------------|-------------------------------------|
| <b>Combat weight</b>    | <b>18.000 kg</b>                    |
| <b>Length</b>           | <b>6.38 m</b>                       |
| <b>Width</b>            | <b>2.95 m</b>                       |
| <b>Height</b>           | <b>2.76 m</b>                       |
| <b>Crew</b>             | <b>3+10</b>                         |
| <b>Engine</b>           | <b>Detroit Diesel 6V-53T 350 BG</b> |
| <b>Max speed</b>        | <b>65km/h on road</b>               |
| <b>Gradient</b>         | <b>60 %</b>                         |
| <b>Side Slope</b>       | <b>30 %</b>                         |
| <b>Max range</b>        | <b>490km on road</b>                |
| <b>Main Armament</b>    | <b>25 mm /30 mm Cannon</b>          |
| <b>Coaxial Armament</b> | <b>7,62 mm MG</b>                   |
| <b>Anti-Tank</b>        | <b>TOW 2 Launcher</b>               |





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# Self-Propelled Howitzer

## T-155 Firtina (Storm)

In the light of the lessons learned from the 155 mm M-44T and M-52T self-propelled howitzer programs operated by the Turkish Land Forces Command and bearing in mind the tactical and technical concepts used by the Turkish Land Forces Artillery Units and the fire support requirements of future battlefields, the T-155 Firtina Modern Howitzer Development Program commenced in 1995. The design and prototype production project started in 1995 by the Technical and Project Management Department of the Land Forces produced the first prototype with a maximum range of 30 km and a 155 mm/39 calibre barrel in 1997. However, as a result of a need for a longer range, it was decided that the new howitzer would possess a 155/52 calibre weapon system and towards the requirements of the Land Forces Command, a second prototype howitzer production with a 40 km range, 155/52 calibre weapon system commenced during 2000. Following this process, the first T-155 Firtina was included in the inventory of the Turkish Armed Forces in 2004. The Firtina's main weapon, where the production line is located at the First Army Main Maintenance Center

Command attached to the Land Forces Command, is produced by the MKE and the fire control systems by Aselsan. The 52 calibre barrel with a length of approximately 8 meters together with over 40 km firing range with rocket assisted projectile, on carriage fire control management computer, global positioning system, automatic barrel guidance system and automatic shell handling system provides Firtina with high firepower. The Firtina 155 mm Howitzer has been designed to fire all types of NATO standard ammunition. This feature allows Firtina the opportunity of joint use with allied nations. Able to undertake tasks within an NBC environment, the Firtina is ready to fire within 30 seconds when on the move and can fire 8 rounds within 1 minute and within the first 15 seconds as simultaneous impact firing. With its advanced fire control system, the T-155 Firtina, firing 3 rounds simultaneously each in different trajectories and arriving on target at the same time at distances between 8 and 25 km, is equivalent to the firepower of 3 howitzers. Having a combat weight of 47 tons, the Firtina Howitzer with its 1,000 HP engine possesses mobility under all land conditions. Subsequent to completing its firing task, the Firtina



is able to leave its position within 30 seconds. With its automatic barrel path lock system that can be internally controlled, the Howitzer is able change its position within a short time and thus minimizes the risk of being exposed to the counter fire of the enemy.



| T-155 Firtina    |   |
|------------------|---|
| Combat weight    | 47.000 kg   |
| Length           | 12 m  |
| Width            | 3.4 m   |
| Height           | 3.4 m   |
| Crew             | 5   |
| Max speed        | 66 km/h   |
| Max range        | 400 km  |
| Engine           | MTU-881 KA 500 diesel 1000hp                                |
| Power/Weight     | 17.85hp/ton   |
| Fire Range       | 18.000 m (standard)/ 40.000 m ( rocket-assisted projectile) |
| Main Armament    | 155 mm L52  |
| Coaxial Armament | 12.7 MG   |





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# Tactical Wheeled Armoured Vehicles

## Pars

FNSS has developed a new generation of wheeled AFVs in 6x6 and 8x8 configurations with a special emphasis on mobility, protection, payload and growth potential. FNSS has named the vehicle Pars, which in Turkish means Leopard. Pars is designed not only to have a high level of ballistic and mine resistance, but also carry a variety of weapon stations and provide a high internal volume, which allows for a full complement of infantry soldiers with all of their equipment. One of the most significant features of the Pars vehicle is situational awareness. A unique feature is that the vehicle commander and driver sit side-by-side. For enhanced visibility, there are two thermal cameras and two optical cameras at the front and rear. An important feature of Pars is its very high mobility that comes from its newly developed active pneumatic independent suspension system. The vehicles are equipped with independent suspension at all wheel stations, providing commonality between each station, thereby reducing logistics and improving life-cycle costs. Pars's centralised engine location, made possible by the suspension design, provides for a very adequate passage to and from the rear of the vehicle. The modular design of the Pars will incorporate external turrets or weapon stations depending on user requirements. It could be a one or two-man turret or a remotely operated weapon station.

The Pars forms the basis of the



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8x8 AV8 vehicle, which DEFTECH, in cooperation with FNSS, is developing for the Malaysian Armed Forces. FNSS would be responsible for the development of vehicles, shared production of the platforms for vehicles, subsystem integration and system integration and system performance within the framework of the project. The very first prototype, of which the hull production and installation will be accomplished, is aimed to be delivered to Malaysia in 2012. Together with this vehicle the 25 mm Sharpshooter Turret

will be sent for qualification procedure. Unless a delay occurs the delivery of the second prototype is expected to take place in the first quarter 2013. The qualification procedure will commence following the delivery of the prototypes. After the qualification is completed, the produced parties will be accomplished by the end of 2013. 257 8x8 AV8 wheeled armoured vehicles with 12 different configurations will be built for the Malaysian Armed Forces within the scope of project.



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### Pars 6x6/8x8

|                  |   |
|------------------|---|
| Weight           | 23/27t  |
| Payload          | 6/9t  |
| Length           | 6.8/8m  |
| Width            | 2.8/2.9m  |
| Height           | 2.4/2.3m  |
| Ground clearance | 0.4/0.2-0.5m  |
| Crew             | 10/14   |
| Max speed        | 100 km/h on road                                      |
| Max range        | 700 km on road  |
| Gradient         | 60%   |
| Side slope       | 30%   |
| Fording          | 1.5m A  |
| Armament         | Various turrets and remote-controlled weapon stations |



## Arma

Arma vehicle's development started in 2007. Otokar developed amphibious tactical wheeled armoured to target the Turkish Land Forces' Special Purpose Tactical Wheeled Armoured Vehicle project. At Eurosatory June 2010, Otokar present the first time to the public, his new wheeled armoured vehicle, the Arma 6x6. Arma 8x8 version development and production phase was completed in last quarter of 2010 and has unveiled IDEF 2011. Otokar received the first contract for its new 6x6 tactical armoured vehicle Arma from abroad. The contract is valued in excess of \$10.6 million including the vehicles, spare parts and training. In June 2011, Otokar has been awarded a \$63.2 million second contract for its new 6x6 tactical armoured vehicle Arma.

Arma vehicle platform with superior tactical and technical features will be an outstanding and cost effective product among competitive products. Thanks to the high level of ballistic and mine protection as well as, the outstanding design allowing the integration of various types of weapon stations and mission equipment, Arma will be an adaptable platform for evolving mission needs in a modern battlefield. The engine is located at the right front of the vehicle, allowing a comparably high internal volume to be efficiently and ergonomically used. With this internal layout, all the personnel especially the commander can keep eye contact continuously among each other.

Arma 6x6 has an 18.500 kg combat weight ,carries a driver, commander and eight dismounts in its fully NBC protected hull. The vehicle payload capacity is 4500 kg. Arma is C-130 air



transportable in standard configuration. The vehicle can be driven in 6x6 or 6x4 modes depending upon the terrain conditions. Arma uses a 6 x 6 chassis and is motorised with a 450hp water-cooled turbo diesel capable of running on F-34 or F-54 fuel drives the wheels through an automatic gearbox and single-speed transfer box, giving it a top speed of 105 km/h and a power/weight ratio of 24.3hp/tonne. This also powers the on-board 24 V DC electrical system, which incorporates two maintenance-free 125 Ah batteries and a 3.3 kW converter. Arma's front two axles are steerable enabling it to make a turning radius of 7.85 m and the vehicle rides on independent hydro pneumatic suspension, offering respectable off-road mobility and comfort. It can negotiate a 45-degree approach and departure angles leading onto 60 per cent inclines and 30 per cent side-slopes. It can also cross 1.2 m-wide trenches and climb over 60 cm obstacles. Arma 8x8 transports 10 dismounts, the driver and the

commander and a maximum load weight of 24 tons. The Arma 8x8 vehicle electronic system was developed by Otokar. With this system, the vehicle's driver with the use of a thermal camera can see the road and the surroundings and continue forward the dark, in the fog and in smoke without opening a light. The same camera can see the back of the vehicle when the driver is driving the vehicle in reverse. Arma is amphibious and driven by 2 hydraulically driven propellers in water allowing a high seagoing performance with a pivot turn capability. The Arma 8x8 can move in water at 8 km per hour without any preliminary preparation. Arma's ballistic and anti-mine protection is provided by high hardness monocoque steel hull and all personnel is seated on anti-mine seats. Arma can be used for various purposes including command control vehicle, reconnaissance vehicle, NBC reconnaissance, ambulance, mine disposal vehicle.



### Arma 6x6/8x8

|                    |  |
|--------------------|--|
| <b>Weight</b>      | <b>18500/24000 kg</b>  |
| <b>Length</b>      | <b>6.3</b>   |
| <b>Width</b>       | <b>2.7</b>   |
| <b>Height</b>      | <b>2.2</b>   |
| <b>Crew</b>        | <b>10/12</b>   |
| <b>Engine</b>      | <b>Water-cooled turbo diesel<br/>450hp</b>                       |
| <b>Max speed</b>   | <b>105 km/h</b>  |
| <b>Gradient</b>    | <b>60 %</b>  |
| <b>Side Slope</b>  | <b>30 %</b>  |
| <b>Water Speed</b> | <b>8km/h</b>   |
| <b>Max range</b>   | <b>700 km</b>  |
| <b>Armament</b>    | <b>Various turrets and remote-controlled<br/>weapon stations</b> |

## Kirpi MRAP

With the contract signed on 27 March 2009 between the Undersecretariat for Defence Industries (SSM) and BMC in order to meet the requirements of Turkish Land Forces for vehicles to carry/transfer weapon, material and personnel safely and quickly. Within the scope of project, 468 vehicles are going to be procured.

At the International defence exhibition of Paris, Eurosatory 2010, BMC has unveiled 4x4 MRAP Kirpi. The First MRAP's were delivered to Turkish Land Forces in March 2011 and 273 MRAP have been delivered to TLF in last quarter of 2012. Deliveries are expected to be completed in early 2013.

Kirpi, the mine resistant ambush protected vehicle, which is actively used by Turkish Armed Forces at hot spots of terrorism attacks, has 350 PS engine, fully automatic transmission and 4x4 or 4x2 wheel drive capability according to the road conditions. Kirpi can be run at a maximum speed of 105 km/h with a maximum range of 800 km with 13 soldiers. It can power-up steep gradients and even cling to 60% steep slopes. The vehicle has 120 cm water fording capability without any preparation. Running between -32 and + 55 C temperature, the bottom part of Kirpi is protected against grenades and land mines and rapidly repairable when exposed to mines. Passing severe mine and ballistic tests according to the NATO standards, Kirpi has a run-flat system which enables 40-meter moving away in case of blowout and a central tire inflation system (CTIS) activated by a single button that allows cross country mobility. Kirpi uses a V-shape chassis to increase vehicle and crew survivability by deflecting



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an upward directed blast from a landmine away from the vehicle, while also presenting a sloped armour face. Kirpi features the latest technologies of shock absorber seats and interior accessories, as GPS system, rear view camera and automatic fire suppression system. The soldiers can enter and leave the vehicle through a large hydraulically operated ramp at the rear of the hull. Kirpi has five firing ports and four bulletproof windows in either side of the troop compartment. Kirpi can be used for various purposes including command control vehicle, reconnaissance vehicle, antitank weapon system, machine gun weapon

system, grenade launcher system, ambulance, mine disposal vehicle, recovery vehicle and maintenance vehicle.

BMC unveiled the new version of MRAP 6x6 in June 2012 at Eurosatory exhibition, the new version has the same ballistic protection and equipment with 4x4 model, the personnel as well as useful load carrying capacity is planned to be increased in 6x6 versions. With a rubber suspension and third shaft mounted to 4x4 versions weighing at nearly 20 tons, the payload is planned to be increased to 25 tons. The 6x6 Kirpi, the prototype of which is planned to be concluded at the end of 2012.



| Kirpi      |   |
|------------|---|
| Length     | 7.07 m  |
| Width      | 2.51 m  |
| Height     | 2.86 m  |
| Crew       | 3+10  |
| Engine     | Cummins IsLe 350Turbo diesel                          |
| Max speed  | 105 km/h  |
| Gradient   | 60 %  |
| Side Slope | 30 %  |
| Fording    | 120cm   |
| Max range  | 800 km  |
| Armament   | Various turrets and remote-controlled weapon stations |



## Kale MRAP

Kale, which was developed by Otokar in order to meet the vehicle requirements of Turkish Land to carry/transfer weapon, material and personnel safely and quickly with the contract signed in 2009 for Tactical Wheeled Vehicle Project, was presented for the first time at IDEF in 2009. Having 16.500 kg weight and 456 mm ground clearance, Kale uses 6-cylinder 300hp water –cooled turbo diesel engine. Having high performance even at terrain conditions, Kale is able to carry 13 crews including driver. Kale can run at maximum road speed of 100 km/h with a max range of 800 km and it has in standard a run-flat system to enable the movement of vehicle even if the blowout as well as air-conditioning system and interior dome light with dim-out feature. Optionally, self-protection



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crane, protection rig against NBC attacks, radio internal communication system, positioning system, automatic fire fighting system, front and rear cameras as well as hydraulic driven ramp door can be equipped in the

vehicle. It has 360-degree manually traversing turret system on the vehicle which can be mounted 7.62 mm or 12.7 mm machine gun or 40 mm automatic grenade launcher.



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| Kale             |   |
|------------------|---|
| Weight           | 16.500 kg   |
| Crew             | 1+12  |
| Engine           | 300hp Water –Cooled Turbo diesel                    |
| Max speed        | 100 km/h  |
| Gradient         | 60 %  |
| Side Slope       | 30 %  |
| Ground Clearance | 456 mm  |
| Max range        | 800 km  |
| Armament         | 7.62 mm/12.7 mm MG/ 40mm Automatic Grenade Launcher |

## Vuran MPAV

BMC has evaluated the needs of Turkish Armed Forces as well as Friendly and Allied Armies, and developed BMC – Vuran Multi-Purpose Armoured Vehicle and BMC – Vuran Weapon Carrier Vehicle. The vehicles were exhibited in IDEF 2011 Defence Exhibition. Main concept of this vehicle covers convenient use by Armed Forces for various purposes and increased ballistic and mine protection including windows. Fully equipped personnel carrying capacity is 6 to 10 persons. The vehicle has total 5

doors including 2 at each side and 1 rear door. The vehicle has (4x4) driving capability on all terrain conditions, and is provided with increased ergonomics. The vehicle has helical springs and independent suspension. Vehicle concept is designed in order to meet various requirements including various manual or remote controlled weapon stations; anti-aircraft weapon station; machine gun weapon station; 40 mm grenade launcher weapon station; TOW, MILAN antitank weapon station; reconnaissance vehicle; command control vehicle; and radar vehicle. The

vehicle is equipped with high engine power and automatic transmission. The body is designed as monocoque in order to provide full protection. The vehicle covers 800 km with one full fuel tank. Vuran allows remote firing from inside the vehicle. The vehicle is equipped with a camera to maintain comfortable driving for the driver. There are firing ports at each side. Run-flat, CTIS, and NBC protection systems are applied on the vehicle. It is possible to place firing ports on the windshield to allow firing from inside the driver's cabin.



| Vuran      |   |
|------------|---|
| Crew       | 2+5   |
| Engine     | Cummins IsBe 250Turbo diesel                          |
| Max speed  | 105 km/h  |
| Gradient   | 60 %  |
| Side Slope | 30 %  |
| Fording    | 80 cm optional: 120cm                                 |
| Max range  | 800 km  |
| Armament   | Various turrets and remote-controlled weapon stations |

## Kaya MPV

Kaya is designed and developed by Otokar as a mine-protected vehicle. It's based on the proven Unimog 5000 chassis for high level cross country mobility. Kaya 4x4 mine protected vehicle with its flexible body configuration can easily be configured for different missions along with varying user needs. Kaya has two variants, one being the armoured personnel carrier (APC) with armoured driver's cabin in the front and armoured troop compartment in the back that can carry 12 fully equipped troops, and it provides the ability to respond possible threats with its weapon turret. Due to its flexible design, the APC variant can be adapted into an ambulance or a command post vehicle. The second variant is a cargo carrier with protected driver's cabin but without the troop compartment in the back, instead having an unprotected flatbed cargo area. The troop's compartment is at the rear with the lower part in V-shape for a higher level of protection against anti-tank mines. The Kaya MPV can run at maximum road speed of 96 km/h with a max range of 800 km. Besides, Otokar has unveiled its new model Kaya 2, which was developed for export at Altay TNMBT prototype presentation. Kaya 2 weighs 2000 kg more than the previous model and has an increased ballistic protection. The engine of this version is also more strengthened than the previous version. Instead of 4-cylinder 4.8 litre 218 hp



© Otokar



Kaya II

© Defence Turkey

supercharged diesel engine used in previous model, it has now 7.2 litre 300 hp water-cooled supercharged Euro III diesel engine. The crew capacity of

the previous version was 12 whereas it is now 10 including driver and commander.



© Otokar

| Kaya             |   |
|------------------|---|
| Weight           | 12500 kg  |
| Length           | 6.4 m   |
| Width            | 2.5 m   |
| Height           | 2.91 m  |
| Crew             | 10+2  |
| Engine           | OM 924 LA 4cyl - Turbo Int - 4800 cc<br>218 hp @ 2200 rpm |
| Max speed        | 96 km/h   |
| Gradient         | 60 %  |
| Side Slope       | 30 %  |
| Ground Clearance | 522 mm  |
| Fording          | 120 cm  |
| Max Range        | 800 km  |
| Armament         | 12.7 mm MG/ 40mm Automatic Grenade Launcher               |



## Cobra

Significant technological, engineering and marketing investments have been made for Cobra Project, which was initiated by Otokar with the support of Tübitak 1997. During its design phase several tests like performance in Acclimatized Wind Tunnel, Brake Performance Tests with 5th Wheel, Environmental Tests, Gradability Tests, Fording Capability Tests, Side Slope Capability Tests, Mobility Performance Tests and Mine Resistance Tests were realized successfully at different locations within and outside the country and under different weather and geographical conditions.

The Cobra has an all-welded steel hull for improved protection against different versions of small arms fire as well as mines. If required, the Cobra can be delivered with a higher level of armour protection utilizing add-on armour.

The power pack is at the front, with the driver being seated at the front left and the vehicle commander to his right. To the front and side of the commander and driver are bulletproof windows with those to the front being provided with a washer and wiper. On either side of the hull is a forward opening door with a bullet proof observation window in the upper part. If required, these single piece doors can be configured as two part hatches.

The troop compartment is at the rear with three men seated behind the commander and driver and facing the front. The centrally seated member of whom normally mans the weapon station. Three men are seated down each side of the Cobra facing each

other on individual seats which fold up when not required. A large door is provided in the rear of the hull which opens to the left.

In the APC version, either side of the troop compartment there are two bulletproof vision blocks with a firing port below. The weapon station is normally mounted on the roof to the rear of the commander and driver with a single piece hatch to the rear.

The water-cooled turbo charged diesel engine develops 190 hp and is coupled to a four speed automatic transmission with permanent 4x4 drive and a two-speed transfer case. The exhaust pipe runs from the engine compartment up to the left side of the roof. The Cobra vehicles has a maximum 115km/h, acceleration of 0 to 60km/h in 13 seconds and a range of 720 km.

Single speed Torsen differentials are standard with the suspension at each wheel station being of the double A-frame type with coil springs which provides good cross-country mobility. Hypoid single reduction differentials are mounted under the hull and are coupled with independent half shafts.

Power steering is fitted as standard, as is an air conditioning system, blackout system, start socket, main cut off switch, gun clips, combat type seat belts, front and rear recovery hooks, thermal insulation inside the hull, pioneer tool kit and run-flat tyres. Optional equipment includes a central tyre inflation system (CTIS), electric winch, NBC system, smoke grenade launchers, driver periscopes and various types of communication equipment. Various types of weapon station and turret can be adapted to the Cobra Vehicles; Open Cupola



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Weapon Station(7.62mm MG/12.7mm HMG/ 40 mm AGL), MKT Closed Turret (7.62mm MG/12.7mm HMG), Remote Controlled Weapon Station –Keskin (7.62mm MG/12.7mm HMG/ 40 mm AGL), 20mm Cannon Open Cupola Weapon Station ,7.62mm/12.7mm Retractable Gun Mount, Tow/Milan/Kornet-E Antitank Missile Launcher. Cobra can be used for various purposes Personnel Carrier, Command Control Vehicle, Command Post Vehicle, Reconnaissance / Surveillance Vehicle, CBRN Reconnaissance Vehicle, Jammer Vehicle, Patrol Vehicle, Recovery Vehicle, Ambulance, EOD Bratt, Amphibious Variants. An optional amphibious kit consists of double hydraulic thrusters with joystick control and closing louvers. The system allows the vehicle to enter water without preparation.

Cobra vehicles are in service with different variants in the Turkish Land Forces Command and Gendarmerie at present. Also it was entered into service more than 10 country inventory and UN operations with different variants.



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| Cobra            |   |
|------------------|---|
| Weight           | 6300 kg   |
| Length           | 5.48 m  |
| Width            | 2.23 m  |
| Height           | 2.1 m   |
| Crew             | 8+1   |
| Engine           | Water cooled turbo charged 6,5 lt,190 HP              |
| Max speed        | 115 km/h  |
| Water-Speed      | 8 km/h (with amphibious kit)                          |
| Gradient         | 60 %  |
| Side Slope       | 40 %  |
| Ground Clearance | 400 mm  |
| Fording          | 120 cm  |
| Max Range        | 600 km  |
| Armament         | Various turrets and remote-controlled weapon stations |

# Specialized Vehicles

## Armoured Amphibious Assault Bridge (AAAB)

In 2007, FNSS has awarded a contract with TLFC for the design, development and production of Armoured Amphibious Assault Bridge. Within the scope of project, 52 AAAB vehicles are going to be procured. The first prototypes that being manufactured in 2009, were completed the following year first prototype began to be operated on land. 4 training sets of Amphibious Assault Bridge, delivered to Land Forces Command in September 2011, were subjected to challenging durability tests for land and sea tasks during 10 months and succeeded such tests. Being under mass production phase, 52 AAAB vehicles are planned to be delivered to the Land Forces Command in mid of 2013.

The AAAB System is a bridge and ferry system designed for Turkish Armed Forces' fast and safe transport through the rivers in the battlefield.

With its diesel engine, automatic transmission, pneumatic suspension and hydraulic brake system, the AAAB system can climb up to 50% gradient and move on 30% side slope. The system, different from the similar systems in the market, has an 8x8 drive system with a central tire inflation system.

The AAAB system has two water pump jets that provide the water operations and 360° movements in the water. The system can operate in water currents up to 2.5m/s.

As a ferry, the AAAB system can transport MLC 21 tracked vehicles. By deploying the ramps, which are carried



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by a hydraulic crane, and joining two systems, MLC70 T vehicle can be transported. By coupling three systems from ramp to ramp MLC100 W vehicle can be transported through a river. As well as the role as a ferry, 12 AAAB systems can be coupled and constructed as a 150m long bridge for crossing of vehicles up to MLC100 W.

For the safety issues, AAAB system has a self-recovery winch, an automatic fire suppression system, a fixed fire extinguishing system, portable fire extinguishers, and positive pressure NBC system.

As nationally designed and developed amphibious bridge system in Turkey, the AAAB system has some additional specifications among its kind. It can carry 4 ramps on a single system. AAAB system has also standard anchoring system



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(both emergency and land anchoring systems), ballistic protection, and easy fault detection with CAN system.



© FNSS

| AAAB        |                        |
|-------------|------------------------|
| Weight      | 36.000 kg              |
| Length      | 13 m                   |
| Width       | 3.5 m                  |
| Height      | 4.1 m                  |
| Crew        | 3                      |
| Engine      | 523 BG (390 Kw) Diesel |
| Max speed   | 50 km/h on road        |
| Gradient    | 50 %                   |
| Side Slope  | 30 %                   |
| Water Speed | 10 km/h                |
| Max range   | 600 km                 |



## Armoured Amphibious Combat Earthmover (AACE)

During the river passage operations to be performed by the Armed Forces, the riverbanks are not always available for the entry and exit of amphibious vehicles to/from the rivers or the available riverbanks can be disadvantageous for the military operations. Being flexible in the selection of amphibious operation area is critical for the increase of Armed Forces' mobility and operation capability.

In order for the amphibious vehicles having launched down to the water, the riverbanks (their slope, width, soil hardness, surface flatness and etc.) should be made available for the capabilities of different vehicles. There are standard military work machines used for this purpose but since they fail to float, their most disadvantageous aspect is not being able to make the opposite shore available similarly. For this reason, the transportation of these vehicles to the opposite side of the river is a must. The transportation requirement reduces the flexibility and success of the operation and at the same time affects the duration of mobility. Another restriction for the utilization of such standard work machines is that the need for another transporting vehicle in order for them to be transported to the mobility area. In order to eliminate such vulnerability, an amphibious vehicle was needed to ensure the availability of both shores for the river passage operations of Turkish Armed Forces and AACE project was developed for this reason. FNSS was the successful bidder in the tender opened as a local development model. Initiated on June 15th, 2009, the project covers the delivery of 12 AACE vehicles, its technical documentation and user manuals, spare parts and ancillary equipment/hardware within 42 months, which is deemed very short for the development of a military vehicle. Realized with fully local design and development, and with widely local production, FNSS' structural design, product technologies, resource technologies and hydraulic electronic system design capabilities were used in the design studies of AACE project. The modelling and simulation infrastructures of the universities were used and cooperation with universities and research centres was made.

AACE basically is an amphibious, armoured and a tracked fortification



work machine that can be used 1 operator and 1 crew. As a work machine, it is able to make shovelling, flattening, transporting and plowing activities.

As compared to standard work machines, AACE has the capability to take in ballast from the soil ground to its ballast canister when necessary and discharge it at the end of the operation. In standard work machines, the dozer blade is swinging while the vehicle is stable however in AACE it is fixed to the vehicle. With its superior hydraulic suspension system, the front side of AACE can be lifted down or up and by this way its blade or ballast canister can touch and access the ground. As a result, more efficient shovelling and plowing can be made. These activities can also be made while the vehicle is mobile.

AACE distinguishes from M9 ACE of BAE Systems, with its new technology and advanced technical features.

One of the most important features AACE has is that it is amphibious and has the capacity for 2 crews. Besides, AACE has modern electronic systems like day and night cameras, multi-function LCD monitor and air-condition. The hull of AACE was designed with aluminium material by taking into account its floating requirements. Its hydraulic, power and power transmission systems were equipped with modern equipment and tools and by this way the vehicle has higher manoeuvre capability and performance.

At AACE's power assembly, Allison full automatic transmission is coupled with Cat diesel engine. AACE can move 45 km/h speed at land and can reach the operation area together with other military vehicles without need for transportation. It can travel

in the flowing water with 360° high-manoevred capability through its 2 water jets.

AACE project is planned in three phases as design, prototype development and mass production. In design and prototype development phases, 14 wide range system and subsystem qualification tests were made with the detailed design of the product and one prototype vehicle developed.

The qualification tests were initiated with Mine Test which was performed in Konya Karapınar in 2011 and then with Ballistic Tests which were performed in internationally accredited laboratories. Through these tests, the endurance of AACE against land mines and armour-piercing ammunitions is proven. Later, the operational performance test took place and its shovelling, flattening, ballast carrying and plowing capabilities as a work machine were approved by SSM and Turkish Land Forces committee.

The EMI/EMC compatibility tests were applied under the supervision of TÜBİTAK for the first time to a land vehicle at an open terrain and AACE satisfied all EMI/EMC conditions that a land vehicle would meet. In June 2012, Water Performance tests were made for testing AACE's amphibious feature. AACE accomplished the operation in the water with 1,5/sec flow speed and its manoeuvre capability was approved.

Other qualification tests that AACE was subjected to are the Land Performance Test, Fuel Consumption Test, Cold Running Test and Cooling System Test. In the mass production phase, the production, acceptance and control tests of 12 AACE vehicles are planned to be completed until the end of 2012.



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| AACE   |   |
|--|---|
| Crew   | 2   |
| Combat Weight (Excluding ballast load) (tones) | Max. 20   |
| Suspension                                     | Hydraulic   |
| Maximum Speed (km/h)                           | Min. 40   |
| Trench Crossing Capability (cm)                | Min. 150  |
| Slope Gradeability (Ballast Loaded)            | Min. 60% (31°)  |
| Side-Slope Capability (Ballast Loaded)         | Min. 30% (16.7°)  |
| Vertical Barrier Crossing Capability (cm)      | Min. 40   |
| Range (km)                                     | Min. 400  |
| Working Temperature                            | (-32 C° to +49 C°)  |
| Smoke Grenade Launcher                         | Yes   |
| CBRN Equipment                                 | Positive Pressure Type  |
| Night Vision System                            | Thermal Camera  |
| Mine Protection (Crew Cabinet Floor)           | Yes   |
| Armour   | Yes   |
| Fire Extinguisher System                       | Fixed Extinguishing System for Engines and Portable Extinguishers |
| Crew Cabinet Equipment                         | Heating, cooling, air-conditioning                                |
| Rescue Hoist Capacity (kg)                     | 15.000  |
| Amphibious Usage                               | Yes   |
| Maximum Flow Speed (km/h) for Amphibious Usage | Min. 5.4 (1,5 m/sec)  |

## Battle Tank Transporter Vehicle and Semi Trailers

In 2009, an agreement was signed between HEMA Industry and Undersecretariat for Defence Industries for the production and procurement of 46 tank transporters including one prototype and trailers within the framework of the Turkish Land Forces Command's TTAR (Tank Transporter and Semi-Trailer) Project with a capacity of 70 tons designed to meet the Main Battle Tanks' transportation needs. These tanks and trailers should be produced with domestic resources. Following the design and production period that lasted for two years, the TTAR went through nearly 150 tests within 6 months. After the acceptance tests, 46 tank transporters and trailers were delivered to the Turkish Armed Forces in April 2012. TTAR shall

transport the following main battle tanks in the Land Forces inventory to the battlefields when needed: Altay Turkish Main Battle Tank standing first on the list, and M-60, Leopard 1A4, Leopard 2A4 NG.

The next generation TTARs having a payload of 70 tons can easily climb 30% uphill inclinations and transport a tank battalion from one end of Turkey to the other within 24 hours without any need for refueling.

Having 480 horsepower and 77-ton carrying capacity, the loaded weights of these vehicles is 115 tons. These Tank Transporter vehicles realized under the TTAR project are deemed as one of the fastest tank transporters manufactured up to now. These vehicles with a speed of 100 km/h under normal conditions will not exceed 65 km/h thanks to a special system. Moreover, breaking distance of the vehicle, when loaded, is than 8 meters from 35 to 0 km/h.

Having the climbing capability at 30% up-hill inclination thanks to special transmission, these vehicles are also able to move in 20% side slopes. The range of Tank Transport and Semi-Trailer is 1200 km in full load and without refueling. The Tank Transporter and Semi-Trailer is also capable of concurrently carrying 2 APCs (Armored Personnel Carrier).



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## Battle Tank Transporter

|                                |  |
|--------------------------------|--|
| Wheel Configuration            | 6x6                                    |
| Gradeability                   | 30 %                                   |
| Side Slope                     | 20 %                                   |
| Fording                        | 80 cm                                  |
| Turning Circle Radius          | 13.5 meter                             |
| Max. Range                     | 1200 km                                |
| Semi- Trailer Loading Capacity | 77.000 kg                              |
| Suspension                     | Hydraulics, adjustable platform height |



# Tank Modernization Programme

## Leopard 1 T Modernization Programme

Totally 397 Leopard 1 Main Battle Tanks take part in Land Forces Command's inventory. For the improvement of firing control systems of these tanks, a contract was signed between SSM and Aselsan for the indigenous design, development, integration and mass production of such firing control system. In 2006 the mass production phase was initiated and the project was completed upon the delivery of the last Leopard 1 T MBT tank to Land Forces Command in 2009.

Within the scope of Leopard 1 Modernization Project, which was the first tank modernization project realized through indigenous design and capabilities, totally 171 Leopard 1A1/A1A4 and Leopard 1A3T main battle tanks were modernized by Aselsan – 1st Main Maintenance Centre Command and the studies were initiated in order to enhance the current firing systems to third generation main



battle tank level through Volkan Firing Control System.

Through Volkan Firing Control System, Leopard 1 Main Battle Tanks gained the capabilities for target determination / recognition in day, night as well as severe weather and battle conditions in 3500 meters range as well as tank engagement and high accuracy in 2000-2500 meters

range and other armoured vehicles in 3000 meters range. Efficient hit capability from moving and stable tanks to moving and stable targets was achieved. Leopard 1 MBT was also equipped with additional armoured plaques within the modernization scope. Following the modernization studies, such tanks were classified as Leopard 1T.

## M-60T Modernization Programme

The modernization of 274 M60A1 Main Battle Tanks taking part in the inventory of Land Forces Command was decided in 2000 as per the requirements of the period and the contract of the modernization project covering 170 of them was signed between Israeli (IMI) company and SSM on March 29th, 2002. Following the contract negotiations, such negotiation contract entered into force on September 30th, 2002 and 170 M60A1 tanks were decided to be produced and assembled within the country through technology transfer. Within the scope of the project related with the transformation of M60 A1 tanks into M60 T tanks, 120mm 44mm calibre smooth-bore gun Main Armament and Ammunition integration was realized in MKE and Electronic Gun and Turret Drive System was produced in Aselsan under the supervision of Israeli Military Industries (IMI) as prime contractor. The prototype tank was produced by IMI Company as per the contract. The hull and turret modifications of the other 169 tanks were realized by 2nd



Main Maintenance Centre Command at modernization line in Kayseri. Initiated in 2002, the project was extended due to several technical problems and completed in 2010 upon the delivery of 170 tanks to Land Forces Command after an 8-year period.

The power capacity and suspension system of tanks were improved through the project and 1000BG MTU 881 engines and Renk 304 automatic power transmission structures were equipped on tanks as a results the

mobility of tanks was increased. Within the scope of modernization studies, the range of tanks and destruction capabilities were enhanced through 120 mm new guns as well as combat capabilities at night conditions were ensured though thermal vision systems. Besides, the current armour was further strengthened as per the project specifications and hybrid reactive armour plaques were mounted on hull and turret of M60 T tanks.



## Leopard 2 A4 Next Generation

Within the scope of the project covering the modernization of 298 Leopard 2A4 tanks taking part in the inventory of Land Forces Command, the Leopard 2A4 NG prototype was firstly unveiled at IDEF 2011.

This prototype configuration, named as Leopard 2 NG (Next Generation) is a state of the art upgrade solution, is far beyond any existing MBT, and shall meet all the requirements for any Leopard 2 midlife upgrades.

In the construction of this upgrade configuration, besides improving system performance, Aselsan's utmost priority was to present a tank with minimum Life Cycle Cost and Maximum Operational Availability. With a partial, patchwork upgrade approach such as replacement of some of the units/components of the existing systems, initial acquisition cost for a midlife upgrade might be lower. But if the Life Cycle Cost is considered, retaining the 20-30 years old systems should result a much higher overall Life Cycle Cost. May be worse than this, because of the obsolescence problems of the spare parts of the existing systems which will be faced in time, there will be a real threat on the operational availability of the MBTs.

So with the Leopard 2 NG upgrade configuration, Aselsan replaced all of the electronic, electro-optic, electro-mechanical and electro-hydraulic systems of the Leopard 2A4 MBTs with newly developed state of the art systems. This leads to increased performance and reduced Life Cycle Cost to incomparable levels to any Main Battle Tank has. Aselsan MBT systems are based on today's modern technology, so in the serial production phase, they will be the most up-to-date systems developed, tested and deployed on Leopard 2 MBTs. This will guaranty the utmost life cycle and the minimum Life Cycle Cost as possible.

Leopard 2 NG is equipped with Aselsan's Next Generation Fire Control System which is based on two independent periscopes - one for gunner and the other for commander - each can perform all tank fire control functions, and also can take over each other's fire control functions. Superior image quality electro-optical periscopes managed by the gunner and the commander provide both gunner and commander accurate target engagement in day, night and severe weather conditions. In case of a failure of one of two periscope systems, the tank shall be operational in the battlefield with full performance, a feature that is beyond the capability

of the current fire control systems. The fire control functions, ballistic calculations, stabilization algorithms and all other computations are performed by both Gunner's and Commander's Periscope's. Thanks to automated system functions and unique simplified user interface both for gunner and commander, training for Leopard 2 NG is further simplified significantly when compared to Leopard 2A4.

In order to eliminate the danger of a hydraulic fluid fire, achieve lower noise level with lower power consumption and lower heat generation and to improve reliability and attain lower maintenance, Leopard 2 NG is equipped with Electrical Gun Turret Drives. To obtain high hit probability on moving tank, gun/turret control and stabilization is achieved by the Gunner's and Commander's Periscope's through the electric drives.

Apart from the classical fire control systems, Next Generation FCS includes Inertial Navigation Sensor to achieve a very high First Shot Hit Probability in Moving Tank / Moving Target scenarios. Based on the extremely accurate automatic target tracking function, and target state estimation capability depending on the Inertial Navigation Sensor, this configuration has an extremely high hit





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probability against rotary wing aircrafts, either using Gunner's or Commander's Periscope.

A Battle field Management System (BMS) is also integrated in Leopard 2 NG to support the commander in situational awareness, collaborative planning, fast and precise decision making and to provide operational flexibility. Use of BMS shall ensure fast and accurate acquisition, exchange and use of the battlefield information, providing a clear and accurate representation of the commander. BMS allows tailoring of the situational representation to the needs of the commanders at each level of command providing support for planning, execution and after mission evaluation.

Leopard 2 NG is equipped with a Driver's Vision System (DVS) composed of a Forward Thermal Camera, Rear Thermal Camera and Rear CCD Camera. DVS provides the driver 24-hour manoeuvring capability under severe weather and harsh battlefield conditions, in addition gives Leopard 2 NG the ability to maintain continuous mission operations while providing a safe driving environment through enhanced situational awareness.

Leopard 2 NG is equipped with a Remotely Operated Stabilized Weapon Station (RWS) that enables the tank to defend itself against air and ground

attacks and also can be used in urban areas against asymmetric warfare. Depending on warfare requirements, 12.7 mm Heavy Machine Gun, 40mm Automatic Grenade Launcher or 7.62mm Light Machine Gun can be interchangeably installed. RWS is fully integrated with FCS and all the controls are accomplished by the commander by his own FCS user interface. In addition, the RWS can also be controlled by the loader using his own user interface and by RWS's own thermal sight.

Leopard 2 NG is also equipped with Laser Warning Receivers (LWR) for enhanced survivability. LWR is a state-of-the-art threat warning system to detect, classify, identify and give warning of laser threats (Laser Range Finders, Laser Designators and Laser Beam Riders) aiming on the platform, and immediately enable the smoke launcher system to mask the MBT by smoke from the hostile force. LWR is closely integrated to the FCS, so that the commander and/or gunner periscopes together with the main/secondary weapon shall automatically slew to the threat direction detected by the LWR, and enable the gunner and/or commander to immediately engage on the hostile force.

Furthermore, to provide the demanded survivability of today's battlefield, Leopard 2 NG's ballistic

protection is increased with add-on armour modules with a combination of several systems providing protection against different threats. The enhanced protection is provided by turret and hull add-on modules, roof protection, heavy track skirts, SLAT armour and the spall liner. Ceramic faced armour modules including composites and light alloys enable the protection system to absorb and minimize the impact effect of attacking today's projectiles such as KEs, ATGMs and RPGs. With turret and hull inside liner, the potential spall effects are drastically reduced, and with roof protection the protection against bomblet threats is improved. Hull belly protection modules as well as the hull inside structural modifications and suspended driver seat protects tank crew against light and heavy mines, while IED protection provides protection against different IEDs. Moreover, in order to increase survivability, Leopard 2 NG is equipped with a halon-free fire suppression and extinguishing system for crew compartment.

With improved protection, the weight of Leopard 2 NG is still kept within ML 70 level by using advanced materials, and the original stopping distance after the weight increase is also retained by transmission brake upgrade.



# **Changing Enviroments, Changing Threats, Changing Strategies Armoured Land Vehicles and Turkey**

An Assessment by Anil Karel, Deputy General Manager of Nurol Makina



We have just turned the corner of the first decade of 21st century. Several political, social and economic events have occurred during this period. Also, increasing threats to security environment have been observed in this decade. Armed conflicts, terrorist incidents, piracy, reformist protests were and are still being encountered on a daily basis. While political structure become as diversified, threats to security of sovereign nations and ethnic based focuses on land gains are made up asymmetrical conflicts which involves ideological terrorism. The asymmetric conflicts are largely based on ambiguity of the globalization and technical/economical unbalances, which started with the removal of borders and absence of counter balancing forces by the end of the cold war. As a result of the asymmetric conflicts, battlefields started to have different dimensions and turned into complex synthetic environments.

Today, military battlefield is defined as multi-dimensional, more complex, more dynamic and ambiguous. Military tactical area is more complex as a result of changing power balances. Threats are changing and increasing day by day. In the past, conventional weapons and armoured vehicles were used in the battlefield, but today, terrorist identity has taken its place. Asymmetric warfare techniques are mostly used by terrorist groups against regular armies, especially in the irregular geographic areas and urban sites. In today's world, terrorists use new technologies and that's why new technological defence systems are required for peace keeping.

There are instable, hot regional spots of the world: Middle East, Southern and Central Asia, Southern America, North Africa. It is reported that lots of major armed conflicts were active in mentioned regions. Syria, Egypt, Korea, Israel, Iran, Iraq, India, Pakistan, Libya, Sudan, China, Russia, Ethiopia, Venezuela, Thailand are some of these major countries. Also terrorism is an important problem in some regions. Unfortunately our country is amongst these regions. The Arab revolution, also known as the "Arab Spring" is one of the driving important hot spot problems of the world. Arab Spring and its effects are still continuing.

Also, some countries play an important role to sustain the peace and balance of the regions. Turkey, in Middle East, Central Asia and also

North Africa, is one of these countries. However the level of threats against this kind of countries is very high and they have internal terror problems. On one hand they are trying to sustain the peace and stability in their regions, on the other hand they are trying to keep their internal stability in balance.

Military specialists emphasize the 5th generation war of the future. In the future, the ambiguity will increase and most probably we will live in the more chaotic environment.

More technological, unmanned, centrally operated defence systems will be designed for the future. New technologies such as biotechnology and nanotechnology will take place in the 5th generation wars. The symptoms of biological war became apparent. Increase in chemical and biological threat areas highlighted the importance of controlled studies and regime control parameters on these items since the terrorists are interested in using these agents. Generic combination of CBRN infected environments require is a big threat upon civilian & military persons for their survival. Also cyber wars, cyber attacks on Estonia and Russian-Georgian Cyber wars have occurred in the past. These are the indications of change of the actors and battlefields. In the next term, beside the conflicts, individual or organized physical and cyber-attacks can be conducted on critical information infrastructures.

It is obvious that the transition process is on-going today. The risk of conflicts among the developed countries is very low however it does not mean that the conflicts should not be realized. Political and economic balance of the world is changing day by day, new relationships and agreements are considered between nations. If the power balance changes significantly on behalf of one party, unwelcomed domination event can happen. Also potential risks of asymmetric threats around the world are being maintained by ethnic, religious states or non-state adversaries. Besides, the internal conflicts should be considered as a particular problem which long lasts and difficult to terminate. Thus, the states place great importance to keep their defence power at the maximum level while the studies on the new military concepts and technologies against changing threats increase.

The transition process can be defined among new threats and conventional wars. During this transition term, new platforms and

systems are taking their places in armies and/or security agencies. Changing threats and operational requirements of this term define the technical specifications of armoured vehicles. However, due to the financial crisis, the procurement budgets are tight and that's why modernization of conventional systems seem keeping their importance as well. For this reason, the modernization programs are carried out and upgraded platforms are presented to users.

### **Changing Environments-Changing Threats-Changing Strategies**

Terror keeps its place over the world as asymmetric war besides international conflicts. Thus threats against armoured vehicles are changing according to regions. Suicide bombers, snipers, KE ammunitions are most known terrorist threats. But as mentioned above, threats are changing with the changing world. Especially, around our region mines and improvised explosive devices are the biggest threats. Anti-tank rockets, anti-tank guided missiles are used by terrorist groups as major threats. Also, mortars and short ranges ballistic missiles are used in some conflict regions.

Change of threats affects the national and international security strategies and strategies are being changed accordingly. Without strategy, technical solution is nothing. Thus, the requirements of armoured vehicles are changing. But such change is not only related with the vehicle specifications, change of infrastructure is another important requirement. Today, the improved protection, mobility and compatibility with other systems are some attributes to improve the fighting ability of armies and security capability of security agencies. Compatibility, in the scope of network centric operations requires improved network infrastructure to enable effective command control capability.

It is obvious that new strategies and technical solutions are required against recent threats. Active/passive armour systems are important to improve protection capability. Protection level should be optimized with mobility according to operational requirements. Protection requirements for internal security are not at the same level with the combat vehicles. But in some cases, upgraded protection level, which includes additional or slat

armour solution, is required by security departments to meet new operational requirements. Also protection is required against improvised explosive devices. Actually armoured protection is not enough by itself. That's why protection can be redefined as survivability. Enhanced situational awareness, electronic devices, fire/explosion detection/suppression systems, electronic and electro-optical countermeasure systems, sensors, signature management techniques are included in survivability.

Mobility is another key attribute. High mobility wheeled platforms are used for the purpose of security. It is related with the weight so protection has a significant effect on the mobility. Protection affects the speed and cross-country mobility. Proper power systems, suspension systems, wheels etc. should be chosen for the operational mobility. Also there are other parameters like cursing range, pay load capability, deployment in the scope of mobility. Of course mobility characteristics are important for the firing capability. Mobility can be enhanced by changing the suspension system to provide not only better ride but also more stable gun platform.

Fire power or lethality is the third key attribute especially for the combat vehicles. For internal security, light weapon stations are required but for heavy armoured vehicles heavy weapons are important for fire power. Remote controlled weapons are important to enable personnel protection. Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) is an indispensable requirement of new armoured vehicles to provide shared awareness to increase operational effectiveness on networked communications technology. It provides superior decision making and coordination of complex operations over long distances if suitable network infrastructure exists.

Reduced logistic budgets and life cycle costs are important. That's why cost effective solutions, reduced system acquisition, sustained costs become as decisive for the procurement of armoured vehicles.

Change of threat will continue and lightweight, hybrid vehicles will be potential solutions in the future, unmanned vehicles will be used for critical operations and to sustain security.



### Armored Vehicles And Turkey

The technological status of land vehicles is summarized above.

There are two main envisages/sights for Turkey; Turkey should be powerful to keep its role to sustain the peace and balance in the region as well as keep internal security. It means, making investments will be a need to sustain existing military and security capabilities. It requires new political and operational strategies and procurement of new systems. The Undersecretariat for Defence Industries (SSM) is the procurement agency for Turkish Armed Forces (TAF). SSM is authorized to perform some procurement for Turkish National Police (TNP) too. SSM has evaluated its responsibilities and established industrialization and procurement policy for the Turkish defence industry.

These can be highlighted as; client-specific solution generation, development of product portfolio, international cooperation, R&D activities, sub-industry involvement, capability integration, focusing to basic scope, institutional productivity and professional human resource. Companies in this sector in one hand must consider expanding to overseas in their strategic plans while keeping their struggle on satisfying requirements of TAF.

Apparently, sectorial endeavour needs taking a step for making concerted efforts and joint actions regarding developing and conducting new technologies, specialization in certain domains and developing new projects. To this end, active participation of user representatives from both TAF and TNP especially during design activities while SSM is conducting planned programs, will enhance the studies and value the fruitfulness of these struggles. The technology development data bank that Universities accumulated and mastered is needed to be considered during the studies.

There are responsibilities for industry and other official agencies. SSM policy needs to be supported by both official agencies and industry. Especially procurement of vehicles, technological and critical systems for Ministry of Defence and Ministry of Internal Affairs, out of supplies, should be performed by SSM.

Turkish companies such as Nurol Makine Sanayi (NMS), FNSS and others have capabilities to design, produce and test different kinds of land vehicles according to different requirements. That's why the technical and operational solutions should be created together with Turkish companies for the procurement programs. Requirements



should be shared in a timely manner in order to have enough breath to survive in designing and producing the system.

We cannot reckon without allies that we are in and global developments while under-lining new strategies for future considerations. Turkey has its own systems being added / planned to be added in its defence inventory. It has choice-worthy appreciation for former endeavours and driven methods regarding these systems for analysing and making right decisions. Turkish Defence Industry, one example of which is NMS has very valuable accumulation on this regard. It is possible to design and take into inventory new systems as per our own strategies. Regarding geographical situation of our country and regional developments, it is also possible to support our policies with our individual designs. Looking from this perspective, it is to be considered to include genuine armoured vehicles and in the near future unmanned vehicles in TAF and TNP inventory. Regarding "Network Centric Operations", armoured vehicles that can be integrated to this network are considered to take place as well. In this context, within a transition process to be generated, a new type of vehicle family must be identified that manned/unmanned armoured and support vehicles take part in. In order to meet this requirement, under the lead of a prime contractor, a program to include all companies taking part in land vehicle sector can be planned and achieved.

Each individual and enterprise in this sector need to be aware of its own responsibilities and conduct good service in order to carry our country forward in the world and to be a more powerful country. Remembering the word "unity is strength", all intuitions, establishments and enterprises in this sector need to make great efforts for the elimination of foreign dependency and satisfaction of the requirements of TAF, which is one of the most leading armies of the world in terms of developing national defence industry.

In modern Army Forces, the programs regarding land combat vehicles have been maintained. Taking into account the programs being driven in our country, the disposition and preparations towards future concerns have been obviously planned. This can be speculated as Transition Period. Transition Period makes it necessary to conduct new concepts, place new



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systems to inventory, integrate some of old systems by modernizing with new ones while old ones removed, provide interoperability, train personnel due to new system requirements etc.

The subjects need to be taken into account emerge during this Transition Period. One of the most prominent topics is the planning of how current systems and the systems that procurement processes are still on the way be integrated with the concepts and systems that TAF will require in the future. There emerges a detailed planning requirement between today and the date that new generation land combat vehicles planned to be taken into inventory in the future. The question "what kind of policy will be followed till the procurement time of future new generation combat systems" is highly noticeable and important for SSM, the procurement authority, and all intuitions, establishments and enterprises in this sector, as well as TAF. On this account, technical and operational specifications of vehicles anticipated to be in inventory in the future need to be identified today.

In this process the studies covering minimal requirements regarding the left service life of vehicles in TAF/ TNP inventory need to be put forth. Interoperability, compatibility, and

system integration requirements between new systems and old ones being taken out of inventory is to be considered as well.

Turkish Army is one of the biggest armies of the world; also Turkish Police has important experience and capability. Vehicles and systems used by TAF and TNP have substantial reference for the world market. This advantage highly deserves consideration and must be evaluated.

When looked at armoured vehicle sector and relevant world market, it is obviously seen generic high volume potential for our country. This potential must be evaluated together with companies, R&D organizations and governmental institutions. NMS in each step it makes, targets adding value to our country. NMS anticipates this target to be shared by other companies and also desire to exhibit a powerful picture for constructive competition in global markets for a better and wealth future.

The most relevant and important issue that we need not to forget is, each step being made forward in defence industry will be a milestone in the future of our country. The stronger we set the bricks, the safer we may look forward to future horizons.



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# HEMA to Unveil its Long Awaited Armoured Vehicles at Idef 2013

In defence sector, HEMA has just announced that armoured vehicles are ready for the use of Army. These last generation armoured vehicles are produced in HEMA's Cerkezkoy facilities.

Mainly; the most parts of the

vehicles (steering, brake, suspension and hydraulic systems, and axle parts, as well as the armoured body work, etc.) are done by HEMA and the rest of some parts of the vehicles are produced by the local companies. Also, final integration of the vehicles

and tests will be accomplished by HEMA.

These vehicles are customer tailored and have open architecture structure which can be done modifications as customer needs.

## Mine Resistant & Ambushed Protected (MRAP) Personnel Carrier,

HEMA has developed the last generation MRAPs in his Cerkezkoy facilities. As you remember, HEMA was selected as 2<sup>nd</sup> contributor in SSM tender at 2009. HEMA's MRAP can operate in challenging rural, mountains and urban terrains. This vehicle can be configured for Command and Control, EOD, Patrol, Convoy Support, Forward Observation, Reconnaissance, Med-Evac missions, and etc.



HEMA MRAP

|                    |  |
|--------------------|--|
| Length             | 6.8 m                                      |
| Width              | 2.4 m                                      |
| Height             | 3 m  |
| Crew               | 10+3                                       |
| Engine             | 400 Hp @ 2100 RPM 296 Hp @ 2500 RPM        |
| Wheel Base         | 3,775 mm                                   |
| Fuel Tank Capacity | 610 Liter                                  |
| Protection Levels  | Ballistic: STANAG-4569 Level-III           |
| Mine               | STANAG-4569 Level-3a,3b                    |
| Payload Capacity   | 3 tons (est) (depends on protection level) |

## 4x4 Gun Carrier Armored Vehicle,

This new generation 4x4 Gun Carrier Armored Vehicle has also developed

in HEMA's Cerkezkoy facilities and be used with many purposes. General

specification of HEMA's 4x4 Gun Carrier Armored Vehicle is;



HEMA 4x4

|                     |   |
|---------------------|---|
| Length:             | 5,7m  |
| Width:              | 2,4 m   |
| Height:             | 2,3 m   |
| Wheel base:         | 3,595 mm  |
| Seats:              | 5-11 persons  |
| Engine Output:      | 300 Hp @ 2500 RPM   |
| Fuel Tank Capacity: | 200 Liter   |
| Protection Levels:  | Ballistic: STANAG-4569 Level-4,                                 |
| Mine:               | STANAG-4569 Level-3a, 2b  |
| Options:            | Amphibious capability, NBC Protection, CTIS, Run-Flat, and etc. |



## 6x6 Special Purpose Tactical Wheeled Armored Vehicles (SPTWAV)

Design criteria of HEMA's SPTWAV is easy to use, operation capability of the hard environment and personnel safety. This vehicle can be configured as; Command and Control, Reconnaissance, NBC, Support, Radar Vehicles, and etc. General specification of HEMA's 6x6 SPTWAV is;



| SPTWAV            |  |
|-------------------|--|
| Length            | 6,4m   |
| Width             | 2,5m   |
| Height            | 2,3m   |
| Wheel base        | 3,595mm  |
| Seats             | 5-13 persons   |
| Max Speed         | 120 km/h   |
| Max Range         | 700 km   |
| Protection Levels | STANAG-4569 Level-4 (up to)                                    |
| Ballistic         |  |
| Mine              | STANAG-4569 Level-3a,3b  |
| Options           | Amphibious capability, NBC Protection, CTIS, Run-Flat and etc. |

## PRODUCTION OF POWER-PACK

None of the power-packs of armoured vehicles used or produced in Turkey are domestic. Therefore it is obligatory to obtain permission from the countries of the power-pack producers before selling or using these vehicles that we name national. The domestic vehicles produced in Turkey lack domestic engines and transmissions, although the HEMA Group has invested greatly in the power-pack production field and it exported 110 thousand engines merely in 2011. Moreover, most parts of these exported engines are manufactured in

HEMA with domestic resources. HEMA proposed an offer to Undersecretariat for Defence Industries for the production of a National Power-pack composed of a 1700 BG Engine and Transmission for the aforementioned Altay tanks. The engine group that HEMA shall produce within the scope of this project consists of 3 separate groups of 500-850HP, 1000HP and 1500-2000HP for the time being. These power-packs are being designed for a variety of purposes including use of land and naval vehicles. Altay Tank and all armoured vehicles shall be



fully indigenous when the power-pack (engine and transmission) is produced domestically.

# Globika by Global Teknik

In order to contribute to national R&D activities by conducting day and night time surveillance and reconnaissance at strategic installations; pursuing a course; supporting border troops and by undertaking patrol and surveillance missions in areas that carry risk to human health and regions that are susceptible to nuclear and chemical hazards, Globika, - a robot platform that can operate manually or autonomously - with the aim of carrying out a deterrent role and coupled with the addition of mounted weapon systems, supports the development of unmanned airborne vehicles. Globika can also be remote controlled and launched from command centers reaching target points independently and, in addition, it can transfer images to these centers received by means of mounted stationary and rotating

cameras.

In the design stage of Globika, advanced technology computer programs were used and the composite manufacturing method was preferred in the manufacture of the body. Additionally, with its electric motors, Globika has environment-friendly credentials.



| Globika           |  |
|-------------------|--|
| LENGTH            | 2 m  |
| WIDTH             | 0.95m  |
| HEIGHT            | 1.2m   |
| WEIGHT            | 250 kg   |
| SPEED             | 30 Km/h  |
| RANGE             | 120 Km   |
| MISSION DURATION  | 8 hours  |
| PROPULSION SYSTEM | DC Electric Motor  |
| CONTROL SYSTEM    | Autonomous, Manual and Training Modes  |
| IMAGE TRANSFER    | Real time (2 stationary 1 pan/tilt/zoom camera)  |
| AUTOPILOT         | GPS Supported  |
| PAYLOAD           | Radar, night vision systems, 360° panoramic camera, (EO/IR) sensors. CCTV laser range finder, FLIR |



# T129 ATAK

## Advanced Attack and Tactical Reconnaissance Helicopter

T129 has been selected in 2007 by the Government of Turkey for the Turkish Land Forces' Tactical Reconnaissance and Attack Helicopter (ATAK) Program. ATAK Contract was signed on 7 September 2007 and became effective on 22 June 2008.

TAI is the Prime Contractor where AgustaWestland and Aselsan are the major Subcontractors for the ATAK. First T129 was scheduled to be delivered in 60 months and Program to be completed in 114 months. TAI and AgustaWestland have joint intellectual rights for all T129 configurations.

An "Early Delivery" version (designated as T129A) was introduced in 2010 and 9 helicopters were contracted with the start of deliveries in Q4 2012, 15 months earlier than the original schedule. T129A weapon systems will be limited to a 20mm machine gun (aimed via a helmet mounted sight) and 70 mm unguided rockets.

The maiden flight of the first prototype took place in Cascina-Costa, Italy on 28 September, 2009. The first TAI manufactured prototype "P6", took-off from Akıncı Facilities on August 17, 2011. Six prototypes are being employed in the Qualification

Campaign, 3 in Turkey and 3 in Italy.

T129, the latest evolution of the A129 platform, developed from the combat proven A129CBT (in service within the Italian Army since 2002), incorporates totally new system philosophy with new avionics hardware and weapon systems, new generation engine (LHTEC CTS 800-4A), new power transmission, tail rotor and several fuselage modifications.

T129, having the best power to weight ratio in its class, is a very stable platform, with excellent performance for "high and hot" conditions, 3 hours endurance, long range and all-weather day and night operations, asymmetrical weapon loading, low visual, aural and radar signature. High level of crashworthiness and ballistic tolerance enables T129 helicopter an excellent multi-role, operational capability in the most hostile of battlefield environments. The relatively small radar cross section and state of the art systems counter measure systems help to provide high battlefield survivability, low visual, aural, radar and IR signatures.

A five bladed rotor system, wheeled landing gear, and powerful advanced technology engines are

major characteristics of the T129. New avionics package provided by Aselsan includes digital cockpit architecture, mission computers and advanced flight and fire control systems. A new FLIR system increases image quality and range performance with real-time image processing and multiple target tracking with high resolution thermal camera, laser range finder, designator and spot tracker.

T129 cockpit provides an excellent situational awareness through good visibility arcs and fully integrated mission and communication systems with an avionics architecture incorporating dual aircraft central control computers and new MFD pages for both crew members. With the assistance of identical capability function for both pilots, targeting system enables crew members to use all weapons effectively according to missions.

T129B (first to be delivered in Q3 2013) could be configured with Umtas (LORAT) ATGMs, and Cirit (70 mm. Guided Rockets) designed for Turkish Armed Forces. Further armament options include Hellfire and Spike ATGMs, Stinger A/A missiles.



# YDS : A Global Brand Preferred by World's Leading Armies

Yakupoğlu AŞ (YDS), a leading company boot manufacturer, has reached a position where its turnover exceeds \$120million USD, achieved through producing 4million pairs of boots yearly and export to over 40 different countries, thus placing them in a position of being Europe's and the Middle East's largest manufacturer.

## YDS recently Signed a Contract with British Defence Ministry

YDS has won a large military boot tender held by the British Defense Ministry. YDS beat 46 other companies for the \$80 million contract to supply the British military, and will now produce 300,000 pairs of boots for British soldiers in four years, according to the terms of the tender. In the first phase of the tender, 33 firms were eliminated, taking into account factors such as capacity, production ability, Research and Development (R&D) ability, financial power, and supply chain power. Of the 14 remaining bidders, companies were forced to provide samples of boots that could withstand cold weather conditions, desert and other rugged outdoor terrain. These boots were tested over a two-year period in countries like Colombia, Norway, and Afghanistan for wear and tear. YDS's boots proved the most successful and thus beat the competitors. YDS is a leading supplier of boots, assault vests and bags to armies across the world. Israeli soldiers are among those who use Yakupoğlu garments, with a company executive saying last year that the tensions between Israel and Turkey did not affect the business. YDS Chairman Vedat Yakupoğlu told Anatolia news agency that he was proud that British soldiers stationed in many parts of the world would be wearing Turkish-made boots. Yakupoğlu said the YDS had prepared for two years for the tender. Firm passes tests "After taxing and rigorous preparation, we won the world's largest military boot tender in terms of turnover and achieved the right to supply the British military," he said. "The British preferred our boots not because they were cheaper, but because they were a higher quality and were produced with the latest



technology. During the tender process they took hundreds of boot samples from companies around the world and tested them under different climatic conditions." Yakupoğlu said. Yakupoğlu said YDS had worked with the Middle East Technical Institute (ODTU) to design quality boots. "The technology we use is only available to a limited number of firms around the world. Our technology, quality, prices and speed were the factors that led to us winning the tender. Soon we will begin delivery. We already service other militaries in Europe, but this is different since it is the largest tender," he said. According to Yakupoğlu, YDS currently controls 10 percent of the European boot market, and plans to increase this to one-third of the market within five years. The company produces 4 million boots per year and exports to over 25 global militaries, including those of Oman, Afghanistan, Chile, and Kazakhstan. YDS also manufactures police boots, motorcycle boots and worker boots.

## A leader in DDR Soling Technology

YDS is the leading producer of Dual Density Rubber (DDR) injected soles in the world. This is a special formula of rubber compound which is injected in two densities to the uppers; a tough rubber outer skin and a lower density midsole where air is injected into the rubber to create a lightweight shock absorbing cushioned bed for the foot. This technology is important for those working and existing in harsh

conditions where a highly durable but comfortable solution is required, so is an enormous advantage in footwear.

The boots, which are produced with DDR® Soling Technology, have 60% better shock absorbing thanks to sponge-like midsole. It improves the walking distance and minimizes the injury risk of jumping and running. DDR® Soling Technology offers 30% lighter soles and 260% better insulation which keeps the foot cool in summer and warm in winter. It provides flexibility and comfort for the wearer with its sponge-like mid-layer, as well as flexibility of any sport like footwear.

Utilising its 100,000m2 production area, of which 60,000m2 is closed; YDS have focused heavily on developing its use of latest technologies funded through a \$20million USD investment, and as a result allowing them to manufacture 400 technical tents and 15,000 footwear a day. It employs 1600 blue collar workers, and over 30 white collar professionals in its modern facility furnished with wide variety of high technology machinery and equipments. YDS is the supplier of

Turkish Armed Forces, Turkish General Directorate of Security, UNICEF, Turkish Red Crescent, and Red Cross



# Solution for Performance Increase and Lifetime Enhancement of Altay Tank Electronic, Electro-Optic Systems and Leopard 2A4

Despite all frequent discussions in recent years, the main battle tanks shall continue their “modern armoured knight” tasks by remaining 40-50 years more in the inventories of the armed forces. Especially the gulf wars and NATO operations being conducted in Afghanistan have proven once more the vitality and prerequisite of such tanks in open terrain. In view of this, many countries have recently been in search of the capacity / capability increase of the tanks taking part in the inventories of their armed forces. For example, the American main battle tanks together with Canadian main battle tanks served in the region during Afghanistan operations occurred short while ago. As per the operations realized in 2006, the main battle tanks were once more evaluated as indispensable under actual conflict conditions and Canada initiated studies to procure newer main battle tanks for its armed forces’ inventory after 2007, though it had previously decided to make reduction in its tank inventory. On the contrary of the expectations, the main battle tank’s field of use has also become prevalent recently. The main battle tanks were initiated to be used at asymmetric conflict environment, which is the major tactical approach of international peace tasks. The operations realized by UN and NATO troops in the Balkan States can be shown as an example on this. In addition, the operations of Western countries in the Middle East are the other example where main battle tanks are used in urban operations.

The modernization of M60 and Leopard 1 tanks taking part in the inventory of our country was successfully realized during the last decade. Participating successfully in both modernization programmes, Aselsan has developed all main Electronic, Electro-Optic and Electro-Mechanical Sub-Systems of Altay tank through the experience gained in such studies and the integration of these systems with Altay tank’s first



prototype has been performed. The maximum performance as well as minimum logistic costs and maximum operational availability have been taken as the major design criteria in the development of such sub-systems. The testing of all these sub-systems developed to make Altay’s performance over the rest of the tanks in the world was initiated 1,5 years ago by integrating them on a Leopard 2A4 tank before the integration with the first prototype of Altay tank.

Prototype Leopard 2A4 tank has been tested with firing for 1 year under

all seasonal and challenging conditions together with TAF personnel and the results obtained show that the battle performance of such Leopard 2A4 configuration, which has the identical sub-systems of Altay tank, shall be of higher levels. Another critical factor besides performance is that this tank shall be able to use the same training and logistic infrastructure of Altay tank. This approach shall not only reduce significantly the training and logistic costs of TAF, but also increase the efficiency.

Leopard 2A4 tanks, the production





of which was launched in 1970's, have been intensively used in the inventories of especially European countries. They involved superior analogue electronic technology of those times and their performance was more than satisfactory. Even if they met the requirements for a long time, today they fall behind due to their analogue technology with obsolete units and materials and fail to satisfy the changing and new requirements. Thus, at the end of 1990's, some of Leopard 2A4 tanks were upgraded to Leopard 2A5 level in order to satisfy the changing requirements as well as improve the performance of such tanks. The outstanding aspects of this modernization are putting on thermal image capability to the existing commander's periscope, reaching at superior performance by using electrical power units instead of hydraulic drivers for routing turret and gun and improving the protection of tank's front part for tank-to-tank battle environment. Even if the Leopard 2A5 has some new technologies, the electronic and electro-optic systems, which are mainly the same with Leopard 2A4, still fall behind the recent technology. Besides, some other problems are encountered such as the discontinuation of spare parts of at least 30-year-age electronic and electro-optic systems, thus it creates weaknesses in the operational availability of such tanks.

Aselsan has improved the performance of Leopard 2A4 through the systems developed for Altay tank and as a result has provided an exact solution alternative to increasing logistic costs of Leopard 2 user countries. By this "Performance and Life Cycle Improvement Package", not only the life-time maintenance costs of Leopard 2A4 tanks, which are planned to be kept by TAF in the inventory for at least 20 years, would be reduced,

but also their performances would be upgraded to 3+ generation. As a result, the acquisitions acquired by Altay project shall be carried further and Leopard 2A4 tanks, which are equipped with the same systems of Altay tanks, would also be a significant force multiplier together with Altay tanks to take part in the inventory in upcoming years.

### **Leopard 2A4 Performance and Life Cycle Improvement Package**

**Next Generation Firing Control System** comprises of two independent periscopes - one for gunner and the other for commander - and each can perform all tank fire control functions as well as take over each other's fire control functions. Through the superior image quality, the electro-optical periscopes managed by the gunner and the commander provide both gunner and commander accurate target engagement in day, night and severe weather conditions. In case of a failure in one of the two periscope systems, the tank shall be operational in the battlefield with full performance, a feature that is beyond the capability of the current fire control systems. The fire control functions, ballistic calculations, stabilization algorithms and all other computations are performed by both Gunner's and Commander's Periscopes. Apart from the classical fire control systems, it includes Inertial Navigation Sensor to achieve a very high First Shot Hit Probability in Moving Tank / Moving Target scenarios. Based on the extremely accurate automatic target tracking function and target state estimation capability depending on the Inertial Navigation Sensor, this configuration has an extremely high hit probability against rotary wing aircrafts, either using Gunner's or Commander's Periscope.

### **Electrical Gun Turret Drives**

provide sensitive stabilization and high First Shot Hit Probability to main weapon of the tank by operating in integration with Next Generation Firing Control System. Besides, it improves the survivability of the tank and significantly reduces maintenance and life cycle costs since there is no need for calibration or adjustment.

**Tank Command Control & Communication System (TCCCS)** provides situational awareness to troop taskforce components as well as helps single-point planning and rapid and sensitive decision making, thus it provides operational flexibility within this context. TCCCS, together with Internal Communication System and Radios taking part in system architecture, enables to gather and exchange rapid, clear and sensitive information regarding the battlefield for all components from troop level to single tank level.

**Tank Driver's Vision System (TDVS)** includes front and rear thermal and day cameras and provides the driver superior visibility at day and night and under severe weather conditions.

**Remote Controlled Weapon System (RCWS)** provides the self-protection of tanks against aerial and ground threats and can be used at urbanized terrain under asymmetric conflict environment at the same time. Based on the requirements, RCWS can be used with 12.7 mm heavy machine gun, 7.62 mm machine gun or 40 mm grenade launcher and it can operate in full integration with Next generation Firing Control System. All the controls can be accomplished by the commander by his own firing control system user interface and in addition, the RCWS can also be controlled by the loader using his own user interface and by RCWS's own sight optics.

**Tank Laser Warning System (TLWS)** is the state-of-the art threat warning system to detect, classify, identify and give warning of laser threats (Laser Range Finders, Laser Designators and Laser Beam Riders) aiming on the platform and immediately enable the smoke launcher system to mask the tank by smoke against the hostile forces. TLWS operates in full integration with firing control system and RCWS so that the commander and/or gunner periscopes together with the main/secondary weapon shall automatically slew to the threat direction detected by the TLWS and enable the gunner and/or commander to immediately engage on the hostile.



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# Land Forces and Havelan

Different types of Command and Control Systems at different levels are developed for the functional areas within the Turkish Armed Forces. For efficient utilisation of these systems besides their current capabilities, they inevitably exchange information with other systems. This will only be possible by bringing these systems, developed at different areas, for different requirements and by using different technologies, into a common understanding and language. From this point of view, the Turkish Land Forces



Command has decided to participate in MIP (Multilateral Interoperability Programme) community, which is supported by NATO also. Havelan has been participating in MIP working groups together with the technical personnel of Turkish Land Forces Command since 2001.

MIP defines a Generic Hub named JC3IEDM (Joint Consultation, Command and Control Information Exchange Data Model) to ensure international interoperability, as well as DEM (Data Exchange Mechanism) standards to provide information exchange between systems. The solution provided by MIP has been adopted and implemented for Turkish Land Forces Command to be as a base not only for the international interoperability but also for the national systems integration. Within this scope, the products of KKBDVM (Land Forces Information Exchange Data Model) and VDM (Data Exchange Mechanism) have been developed by Havelan. KKBDVM is a relational data model and provides a common taxonomy for all systems by defining all battle-space objects that can be a part of an operation. VDM is an



application developed according to MIP standards to provide information exchange amongst data repositories derived from KKBDVM. Through this application, data exchange is achieved from force level to troop level according to need-to-know principle.

The structuring of systems on logical



concepts and data structures provided by joint data model may be an ideal case for the new developed systems; however it is not always the most appropriate solution in terms of cost and technical issues when considering the legacy systems. For this reason, the development of service oriented solutions for the integration of legacy systems is inevitable. Considering the current capabilities of the systems, the

integration of two legacy systems over CORBA services has been successfully realized. Following this phase, which is considered as the first step, the works on the development of web services to include all possible information exchange requirements are on-going.

The specified products have been used successfully in national and international tests and exercises. We aim to enhance and improve our products by reflecting our experiences on system integration with the recent technological developments. In line with this aim, studies have been initiated for development of a new C2IS, Defence Out Of a Box (DOOB), to be used by armed forces for their core battle and resource management activities.

Below topics shall be dealt with DOOB:

- Operational Planning and Management
- Material and Asset Management
- Order of Battle
- Common Operational Picture

The users will be able to fulfil basic command and control activities in national and international environments without any integration concerns by using DOOB. By means of the provided framework joint operations can be easily performed via MIP compatible systems also.

DOOB will be more user-friendly, expandable, easily manageable and high performance than the existing products in the market. We aim that the user having basic computer literacy is able to use the application without long-term training. DOOB will be ready to be released to the market at the end of 2012.







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# Radar and Electronic Warfare in Land Platforms

Serhat Erdemir

Aselsan

Radar EW Programs Manager

In looking at the historical past of the formation and change of the organizational structure of military doctrines, strategies and powers, it can be seen that certain technological, political and social developments have played an effective role. The French Revolution in 1789 and the Industrial Revolution that took place in the mid-19th century can be given as examples of these types of events. The last example in this area took place as of the beginning of the 1970s with the big leap taking place in technology.

In considering military operations in recent times, the key factors that determine the results is the rapid and correct compiling of information from the combat area, analyzing this information, transferring the analysis results to relevant elements and knowing that the other side has the capability to obstruct access to this information. For these reasons, we can state that a complete information war is being waged at the present time. In order to obtain an edge in the information war on the battleground, not only is the use of correct information regarding the opposing side at the right time, at the right place and with the right resources are important, but also preventing access to information on friendly elements by the opposing side is important as well.

Obstructing access to information can be the complete elimination of relevant systems, stopping operations for a particular time or providing disinformation (deception). In this sense, the capability of Electronic Warfare (EW) comes to the forefront, for the function of gathering information and dissemination (transfer) takes place by utilizing the electromagnetic spectrum. The basic purpose of EW is to decrease or completely eliminate the warfare capability of the opposing side by controlling the electromagnetic spectrum and by enabling its effective use by allied units protecting combat strength.

As we emphasized above, success in EW is closely related to the correctness of information gathered

on the opposing side. This information gathering activity is a continuous activity. It commences during peace time, continues during times of crisis and reaches its highest level during operations. By monitoring the electromagnetic spectrum activities of the opposing side, information is obtained on their strength and placement and by interpreting variances; attempts are made to detect their intention and next move. The analysis of assembled information while providing information on the capabilities of the opposing side, also provides their weak and open sides to attack. For this reason, the information gathered is also used to deceive or to make unusable the opposing side's critical sensors and command and control infrastructure.

## Radar And Electronic Warfare

Radars that can guide weapons with reconnaissance, surveillance, target detection and sensitive strike capabilities to their target and which can accomplish these functions under adverse weather conditions is one of the critical sensors of military strength. For this reason, EW activities conducted against radar have a high degree of significance.

Radar and Electronic Warfare is conducted under two basic activities: Radar and Electronic Support (ES) and Radar and Electronic Attack (EA).

ES activities encompass target radar transmission search, detection and recognition, position determination and formation of Electronic Combat Range (ECR) functions. EA activities, on the other hand, are carried out with the purpose of reducing the effects of target radars or to cease their operations for a particular time.

In general, ES and EA activities take place with systems mounted on land or air platforms. Air platforms complement or in some cases take place as alternative platforms. Due to the fact that they can undertake missions at high altitudes; avoid the negative effects of land formations;

long range; the ability to move rapidly and mission flexibility are some of the features that provides air platforms with advantages in certain applications. However, the constraints it brings in size, weight and power supply, limitations in placing antennas, reflections from the platforms, and as a result, the performance constraints that arise, are some of the issues that must be born in mind in air platform applications.



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Mobile Radar ES and EA Systems

## Radar ES and EA Systems in Land Platforms

Land based systems are divided into three classes as fixed, mobile and portable. Despite the fact that Radar ES and EA in land platforms are commonly placed on mobile platforms, this article also provides comments





relating to fixed and portable system solutions.

#### **Mobile Radar ES and EA Systems in Land Platforms**

Operational requirements and usage features identify system solutions, the capability to be obtained and the activity to be attained. The basic factors that influence system solutions in Mobile Radar ES and EA Systems in Land Platforms are examined in other sections following this article under the relevant headings

#### **Configuration Selection**

All attacks require guidance and evaluation of effects after application. For example, guiding the firing of artillery units and evaluating the post firing effects are accomplished with forward observers. This function in EA applications is performed by ES systems.

During times of peace and crisis, with search, detection, recognition and location designation functions, the Radar ES Systems, by obtaining information on the opposing side's radar, undertakes the task of EA applications with the start of operations. Tracking the reactions of the target applied by EA by an ES system is important in ensuring that the effectiveness of EA is perpetual. In the mobile applications of land

platforms, the Radar ES function is generally carried out by systems that have been mounted on different platforms. The basic reason for this is to escape from the high power emission of the Radar EA. In the event both functions are on the same platform, it can be observed that high isolation requirements are mostly not obtained and, related to this, that both the ES and EA systems do not operate at the same time towards the same target. In these types of applications the use of the "look-through" method together with tracking the changes in the target radar are also related to the effectiveness of the method, the target numbers that the EA is involved with and the features of the target.

#### **Operation Frequency Range, Range, Instantaneous Bandwidth and Angular Coverage**

The operating frequency range, range, instantaneous bandwidth and angular coverage features of Radar ES and EA Systems should be determined in a manner that is compatible with the "Analysis of Target Radars" and suitable to the conditions of the region where the system is to undertake the mission.

Naturally, on a single vehicle, solutions that include a wide operating

frequency range, high instantaneous bandwidth, long range, and wide angular coverage should be preferred. However, meeting all of these requirements together is sometimes not possible depending on the features of the carrier platform or in order to meet these requirements large, non-standard configured vehicles are used thus, due to reduced maneuverability in the tactical area and location congestion, in terms of maintenance and repair, system solutions that create a disadvantage may occur.

The operating frequency range is a direct determining parameter based the dimensions of the antenna. A two-fold change in the lower limit of the operating frequency, on the condition that the same antenna gain is protected, results in a roughly four-fold increase in the antenna's range.

Range together with the features of the target radar (operating frequency, output power etc.) is dependent on the antenna gain and level of sensitivity for Radar ES Systems and on output power for Radar EA Systems, and thus on the antenna gain. An antenna gain for the same operating frequency can only be enhanced when the antenna range size is increased. The dimension of the antenna to be used, in large measure, is determined by the platform to which the antenna is mounted. For example, since the size and weight



limitations for fixed land-based systems are less, it is possible to use much higher productive (heavy and larger size) antennas in land platforms compared to mobile systems. For this reason, in systems used for the same task, it is only natural, depending on the platform to which they are mounted, to see differences in feature (capability).

Instantaneous bandwidth is an effective parameter on “target capture possibility” for Radar ES Systems. Systems with high instantaneous bandwidth together with the possibility of a higher target capture possibility also result in the degradation of system sensitivity levels with an increase in instantaneous bandwidth. Since the sensitivity level affects the target detection range for the systems with the same antenna gain, different ranges are obtained depending on the instantaneous bandwidth.

In a similar way, increasing instantaneous angular coverage also increases the target capture possibility. However, since angular coverage is related to antenna beam width and the number of total antennas and by increasing beam width antenna gain will decrease, it will be necessary to increase the number of antennas to be used in the system.

It is also possible to come across similar results in terms of Radar EA Systems. Although it is considered that high instantaneous bandwidth or wide angular coverage increases the effects of EA, because of its effects on other system units and the constraints arising from the carrier platform it does not always make it possible to reach workable solutions.

As can be seen, many performance parameters in Radar ES and EA Systems are associated with each other. Improving one parameter results in the degradation of others or where it is a cumbersome system consisting of many units makes it compulsory to seek solutions.

For this reason, in determining the performance requirement of systems, a decision based on target analysis and mission region conditions and producing system solutions that meet operational requirements, easy maintenance and repair with high “ready for mission possibility” are of critical importance.

### **Vehicle Type, Number and Mobility**

Mobile systems in land platforms are mounted on military vehicles with different size transport capacity (4x4

5 ton class, 6x6 10 ton class etc.) thus, the maneuver capability of these vehicles in the tactical area differ. Naturally, since the turning diameter of large vehicles is longer compared to smaller vehicles, their maneuver capabilities are much lower.

In general, whenever possible, small vehicles that carry all system units should be preferred. However, since the capabilities of mission systems and their performance features are directly limited to carrier platform capacity, in certain applications, a vehicle together with a trailer or the use of more than one vehicle may also be on the agenda. Transporting some system units to a second vehicle provides the possibility of deploying smaller vehicles according to single vehicle configuration and in generating “agile” system solutions in the tactical area.

It is known that military systems undertake missions in regions where ideal transport conditions such as a level asphalt and low-sloped roads do not exist. Therefore, bearing in mind the transport conditions of the regions where the mission is to take place, it is necessary to identify the size of the vehicles. Placing system units on more than one smaller vehicles (maneuver



capability suitable to transport conditions in the mission region) can be a sound option.

Mobility of mobile Radar ES and EA Systems in land platforms must be compatible with other elements of the unit to which they are attached. For example, if the other elements of the unit that are deployed change location frequently and rapidly, the Radar ES and EA Systems must be placed on vehicles suitable for use. This requirement plays an important role in the selection of the vehicle that will carry these systems.

### Use During Mobility

In land platform mobile applications, the use of ES and EA functions while the vehicle is on the move is dependent on land conditions and the physical limitations brought about by the antenna and conditions in raising it. However, performance degradation due to not being able to completely raise the antenna, the serious negative effects due to vibrations caused by direction finding accuracy and unsuitability of the operational environment in terms of the operators and similar reasons, lead to Radar ES and EA Systems in general not being preferred while in motion. The widespread use of these systems is in the form of fixed use after the transfer of antenna raising mechanisms in a closed manner to the mission area takes place, the antenna being raised and, after the necessary adjustment and calibration has taken place.

### High Power Requirements

As with the Radar EA system, the generators of systems with high power requirements must be heavy and in large sizes. In mobile systems, "increasing reliability" with the use of dual (reserve) generators is one of the preferred methods. In applications where the generators take place on the same vehicle with mission systems, the negative effects this creates for the vehicle's carrying capacity and in terms of deployment can be frequently observed. Since placing generators on trailers and being pulled by the vehicle negatively affects the maneuver capability of vehicles on mission, in particular during difficult conditions, it is mostly far from being a suitable solution. Another solution is transportation by smaller vehicles

where the generators load-carrying capacity and loading area is suitable. Due to the improvement obtained in placing mission systems on a separate vehicle, "accessibility" is increased and consequently ease of maintenance and repair is obtained.

### Field Placement Features

As with all land-based systems, the performance of the Radar ES and EA Systems varies based on the constraints (height, land formations etc.) brought about by placement in the field. The issues that must be taken into account on the matter of land formations are summarized below:

In order to meet the range requirements and to obtain an open line of view, where possible it must be placed at the highest point.

Radar ES and EA Systems must cover the same target region.

Attention must be given so that Radar ET activities are placed in a manner where it will have the least effect on Radar ES and other elements of allied units. The use of antennas with high versatility and the placement of radar EA Systems at the forefront compared to other elements are among the measures taken to reduce interaction.

Radar ES and EA Systems should be placed at a point where communications between these Systems, with command and control centers and other EC elements are possible which is important in obtaining a regular flow of information.

In the event of an attack by the opposing side, placement should be at a point where rapid gathering and easy change in location is possible.

Where necessary, a point should be selected where logistic support can take place and supplies can be easily provided.

### Fixed-based Radar ES and EA Systems

Another application option in land based systems is systems that are set-up at fixed installations. Since these type of fixed systems, which provide great advantages in terms of meeting weight, size and power requirements

compared to mobile land platforms, are set-up at dominant points, they are less likely to be effected by constraints that originate from land formations. However, due to adverse environmental conditions (high wind speed, snow, ice etc.) that height entails, there are access and communication difficulties. Additionally, even passive systems such as Radar ES Systems become more exposed to visual discovery, that require taking special protective measures against hostile effects.

### Portable Systems

In terms of portable systems, the biggest constraint is weight and size. Due to this constraint, in systems where it is required to be carried by individuals for extensive periods under adverse land conditions, due to the reason of the antenna being small and low gain (and therefore short range) antennas not able to be extended, the restrictions on the line of view and again for the same reasons, serious performance degradation from reflections coming from the ground, low volume thermal problems that take place and not being able to provide high power requirements in sufficient periods of time, are some of the negative effects that first come to mind. For these reasons, the use of portable Radar ES and EA Systems that do not require high performance, narrowband, low power application needs, gains importance.

As with other electronic warfare elements, the effective use of Radar ES and EA Systems contribute to a large extent to the defense strength of the country and take place among critical capabilities.

The effectiveness of these systems can take place in a complete and continuous manner starting with the description of the requirements stage, the generation of appropriate system solutions, the information compiled during times of peace and crisis, placement in the field, mission planning and coordination with other elements and a series of other similar activities.

# TASMUS-G System

For the survivability of current tactical operations, intense, high-speed and real time digital data transfer between various receivers in tactical areas, weapon systems, computers and command centers has become a compulsory situation. New military doctrines based on mobility, flexibility and extensibility require that these data transfers take place while tactical elements are on the move. For this reason, the requirements for increased communication speed in tactical areas, reliability, security, flexibility, high survivability, changing technology requirements and the requirements of communication services that are offered has brought forth the need for the development of a Tactical Area Communications System. In line with these needs, work commenced on a first generation TASMUS System within Aselsan in the 1990s with the support and under the direction of the Turkish Armed Forces. In 1996 the first contract was signed and starting in 2000 deliveries as parts continued until 2005 to various regions of Turkey. These delivered systems are being utilized in a very intense and productive manner by a wide level of units from the army to the battalion attached to the Land Forces Command.

The TASMUS-G System came into being in line with new technological developments and included in the Turkish Armed Forces' inventory in 2010 after the redesign of the first generation TASMUS System developed by Aselsan and realized for the inventory of the Turkish Armed Forces in the year 2000. The System, with its Network-Centric Warfare concept compatibility, its powerful IP infrastructure and with its architecture open to new developments provides an integrated solution that can completely answer all communication requirements needed in the tactical area. From the point of users, the data speed capacity has increased approximately 8 to 10 times more than the first generation TASMUS. In order to use more effectively the Command and Control Systems, significant improvements and additions were made and features relating to security were developed compatible to new criteria.

Close cooperation with universities

## System Architecture

The architectural structure of the TASMUS-G System is given in Figure 1 below:

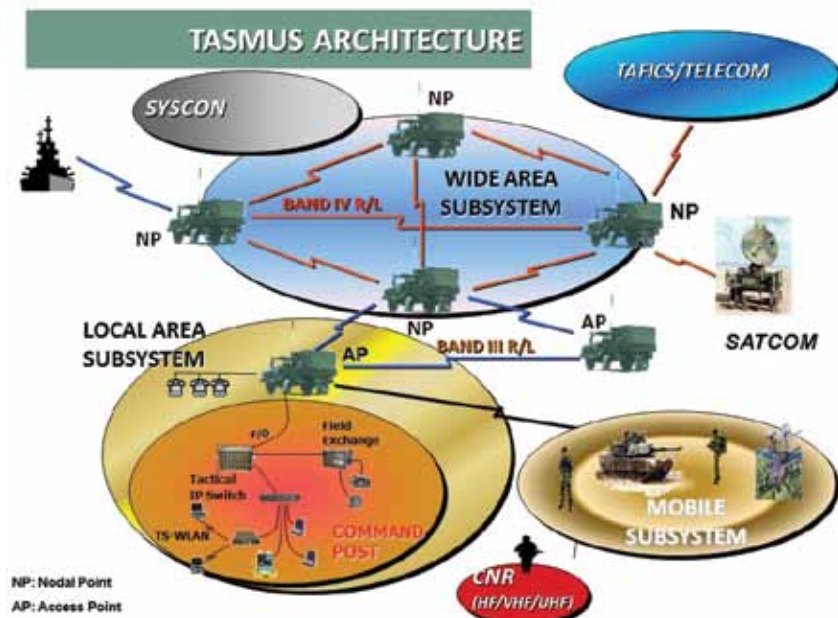


Figure 1: TASMUS-G System Architecture

and domestic industry within the project's coverage took place and new sub-contractors undertook a critical role in the project. In this way, a more productive design and production process was obtained during the project and at the same time the know-how gained was shared with other organizations.

With the TASMUS-G System, the Turkish Armed Forces has become one of the leading armies in NATO and

the world to possess the most modern communications system.

The TASMUS-G System, designed to have a compatible structure with the TACOMS POST 2000 architecture that is related to future generation tactical area communication systems within NATO and prepared with the contributions of Aselsan, is composed of four basic subsystems. These subsystems are indicated below.

Wide Area Subsystem: This is

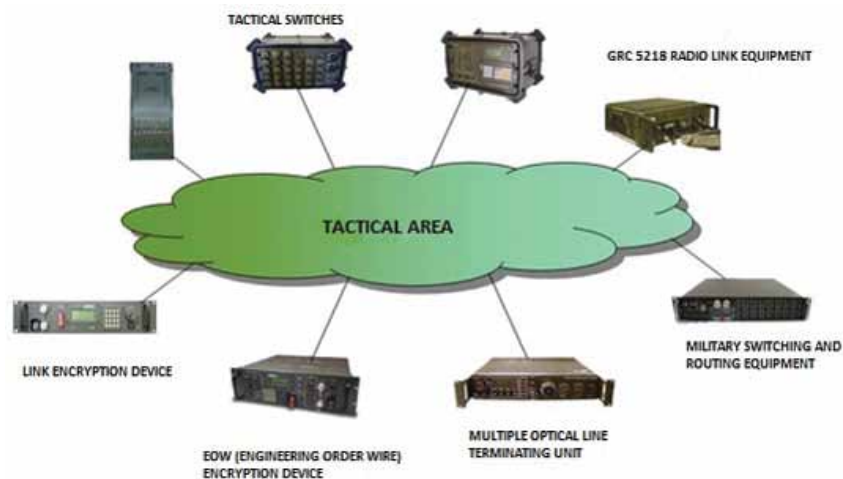


Figure 2: TASMUS-G Network Terminals



the system with the radiolink devices that cover the area of operations and consists of interconnected System Access Points (SEP) that make up the system's main transmission medium through a grid structure. This subsystem which provides a high capacity switching service between Local Area Subsystem, in addition, provides access to strategic systems such as TAFICS, PTT and NATO combat systems.

**Local Area Subsystem:** It is the system that provides services to all users in the tactical area and consists of Mobile



Figure 3: TASMUS-G User Terminals

Subscribers Access Points (MSAP) and Command Post Access Packages (CPAP). The Local Area Subsystem (LAS) provides voice, data and image communications for wired and wireless subscribers within the total system. With the use of Integrated Access Stations within CPAP, high capacity IP infrastructure is provided to command posts. The communication performances of rapidly increasing IP-based Command and Control applications will move to the highest level with this infrastructure.

**Mobile Subsystem:** Consists of software-based 9651 handheld radio and 9661 vehicle radios that operate in the TDMA mode. The Mobile Subsystem provides all of the communication services offered to wired users of the system to mobile users as well.

**System Control Subsystem (SISCON):** Undertaking system operation plans, frequency plans, wireless coverage area analysis, configuration of all units, their replacement, system performance calculations, monitoring the system, producing the switching of encryption devices in the system and remote transmission and management of these switches are some of the tasks it enables.



Figure 4: 9651/9661 Software-based Wireless (SBW) Family

### System General Features

The general features of the TASMUS-G System are listed below:

By bringing together IP, ATM and ISDN switching technologies, TASMUS-G offers an effective switching infrastructure.

Responds to all voice, data, fax and image (video and video conference) communication needs that will be necessary for the operational requirements of units and which is met through an integrated system solution.

Provides automatic and continuous monitoring of the geographical position of units from one center.

TASMUS-G has been designed to be compatible with VoIP infrastructure.

The TASMUS-G System with its software-based wireless family enables all of the communication opportunities and services provided to wired users to mobile users as well.

All links in the system are protected by nationally developed cryptos.

All terminals in the system undertake cryptographic communication from end to end.

The link between units within the system is enabled with 2, 8 and 34 mbp radiolink devices.

With TASMUS-G, interfaces that



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integrate to single channel CNR networks are present.



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# An Unmanned System Solution from Aselsan: “Bomb Disposal Robot”

The importance of counter measures against improvised explosive devices (IEDs) and bombs are becoming increasingly important. These explosives should be quickly and safely detected, deactivated or disposed without creating any vulnerability. In order to accomplish this task Aselsan has developed the “Kaplan Bomb Disposal Robot”. With this new generation unmanned system that has started production; an important step has been taken in counter-measures against IEDs.

Developed by Aselsan, the “Kaplan Bomb Disposal Robot” is an indigenous product that enables the remote disposal of IEDs under demanding conditions. Equipped with the latest technology, it's most important features that make it superior to similar systems is the Robot's power, endurance and ease of control.

The Kaplan Bomb Disposal Robot, enables the bomb disposal personnel to examine a suspicious object from 500 meters and is equipped with a 7 degree of freedom robot arm that helps examine the IEDs in detail and deactivate them with its disrupter. The tracked vehicle with a suspension system can move up and down stairs to reach suspicious objects and can traverse on snow, mud and water. The system, operating under adverse

weather conditions and between - 30° C and + 69° C, can travel 15 km without changing batteries and can fulfill the bomb disposal tasks for over 4 hours. The Kaplan Bomb Disposal Robot is powerful enough to tow an automobile from its way and is capable to easily remove and clear suspicious buried objects on the road.

With its onboard surveillance system and cameras placed on the Robot's arm, the Kaplan Bomb Disposal Robot is able to examine suspicious objects with high resolution. The Robot

user is able to follow the live images of objects placed under a vehicle or inside a car from the Operator Control Unit (OCU) and even can record them for future examination.

The Robot can listen to the surroundings where an examination is taking place with the microphone on the Robot and where necessary, can announce the user's audible warning to its surroundings.

The explosive that is decided to be disposed by the bomb disposal specialist is destroyed with the



The Kaplan Bomb Disposal Robot is a member of Aselsan's Kaplan Tracked Unmanned Ground Vehicle (UGV) family. The Kaplan UGV can be easily equipped with different payloads according to the mission's requirements due to its modular structure and can be utilized in reconnaissance, surveillance and target acquisition activities, detection of buried mines or IEDs and electronic warfare applications.



Aselsan participated in the "Robotics Rodeo" tests organized by TARDEC and JIEDDO of the US Department of Defense, in June 2012 with the "Reconnaissance & Surveillance" configuration of Kaplan UGV family.

The Kaplan Reconnaissance & Surveillance Robot successfully concluded the 8.5 km "Endurance Test" without changing batteries and requiring maintenance. Also, as the only qualified robot to participate in the "Safeguard/Intrusion Detection" category, the Kaplan made a strong impression with its automatic intrusion detection capability and was finally introduced to the top rank guests in a special demonstration.



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disrupter mounted on the Robot's arm. The Robot's arm can be directed in a sensitive manner to the target point on the suspicious object and all of the ongoing processes can be observed live from a remote distance.

The task of disposing a bomb that need to be completed with high sensitivity in a short time is simplified with the use of advanced software interfaces available in the remote OCU. The robot has automatic cruise control capability and predefined positions for the robot arm help the operators during the mission period. The automated processes provide the opportunity for the user to focus on the mission and decrease the work load in a highly stressed environment. Additionally, with the three dimensional Robot display in the OCU, all movements of the Robot can be monitored even if the robot is not in line of sight.

The Kaplan Bomb Disposal Robot due its network-based communication infrastructure it can also be easily integrated to the Command and Control Systems.



#### *Kaplan Bomb Disposal Robot*

|                                  |   |
|----------------------------------|---|
| <b>Dimensions</b>                | < 116 x 65 x 90 cm (LxWxH)  |
| <b>Weight</b>                    | < 160 kg (with batteries)   |
| <b>Maximum Speed</b>             | > 7 km/hr (level, asphalt road)   |
| <b>Minimum Speed</b>             | < 0.5 km/hr (level, asphalt road)   |
| <b>Tractive Power</b>            | > 100 kgf (level, asphalt road))  |
| <b>Operating Time</b>            | > 4 hours   |
| <b>Obstacle Clearing</b>         | Obstacle: <22 cm<br>Trench: <60 cm<br>Slope: < 45 degrees<br>Stairs: < 45 degrees<br>Side Slope: < 35 degrees<br>Passage Through Water: < 15 cm   |
| <b>Operating Temperature</b>     | - 30° ... +69° C  |
| <b>Robot Arm</b>                 |   |
| <b>Movement Freedom</b>          | 7 pivots (5 turn, 1 linear, 1 clamp)  |
| <b>Hand Clamp Angle</b>          | >15 cm  |
| <b>Accessories</b>               | Loudspeaker<br>Microphone<br>Front Drive Camera<br>Front LED Illumination<br>Hand Clamp<br>Target Camera<br>Side/Ascent Directional Platform<br>20x optic zoom camera<br>Water Ball<br>Secure Firing System |
| <b>Remote Control Unit (RCU)</b> |   |
| <b>RCU</b>                       | Portable<br>Turkish interface<br>Wired/wireless web-based communications  |
| <b>User Interface</b>            | Live image monitoring and recording<br>3D robot display<br>Automatic vehicle and robot arm guidance   |



# Water and Fuel – Wherever You Go

Water and fuel are critical to armed forces and emergency services, without both they will not survive. No water means that the soldier or emergency service worker stops functioning and no fuel means that trucks don't roll and batteries don't get charged.

WEW of Germany has been providing transportable liquid containers for over 60 years. During this time the company has provided solutions for the chemicals, food stuffs, petro-chemical and defence markets. All of these have one common thread, the need for high integrity solutions which can be transported anywhere in the world whether by sea, road, rail or even by air.

In the defence market the company has built over 2,000 tank containers which are in-service with US, German, British, Belgian, Irish, Slovakian and Latvian forces.

To ensure that armed forces are able to move liquids successfully around the world it is key that the containers are built to at least ISO container

standards and have full worldwide certification. These certifications allow the tanks to fully exploit the civil supply chain. Combining this with military hook arm systems, which are also used on some civil trucks and by fire-fighters and natural disaster agencies, a reduced height for stability and deployability, typically with a non-cylindrical, elliptical tank and an internal design which reduces the movement of liquid in the tank gives a solution which allows fuel and water to be delivered wherever it is needed.

These modular solutions, when robustly designed, provide users with water and fuel containers that can be taken into the harshest environments. WEW tanks are deployed into Afghanistan with US, British and German forces.

"We have learnt, fortunately not the hard way, that you cannot cut corners with the design if you want the tank to last more than a few moves," says Dr Ulrich Bernhardt, CEO of WEW. "We have frequently seen cheap tanks on

the scrap heap, with the tank broken, after only a dozen deployments by hook arm DROPS or PLS because the design puts the stress on the tank not on the frame."

Once the tank has arrived in an operational area it is still not so easy, there is still much to be taken into account. First of these is how is it to be deployed. As forward operating bases (FOBs) become the more normal method for armed forces to establish a presence in an area and then patrol from there, the FOB needs to have all the logistic support that would be required back in a larger site. Using modular, deployable tanks is an easy way to deliver fuel and water and provide a fuel station or water station inside the base. These tanks require very little ground preparation other than selecting somewhere reasonably flat, have no impact on the environment and can be fitted with all the requirements for pumping fuel or water including generators and water filtration systems so that the water is

A German Army Fuel Dispensing system supplied by WEW deployed in Afghanistan. These units require little maintenance or ground preparation and once the operation is complete can be picked up and deployed elsewhere with no contamination of the ground to be cleared up. Shown here is one tank mounted on a man 8 x 8 and in the background 20ft standard IS O container size bulk fuel tanks





clean and fit for human use. Just as importantly when the time comes to depart from the FOB the tank can be picked up and taken away leaving no footprint behind.

As the tanks are 'drop and go' and require little other support, it is easy to pick them up when re-supply is necessary and replace them with a new one. This ease of movement was part of the design process implemented by WEW and also required that little or no front line maintenance should

include camouflage – putting wooden boards, for example, on the frame of the tank to hide it; fitting ballistic protection panels, which can add considerable weight; or ballistically protecting the pumps and generators and spraying specialist self-sealing foam such as produced by Hutchinson onto the tank. The choice is for the customer and will depend on the risk he considers the tanks to be subject to.

The tanks currently in-service have

400L per minute of fuel, and has a wide range of protection/environmental options.

Both LMV W and F can also be mounted on a trailer such as the US Army's ubiquitous M-1095. In the future it is likely that defence forces will be deployed into harsh environments where water is scarce and what is available is dirtier and where fuel to run purification units is in short supply, WEW is looking at using water purification solutions which use less

The WEW LMVs can be mounted on trailers, shown here is an LMVW (water variant) fitted with a cooler /dispenser system which provides the user with temperature-controlled potable water as soon as the unit is deployed.



be needed as those deployed there have little time to do that and need to be focused on carrying out their military or humanitarian task. During the design process the company puts considerable effort into capturing the user's requirements, finding out how customer want to use the tanks and listening to users' suggestions as to how any design might be adapted to make deployment and use even easier.

Once a tank is in the overall area of conflict it becomes an asset which requires protection. As with all protection it has to be a balance between level of protection, value of the asset, cost of the protection, weight of the armour and coupled to that the degradation of the tanks capacity – there is only a finite amount of mass that can be moved by DROPS. The basic options available

been designed to be transported on the back of 8x8 vehicles and to carry about 20,000l, going forwards the demand for small modular tanks is growing as the number of Lightweight Protected Vehicles increases across military vehicle fleets. WEW is developing a range of 3000 litre Light Vehicle Modules (LMV) for water and fuel which can be deployed on 4x4 / 6x6 wheeled vehicles such as Hawkei or Bushmaster.

The LMVW (water variant) can be fitted with a cooler /dispenser system which provides the user with temperature-controlled potable water as soon as the unit is deployed.

The fuel variant of this module - LVMF (Light Vehicle Module – Fuel) can be fitted with a variety of pumps, which can deliver from 100L per minute up to

energy such as ultra-filtration. These units destroy bacteria and remove other impurities making the water suitable for both drinking and cooking.

Reducing the size of water and fuel logistic solutions is another area of focus. Of course 100 litres of fuel will always take up a finite volume but the company is looking at how it can pack the heating, chilling and the cleaning functions in a 20' water tank container rather than needing to have more space for these units.

High mobility forces frequently have a need for multiple fuels for example for their own transport and as a reserve for helicopters working at the limit of their range, so we are looking at how we can develop tanks similar in size to the LMVs capable of carrying two types of fuel securely.

A 'drop and go' fuel station deployed in a forward operating base. These modular containers require little ground preparation and, once no longer needed, can be removed without leaving an environmentally contaminated footprint.





# Remote Weapon Station

## FNSS Claw Remote Controlled Turret

FNSS and Aselsan has completed the first example of the Claw Remote Controlled Turret (RCT) which it has developed as a joint venture for the home and export markets. The ability to locate a weapon system almost entirely on top of a vehicle hull with virtually no intrusion to the hull can be a major advantage. These systems also enable the gunner to be located anywhere inside the hull providing additional flexibility. This approach led the way for the Remote Weapon Stations and later to Remote or Unmanned Turrets.

Remote or unmanned turrets are fairly new players in the arena of weapon systems as alternatives to conventional turrets and remote controlled weapon stations. They can be considered as a hybrid design combining the non-intrusion of remote weapon stations with armor protection and reachability of the conventional turrets. Development of the Claw RCT started in 2008 with the first example being completed in early 2011 and this was shown in public for the first time in May 2011. The project was internally funded by both companies.

The Claw RCT is suitable for installation on a wide range of tracked and wheeled armoured fighting vehicles (AFV) as original equipment or to enhance the firepower of older platforms. The first example of the Claws RCT is armed with the Rheinmetall Italy 25 mm KBA dual feed automatic cannon which is provided with 210 rounds of ready use 25x137mm ammunition in two separate compartments for HE and AP. The empty cartridge cases and links are ejected outside of the turret for main and secondary armaments.

The 25 mm KBA cannon has a maximum cyclic rate of fire of 600 rounds/minute and the gunner can select single shot or burst modes of fire. A 7.62 mm MG3 machine gun (MG) is mounted co-axial with the 25 mm KBA cannon on the right side of the Claws RCT and this is provided with 400 rounds of ready use ammunition. The gun is electromechanically cocked from the user interface within the hull. A key feature of the Claw (or Pence in Turkey), is that ammunition for both of these weapons can be reloaded from within the platform under full armour protection. A bank of four 76 mm grenade launchers are mounted either side of the turret towards the rear, but these could be replaced by grenade launchers of other calibres according to customer requirements.

Turret traverse is all electric through a full 360 degrees with weapon elevation from -10 to +50 degrees with rates of more than 60 degrees per second.

Claw turret has an advanced fire control capability with the help of its onboard fire control computer and stabilized independent sight system. The Claw's fire control software (FCSW) combines laser range, environmental readings, ammunition type, and turret control inputs to automatically elevate the gun for range and to automatically generate a kinematic lead solution if a target is moving. This functionality, very similar to that of Main Battle Tanks (MBTs), allows the gunner to center the reticule on a moving target, lose the target, and achieve a first-round-hit, without the need to fire sensing rounds and adjust aim.

The dual axis stabilized optronics package includes a 8-12  $\mu$ m thermal

imager with wide and narrow fields of view, day camera and laser range finder and provides the platform with the ability to engage targets under almost all weather conditions with a high first round hit probability. The gun is electronically slaved to the sight. An automatic target tracker is fitted as standard. The next version of the RCT will have an independent commander's sight on the roof of the turret enabling hunter/killer capability. The weapons are laid onto the target by the gunner within the hull of the platform using a control console with a flat panel display and dual handed controller.

This display could also be used to provide images from cameras mounted around the vehicle as well as information from a battle management system, for example. The turret shell is of all welded aluminum armour protection with add-on steel armor providing ballistic protection to STANAG 4569 Level 2 as standard but this can be increased to Level 3 standard. The low weight of 1,700 kg of the baseline Claws RCT allows it to be fitted to a much wider range of platforms than conventional manned turrets fitted with a basket. The latter takes up considerable internal volume and reduces the number of troops that can be carried when the platform is being used in the armoured personnel carrier role, for example. The first example of the Claws RCT will soon enter the qualification phase including firing trials integrated onto the FNSS Pars 6x6 vehicle. While the prototype Claw RCT is armed with the 25 mm KBA cannon, a number of other weapons could be installed in this turret including the ATK 25 mm M242 and 30 mm MK44 cannons.



# Tank Transporter and Semi-Trailer ***in and around Turkey***



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