

REPORT

JUGOIMPORT-SDPR broj 22, decembar 2006.

**SRBIJA I NJENA ODBRAMBENA INDUSTRIJA U
EVROATLANSKIM INTEGRACIJAMA
SERBIA AND ITS DEFENSE INDUSTRY
IN EURO-ATLANTIC INTEGRATIONS**



**PROTIVOKLOPNI SISTEM
VOĐENE RAKETE BUMBAR
BUMBAR (BUMBLE-BEE)
ANTI-TANK MISSILE SYSTEM**





YUGOIMPORT-SDPR

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BRODSKI SISTEMI I NAORUŽANJE U USLOVIMA ASIMETRIČNOG RATOVANJA SHIPBORNE EQUIPMENT AND COMBAT SYSTEMS IN ASYMMETRIC THREAT ENVIRONMENT

Svetozar Šutić, inženjer (Tehnološko-metalurški fakultet u Beogradu) i ekonomista (Ekonomski fakultet u Novom Sadu), dao je značaj doprinos afirmaciji ugleda Jugoimport-SDPR u zemlji i svetu. Profesionalnu karijeru započeo je u TV Titograd i TV Novi Sad odakle prelazi u SDPR u junu 1986. godine. U našem preduzeću je obavljao brojne odgovorne dužnosti do maja 2005. godine kada prelazi u preduzeće EVCONS Group iz Beograda. Govorio je engleski, nemački i ruski. Svetozar Šutić bio je stručnjak za međunarodni marketing, poznavalac i zagovornik uvođenja integralnog informacionog sistema i sistema kontrole kvaliteta u Jugoimport-SDPR. Objavio je brojne stručne radove iz ovih oblasti. Svetu Šutića pamtimo kao velikog stručnjaka, neumornog i odgovornog radnika, smirenog i umerenog čoveka, dobrog i poštovanog prijatelja. Njegova toplina, optimizam i pregalaštvo će nam uvek nedostajati.

IN MEMORIAM
Svetozar Šutić
(1945 - 2006)



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EDEPRO- DOMAĆE ZNANJE ZA CEO SVET EDEPRO - LOCAL KNOWLEDGE FOR THE WHOLE WORLD

Svetozar Šutić, engineer (Faculty of Technology and metalurgy in Belgrade) and economist (Faculty of Economy in Novi Sad), gave exceptional contribution to the affirmation of our company both in our country and worldwide. Svetozar Šutić commenced his professional career in TV studio in Podgorica and Novi Sad. On arrival to Yugoimport-SDPR in 1986, he was responsible for a number of duties until May 2005 when he moved to EVCONS Group in Belgrade. He spoke fluently English, German and Russian. Svetozar Šutić was an expert in international marketing, connoisseur and supporter of implementation of integral information system and quality control system into Yugoimport-SDPR. We shall always remember Svetozar Šutić as exceptional expert, dedicated collaborator, skilled and capable executive, calm, reasonable man, good and respected friend. We shall always miss his wormth, optimism and hard working.

DOSEGNUTI SVET...

Piše
Nenad Miloradović

JUGOIMPORT-SDPR završava i ovu poslovnu godinu ostvarujući značajan porast ugovaranja u odnosu na prethodnu godinu. Godina 2006. prošla je u znaku nastavka izuzetnih marketinških napora preduzeća u cilju ostvarivanja kontinualnog prisustva JUGOIMPORT-SDPR kao integrišuće snage srpske odbrambene industrije na globalnom tržištu naoružanja i vojne opreme i ostvarenja zadatih ciljeva koji se mogu sublimirati sloganom: dosegnuti svet...

Naglašeno prisustvo u praktično svim regionima sveta, kroz učešće na međunarodnim izložbama NVO (Singapur, Jordan, Francuska), kao i kroz nastavak višegodišnjih aktivnosti nastupa na ciljnim tržištima, proširili su krug partnera, produbili i učvrstili ranije uspostavljene kontakte i doveli do novih ugovora, te povećanja izvoza srpske odbrambene industrije kao osnovnog strateškog partnera JUGOIMPORT-SDPR.

Time se još jednom dokazuje ranije istaknuto zapažanje da se napredak na globalnom tržištu NVO mora planirati na «duge staze», tj. da zahteva značajna ulaganja i dugotrajne napore. Prisustvo na svetskom tržištu, svakako, nije samo po sebi dovoljno za uspeh. Ono samo otvara mogućnosti plasmana robe i usluga u uslovima oštrec konkurencije. Analiza potreba tržišta uopšte, kao i konkretnih kupaca, neophodna je za usmeravanje ponude i donošenje odluke o ulaganju i neposrednom učešću u razvoju tržišno atraktivnih proizvoda, odnosno programa modernizacije sredstva NVO. U ove aktivnosti JUGOIMPORT-SDPR ulaže velike napore poslednjih godina.

Nakon prestanka postojanja Državne zajednice Srbija i Crna Gora, JUGOIMPORT-SDPR je postao Javno Preduzeće u vlasništvu Republike Srbije.

Nedavno pristupanje Republike Srbije programu «Partnerstvo za mir» zatvorilo je prvi krug višegodišnjih procesa evroatlanskih integracija. Sve to vreme JUGOIMPORT-SDPR aktivno učestvuje u pronalaženju puteva za poslovne integracije srpske odbrambene industrije sa visokorazvijenim zemljama Zapadne Evrope i SAD, pre svega u cilju opremanja Vojske Srbije visokosofisticiranim sredstvima NVO sredstvima iz uvoza, uz istovremeno učešće preduzeća srpske odbrambene industrije u tim projektima. To učešće ne obuhvata samo kooperaciju u proizvodnji sredstava koja se isporučuju Vojsci Srbije, već i širu proizvodnu kooperaciju, čime se upošljavaju kapaciteti i podiže tehničko-tehnološki nivo srpske odbrambene industrije.

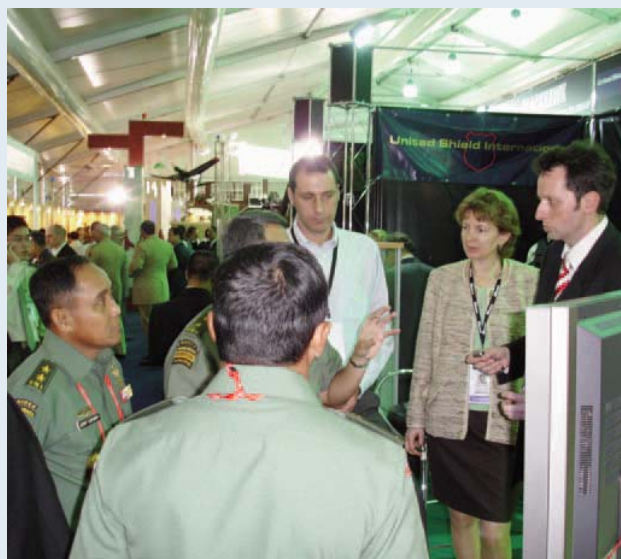
REACHING THE WORLD ...

By
Nenad Miloradović

JUGOIMPORT-SDPR will end this business year showing once more significant increase of contracted deals compared to preceding year. Year 2006 was marked by continued intensive marketing efforts to retain the presence of JUGOIMPORT-SDPR as integrating force of the Serbian defense industry in global arms and defense equipment markets and to achieve designated goals that may be summarized with the slogan: reaching the world...

Pronounced presence in practically all regions in the world, participation in international arms exhibitions (Singapore, Jordan, France) as well as continued activity of many years in target markets have expanded the roster of our partners, deepened and strengthened previously established contacts, leading to concluding of new contracts and increased export sales of the Serbian defense industry being the key strategic partner of JUGOIMPORT-SDPR.

This testifies to already emphasized view that progress in global arms and defense equipment markets requires long-term planning, i.e. that it entails significant investing and enduring efforts. The presence itself in the world market does not warrant success. It only opens the venues for sales of goods and services in a highly competitive market. Analyses of the market in general and of specific needs of particular customers are required for directing of quotations and decision making to invest in development of market-attractive products, including upgrading of weapons and equipment in service. These activities were the subject of major efforts on the part of JUGOIMPORT-SDPR in recent years.



Saglasno procesima evroatlantskih integracija, strateški ciljevi srpske odbrambene industrije obuhvataju i integraciju njenih istraživačko-razvojnih i proizvodnih kapaciteta u odgovarajuće evroatlantske programe razvoja i proizvodnje sredstava NVO. Istraživačko-razvojni opitni, remontni i proizvodni kapaciteti vojnotehničkog instituta, tehničkog opitnog centra, tehničkih remontnih zavoda, kao i preduzeća odbrambene industrije sa svojom laboratorijskom, proizvodnom i kadrovskom bazom, sa zaokruženim ciklusima razvoja i proizvodnje složenih sredstava NVO, značajno višedecenijsko iskustvo u samostalnom razvoju i proizvodnji širokog dijapazona sredstava NVO razvijenih na osnovu zapadnih i istočnih standarda i koncepcija, kao i integracijom zapadnih i istočnih koncepcija, predstavljaju značajne komparativne prednosti srpske odbrambene industrije i dobru osnovu za navedene tehničko-tehnoške integracije. Poslednjih godina JUGOIMPORT-SDPR ostvario je nekoliko projekata koji pridaju navedenom domenu.

S druge strane, posebno značajan doprinos srpske odbrambene industrije razvoju sistema globalne bezbednosti i integrisanju srpske odbrambene industrije u pomenuti sistem, predstavlja aktivno i intenzivno učešće u programima opremanja oružanih snaga i snaga bezbednosti zemalja koje se suočavaju sa narastalim problemom savremenog terorizma. Poslednjih godina, JUGOIMPORT-SDPR je ostvario značajne rezultate u ovoj oblasti bazirajući svoju ponudu na visokom kvalitetu i pouzdanosti proizvoda srpske odbrambene industrije, kao i na svom intenzivnom prisustvu na tržištu i ulaganjem u razvoj tržišno atraktivnih proizvoda.

Završavajući još jednu uspešnu poslovnu godinu, svim partnerima i prijateljima iz zemlje i inostranstva JUGOIMPORT-SDPR želi uspešnu Novu 2007. godinu, sa željom da zajedno dosegemo svet...



After the demise of the State Union of Serbia and Montenegro, JUGOIMPORT-SDPR has become a Public Enterprise owned by the Republic of Serbia.

Recent joining by the Republic of Serbia of the "Partnership for Peace" completed the first round of the process of Euro-Atlantic integrations that lasted several years. Throughout that period JUGOIMPORT-SDPR was active in seeking the ways and means for business integration of the Serbian defense industry with its counterparts in highly developed countries of Western Europe and the USA, primarily by equipping Serbian Army with imported sophisticated arms and equipment with simultaneous involvement of Serbian defense equipment companies in these projects. Such participation includes not only co production of equipment supplied to Serbian Army, but broader industrial cooperation as well, leading to higher employment of domestic capacities and technical-technological advancement of Serbian defense industry.

In keeping with the processes of Euro-Atlantic integrations, strategic objectives of Serbian defense industry also include integration of domestic research & development and manufacturing capacities in relevant Euro-Atlantic arms & equipment development and production programs. Available R&D, test, overhaul and production capacities of the Military-Technical Institute, Technical Test Center, overhaul depots and defense industry factories with their laboratories, manufacturing facilities and human resources, with completed cycles of development and production of complex weapon systems, significant experience of several decades in indigenous development and manufacturing of broad variety of arms and equipment developed against Western and Eastern standards and concepts, including integration of Western and Eastern concepts – all these factors represent significant comparative advantage of Serbian defense industry and solid foundation for above stated technical-technological integrations. In recent years JUGOIMPORT-SDPR has achieved several projects within that area.

On the other hand, particularly significant contribution by Serbian defense industry to global security and its integration in that system comprises active and intensive participation in outfitting the armed and security forces of the countries faced with increasing threats of modern terrorism. In recent years JUGOIMPORT-SDPR has achieved prominent results in this field, basing its offers on high quality and reliability of Serbian defense products, as well as relying upon its intensive presence on the market and investing in commercially attractive products.

In closing another successful business year, JUGOIMPORT-SDPR wishes to all partners and friends from our country and abroad a prosperous New Year 2007, wishing our joint reaching the world..

PONUĐA SRPSKE ODBRAMBENE INDUSTRIJE U GLOBALNOM RATU PROTIV TERORIZMA

Piše
Aleksandar Lijaković

Do pre dvadesetak godina, pod pojmovima “anti-terorističke jedinice”, “anti-teroristička dejstva”, kao i “sredstva naoružanja i vojne opreme (NVO) namenjena anti-terorističkim jedinicama” podrazumevane su relativno usko specijalizovane, specijalno odabrane, obučene i opremljene formacije vojske i policije, njihova dejstva i odgovarajuća sredstva NVO koja su, po svojoj osnovnoj koncepciji i primenjenim tehničkim rešenjima, posebno prilagođena upotrebi u rešavanju tipičnih taktičkih situacija antiterorističke borbe. Takav pristup bio je diktiran opštim faktorima globalne bezbednosti koji su podrazumevali izazove terorizma kao relativno uske, specifične i, pre svega, ograničene pretnje sa stanovišta masovnosti terorističkih grupa i organizacija, te i realizovanih terorističkih dejstava. Promene globalne bezbednosti koje su usledile karakteriše značajna revizija pristupa pojmu antiterorističkih dejstava koja postaju znatno masovnija i počinju da se kombinuju sa oružanim pobunama zahvatajući prostorno širi deo teritorije. To je postalo posebno značajno u naseljenim područjima koja postaju praktično ključna područja vođenja savremenih oružanih sukoba. Pretvaranje čitavih gradova i širih naseljenih područja u prostorni, ravnomerno uspostavljeni “epicentar” borbenih dejstava navedene kategorije dovelo je do eskalacije posebno osetljivog problema zaštite civilnog stanovništva.

Razvoju sredstava NVO koja su po osnovnim koncepcijskim i taktičko-tehničkim karakteristikama prilagođena, odnosno posebno pogodna za upotrebu u aktuelnim uslovima protivterorističkih, odnosno protivgerilskih / protivpobunjeničkih operacija, mirovnih i drugih operacija, posvećuje se pažnja u odbrambenoj industriji Srbije, te i u obe prethodne Jugoslavije. Razlozi za to leže u značajnom iskustvu snaga bezbednosti i oružanih snaga Republike Srbije počev od kraja 80-ih godina prošlog veka u izvođenju antiterorističkih i antigirilskih operacija na Kosovu gde su se snage bezbednosti Republike Srbije, kao i OS SR Jugoslavije suočile sa mnogim aspektima aktuelnim u današnjem globalno proklamovanom ratu protiv terorizma upravo u navedanim sukobima, kao i izvesna bliskost navedenih uslova savremenih antiterorističkih / antipobunjeničkih dejstava sa doktrinom prisutnom u razvoju OS prethodne Jugoslavije, koja je podrazumevala intenzivan razvoj pešadijskog naoružanja borbenog sistema pešadijske i

SERBIAN DEFENSE INDUSTRY OFFER IN GLOBAL WAR AGAINST TERROR

By
Aleksandar Lijaković

Until about twenty years ago, the terms “anti-terrorist units”, “anti-terrorist operations” and “arms & equipment designed for anti-terrorist units” comprised relatively strictly specialized specially selected, trained and equipped military and police formations, their operations and specific weapons and equipment which, in their concept and technical solutions were specially adapted for typical tactical situations of anti-terrorist combat. This approach resulted from general factors of global security which considered terrorist challenges as relatively limited specific terrorist threats in comparison to massive terrorist groups and organizations and execution of their terrorist activities. Subsequent changes in global security situation are characterized by revised approach to anti-terrorist operations since the threats were now combined with armed rebellions embracing larger territories. These events became more prominent in populated areas that comprise key areas where present day conflicts are waged. Converting of complete cities and other settlements into area, uniformly spread “epicenter” of combat operations of that nature, has escalated the sensitive issue of protection of civilian population.

Serbian defense industry focuses special attention on development of weapons and equipment which, in their concept and tactical-technical characteristics are adapted and suited for use in anti-terrorist, anti-guerilla, counter-rebel and peace-keeping and other operations. Reasons for this are significant experiences gained by our security and military forces since 1980-ies in waging anti-terrorist and anti-guerilla operations in Kosovo, where Serbian police forces and armed forces of FR Yugoslavia were faced with many aspects similar to currently proclaimed global war against terrorism. Also, there is marked similarity of present-day anti-terrorist and counter-rebel operations with the doctrine of development of the former Yugoslav Army, characterized by intensive development of small arms, combat systems for infantry and counter-infantry operations and of combat anti-armor systems.

Bearing in mind the need for integration of Serbian defense industry and of the country's defense and security structures into global security system, for a number of years intensive efforts were made to develop modern surveillance and area

protivpešađijske borbe, i borbenog sistema protioklopne borbe.

Imajući u vidu potrebu za integracijama odbrambene industrije Republike Srbije, kao i odbrambeno-bezbednosnih struktura zemlje u celini u sistem globalne bezbednosti, već više godina se intenzivno radi na razvoju savremenih sistema za osmatranje, kontolu teritorije, odnosno na njihovom prostornom integrisanju sa komandnoinformacionim sistemima i sistemima za upravljanje vatrom na nivou pešađijskih antiterorističkih jedinica, borbenih vozila i sistema vatrene podrške. Razvojem ovakvih sistema upotpunjena je i zaokružena celina ponude srpske odbrambene industrije u ovoj oblasti. Preduzeća odbrambene industrije i ustanove MO i MUP Republike Srbije – Vojnotehnički institut, Tehnički opiti centar i Institut bezbednosti iz Beograda, Zastava Oružje iz Kragujevca, Prvi Partizan iz Užice, Sloboda iz Čačaka, Krušik iz Valjeva, Milan Blagojević Lučani, Prva Iskra Barič, Trajal i 14 Oktobar iz Kruševca, TRZ Čačak, Lola sistem iz Železnika, IRITEL i IMTEL iz Beograda, kao i druga preduzeća odbrambene industrije uključeni su u programe razvoja i proizvodnje, kao i programe modifikacija, modernizacija i konverzije u oblasti sredstva NVO koja su po konceptu posebno prilagođena izvodenju antiterorističkih operacija u širem smislu. Osnovne kategorije tih sredstava NVO i usluga iz ponude šire odbrambene industrije SCG su sledeće:



1. Streljačko naoružanje, sredstva pešađijske bliske vatrene podrške, protivoklopno/protivfortifikacijsko naoružanje, municija i lična zaštitna oprema

• savremeni borbeni pištolji kalibra familije CZ 999 9 mm i .40 S&W, kao i borbeno-sportski pištolji familije TOP XX namenjene prestižnim takmičenjima u praktičnom gađanju u organizaciji IPSC, u kojima pripadnici jedinica bezbed-

control equipment and provide its spatial integration with the command-information and fire control systems at the level of infantry anti-terrorist units, combat vehicles and fire support systems. Development of such systems rounds-up the capability of Serbian defense industry in this field. Serbian defense industry enterprises and Serbian military and police establishments – Military-Technical Institute, Technical Test Center, Institute of Security, Belgrade, Zastava Oružje of Kragujevac, Prvi Partizan of Užice, Sloboda of Čačak, Krušik of Valjevo, Milan Blagojević Lučani, Prva Iskra Barič, Trajal and 14 Oktobar of Kruševac, TRZ Čačak, Lola sistem of Železnik, IRITEL and IMTEL of Belgrade and other defense industry enterprises are involved in arms and equipment modification, modernization and conversion programs the concept of which is specially adapted for use in anti-terrorist operations in general. Main families of weapons and equipment involved include:

1. Small arms, infantry close fire support weapons, anti-armor and anti-fortifications weapons, ammunition and personal protection equipment

- Advanced combat issue pistols, family CZ 999 9mm and .40 S&W, also combat-sporting pistols family TOP XX, intended for competition marksmanship under IPSC organization, events where members of Serbian police force regularly achieve excellent results; pistols of family CZ 999 manifest highest reliability, previously achieved by family CZ 99, including barrel life of 200,000 cartridges.
- Official shotgun cal. 12
- Family of automatic weapons in calibers 7.62x39 mm, 7.62 x 51 mm and 5.56 x45 mm, that includes the reliable standard assault rifle M70 AB2, distributed in 500,000 units, assault rifle M77 in NATO caliber 7.62x51 mm which again is the favored caliber for anti-terrorist operations; the latest family of assault rifles M21 /M21S/M21K of cal. 5.56x45 mm NATO, already in use by the police in security risk areas; family of automatic rifles made in Serbia based on Kalashnikov design and recognized around the world for their high reliability, product quality and for its technical solutions.
- Sniper rifles, including tactical high-precision rifle cal. 7.62 x 51 mm and semi-automatic sniper rifle M91 cal. 7.62x 54 mm
- Long-range rifle in calibers 12.7x107 mm and 12.7 x 99 mm capable of engaging different

categories of targets in anti-terrorist combat, at ranges of up to 2000 m; characterized by high accuracy, powerful gas brake and spring absorber, resulting in recoil comparable to recoil of medium hunting carbine, high reliability owing to oversized Mauser mechanism.

• GP machine gun/machine gun M84, cal. 7.62 x 54 mm is one of the most popular products of Serbian defense industry (not only among small arms), with its technological solutions it surpasses other weapons of that category in respect of reliability and endurance – barrel life is 20,000 rounds

nosti Republike Srbije postižu izuzetne rezultate; pištolji familije CZ 99 karakteriše, pre svega, dokazana visoka pouzdanost dostignuta kod modela familije CZ 99, uključujući životni vek cevi od 200 000 metaka.

- službena sačmara kalibra 12
- familje automatskog oružja u kalibrima 7.62x39 mm, 7.62 x 51 mm i 5.56 x45 mm, koje uključuju standardnu pouzdanu jurišnu pušku M70 AB2 koja je distribuirana u količini od 500 000 primeraka, pušku M77 u kalibru 7.62x51 mm NATO koji danas postaje ponovo sve privlačniji kalibar jurišnog oružja za savremene uslove antiterorističkih operacija, kao i najnoviju familiju jurišnih pušaka M21 /M21S/M21K u kalibru 5.56x45 mm NATO koju već koriste snage bezbednosti u kriznim područjima; familije automatskog oružja proizvedene u Srbiji na bazi sistema Kalašnjikov karakteriše u svetu već dugo prepoznatljiv visok nivo pouzdanosti, kvaliteteta proizvodnje i primenjenih tehničkih rešenja.

- snajperske puške, uključujući taktičku pušku visoke preciznosti u kalibru 7.62 x 51 mm i poluautomatsku snajpersku pušku M91 kalibra 7.62x 54 mm

- dalekometna puška u kalibrima 12.7x107 mm i 12.7 x 99 mm, koja omogućava gađanje različitih kategorija ciljeva u protivterorističkoj borbi do daljina od 2000 m; sredstvo karakteriše visoka preciznost, kao i moćna gasna kočnica i opružni amortizer, koji trzaj dovode na nivo trzaja srednjeg lovačkog karabina i visoka pouzdanost primenjenog uvećanog sistema Mauzer

- Mitraljez/puškomitraljez M84, u kalibru 7.62 x 54 mm jeste jedan od tržišno najznačajnijih proizvoda srpske odbrambene industrije, ne samo u domenu strelječkog naoružanja; sredstvo primenjenim tehnološkim rešenjima prevazilazi druga oružja te kategorije u oblasti pouzdanosti funkcije i izdržljivosti - vek cevi iznosi 20 000 metaka, a oružje može da ispali do 500 metaka u jednom neprekidnom rafalu bez narušavanja funkcije; mitraljez je standardno opremljen optičkim nišanom

- Familija teških mitraljeza 12.7 x 107 mm, razvijenih na bazi mitraljeza NSV, namenjenih za ugradnju u borbena i terenska vozila, lake patrolne čamce i druge plovne objekte, koja uključuje i pešadijsku varijantu, montiranu na pešadijsko postolje; Pešadijski teški mitraljez razvijen je na osnovu aktuelnih iskustava, opremljen je optičkim nišanom i u kombinaciji sa mitraljezom M84 i snajperskim puškama predstavlja izuzetno efikasno sredstvo za zaštitu visokorizičnih zona terorističko-pobunjeničkih aktivnosti, do daljina do 2000 m

- Automatski bacač granata u kalibru 30 mm ABG M93, dometa do 1700 m, koji omogućava precizno dejstvo na tačkaste ciljeve na daljinama do 400 m, a do 1700 m na prostorni raspoređeno ljudstvo uključujući i ljudstvo zaklonjeno uglovima zgrada i drugim urbanim i poljskim zaklonima

- Prigušivači pucnja za pištolje, automate, automatske i snajperske puške i odgovarajuće prigušene municije;

- Podcevni bacači granata 40 mm, lanseri ručnih/lansirnih granata i lanseri tromblonskih mina koji se mon-



whereby 500 rounds can be fired in continuous burst without affecting its functioning; machine gun is provided with optical sight as standard.

- Family of heavy machine guns cal. 12.7 x 107 mm, developed based on the NSV design, intended for mounting on combat and cross-country vehicles, on light patrol boats and other vessels, it includes infantry version mounted on stand. Infantry heavy machine gun was developed with consideration of actual experience and outfitted with optical sight. In combination with machine gun type M84 and sniper rifles it represents formidable defense system against terrorist incursions, up to 2000 m distance.

- Automatic grenade launcher cal. 30 mm ABG M93, range to 1700 m, enables precision engaging of spot targets up to 400 m, against area targets up to 1700 m, including person-



tiraju na standardne jurišne puške i odgovarajuća municija 40 mm ruskog i NATO standarda, ručne i ručnolansirane granate i tromblonske mine - razornog, osvetljavajućeg, dimnog dejstva

- Nesmrtonosna municija na bazi šokfleš efekta i hemijskih sredstava za privremeno onesposobljavanje raspoloživa u vidu ručnih i ručno-lansiranih granata, granata 40 mm, tromblonskih mina

- Prenosni minobacač tipa «commando» 60 mm dometa 1700 m

- Laki minobacači velikog dometa u kalibru 60 mm, 81 mm i 120 mm velikog dometa sa odgovarajućom razornom, osvetljavajućom i dimnom municijom; minobacače karakterišu srtazmerno male mase za nivo ostvarenih dometa, – 5200 za kalibar 60 mm, 6800 za kalibar 81 mm i 9500 m u kalibru 120 mm, kao i visoka brzina gađanja;

- Protivoklopna sredstva u kalibrima 64 mm, 90 mm, 120 mm, sa bojnim glavama kumulativnog dejstva i bojnim glavama termobaričkog dejstva, trenutno raspoloživom u kalibru 90 mm posebno prilagođenim za dejstvo na ciljeve u protivterorističkim i specijalnom dejstvima; Raketni lanser OSA u kalibru 90 mm, originalno namenjen za dejstvo protiv borbenih vozila, u uslovima posebno je pogodan za dejstvo na utvrđene objekte, posebno malorazmerne ciljeve na daljinama do 600m, uključujući objekte poljske i urbane fortifikacije

- BUMBAR prenosni sistem vođene protivolopne rakete dometa do 1000 m omogućava takođe anitrorističkim jedinicama samostalno efikasno dejstvo protiv posebno značajnih otpornih tačaka; sistem sa stanovišta upotrebe u razmatranoj kategoriji oružanih sukoba karakteriše visoka prenosivost i borbena autonomija, – tim od dva borca može da za relativno kratko vreme dejstvuje na pet ciljeva, mogućnost dejstva iz zatvorenog prostora, malo demaskiranje strelca, visoka efikasnost na cilju i visoka verovatnoća pogađanja, čime se takođe smanjuje mogućnost neželjenog dejstva protiv civilnog stanovništva.

- Sredstva lične balističke zaštite, uniforme i druga lična oprema - taktički prsluci, maskirna oprema i dr. prilagođena različitim klimatskim, geografskim i taktičkim uslovima upotrebe jedinica vojske i policije; Osnovni parametri koncepcije - nivo balističke zaštite i površina tela koja se štiti zaštitnim prslukom i balističkim pločama mogu se varirati prema konkretnim zahtevima /uslovima korisnika; u proizvodnji se nalaze prsluci zaštite nivoa IIIA i ploče do nivoa zaštite IV, uključujući i ploče anatomski oblikovane u trodimenzionalnoj tehnologiji. Osnovni materijali koji se koriste za proizvodnju prsluka jesu aramidna i polietilenska vlakna



nel masked by building corners and other urban and field defilades.

- Silencers for pistols, submachine guns, automatic and sniper rifles and appropriate low-noise ammunition.

- Underslung grenade launchers cal. 40 mm, hand grenade and grenade launchers, rifle grenade launchers fitted on standard assault rifles; appropriate ammunition 40 mm of Russian and NATO standard, hand and launcher fired

grenades and rifle grenades – high explosive, illuminating, smoke types.

- Disabling ammunition based on shock-flash effect and chemical agent for temporary disabling of hostile manpower, delivered as hand and hand launcher fired grenades, cal. 40 mm grenades and rifle grenades.

- Portable mortar cal. 60 mm “commando”, range to 1700 m.

- Light mortars of increased range, cal. 60mm, 81mm and 120mm, extended ranges with HE, illuminating and smoke charges; mortars are characterized by relatively low weight compared to firing ranges: 5200 m for cal. 60mm, 6800 m for cal. 81mm, 9500 m for cal. 120mm and by high rate of fire.

- Anti-armor launchers cal. 64 mm, 90 mm, 120 mm, with shaped charge warheads and thermo baric warheads presently available as cal. 90 mm, specially adapted for anti-terrorist and special targets; rocket launcher OSA cal. 90 mm originally developed for armor defeating, suitable for fortified buildings and small dimension targets at ranges to 600m including field and urban fortifications.

- BUMBAR (Bumble bee) portable guided anti-armor missile of range to 1000m, suitable for autonomous use by anti-terrorist units against important hardened targets; in respect of application in stated operations its characteristics are high portability and combat autonomy – team of two fighters can engage five targets within short time, suitable for firing in enclosed area, low signature to unmask operator, high target effectiveness and high hit probability, therefore reduced possibility to hit civilians.

- Personal ballistic protection equipment, uniforms and other personal gear – tactical vests, camouflage equipment, etc. adapted for different climatic, geographic and tactical uses by the military and police. Basic concept parameters: level of ballistic protection and body parts protected by protective vest and ballistic plates may vary, depending on requirements of users. Protective vests in current production offer level of protection IIIA, plates up to level IV, including anatomically shaped plates in 3-dimensional technology. Chief materials used to produce vests are aramide and polyethylene fibers - (Kevlar and Dyneema), whereas plates

(Kevlar i Dyneema), dok se ploče rade u najčešće od polietilenskih vlakana do nivoa III i u kombinaciji ovih materijala sa keramikom za nivo III + i IV. Šlemovi balistički se proizvode od vlakana i obezbeđuju nivo zaštite V50 do 550 m/s.

- Desantni i specijalni padobranci;

2. Borbena i neborbena vozila, naoružanje, programi modifikacija, modernizacija i konverzije

- Programi modernizacije tenkova porodice T-55, uključujući kineske derivate tog tenka, kao i tenkova porodice T-72 omogućavaju uspešno korišćenje tih tenkova u navedenim dejstvima, pre svega imajući u vidu povećanje balističke zaštite primenom eksplozivnog reaktivnog oklopa i drugih rešenja, kao i integraciju panoramske osmatračko-merne sprave komandira i komandno-informacionog sistema, čime se izrazito poboljšava upravljanje vatrom i razmena podataka sa drugim elementima borbenog poretka u realnom vremenu

- Porodica teških oklopnih transportera, razvijena na bazi konverzije tenka T-55; prvi realizovani član porodice predstavlja borbeno vozilo za podršku borbenih inženjera MUNJA. Vozilo predstavlja ekonomski izuzetno prihvatljivo prelazno rešenje za rešavanje niza taktičkih situacija u savremenom urbanom ratištu; Sredstvo omogućava prevoz odeljenja od 8 ljudi uključujući i tri stalna člana posade vozača, komandira i nišandžiju. Koncept zaštite omogućava, uz dostizanje zaštite od dejstva ručnih PO sredstava višeg nivoa nego što je nivo dostignut kod većine savremenih borbenih vozila pešadije primenom reaktivnog oklopa i modularnog oklopa (u perspektivi), kao i drugih elemenata pasivne zaštite, a uz značajan nivo pokretljivosti, posebno uz primenu modularne pogonske grupe razvijene za modernizaciju tenka T-55. Koncept takođe omogućava ugradnju daljinski upravljane oružne stanice.

- Programi modifikacije / konverzije / modernizacije borbenih i neborbenih vozila, uključujući izradu oklopne zaštite i ugradnju naoružanja - automatskih bacača granata 30 mm, mitraljeza kalibra 7.62 x 54 mm i 12.7 x 107 mm i topova 20 mm u vidu turela, podizućih platformi, kupola ili daljinski upravljanih turela na borbenim i neborbenim vozilima, a u cilju transporta do reona dejstva i neposredne vatrene podrške dejstava specijalnih jedinica;

- Konverzija oklopnog automobila BRDM-2 u borbeno vozilo za podršku specijalnih snaga VUK takođe predstavlja primer ekonomski prihvatljivog rešenja savremenog vozila prilagođenih aktuelnim uslovima i omogućava postizanje značajnih performansi. Konverzija se obavlja u okviru generalnog remonta vozila, i obuhvata u osnovi poboljšanje pokretljivosti (ugradnjom dizel motora povećane snage), poboljšanje vatrene moći (ugradnjom spregnutog mitraljeza snajperskog tipa 7,62 mm i automatskog bacača granata kalibra 30mm), poboljšanje balističke zaštite do 14,5mm sa ceone strane i 12,5mm sa bočnih strana, rekonstrukciju unutrašnjeg prostora za smestaj 8 članova posade sa kompletnom specijalnom opremom i licnim naoružanjem, ugradnju uređaja za globalno pozicioniranje (GPS) i satelitsku navigaciju, ugradnju panoramskog optoelektronskog sistema za osmatranje, ugradnju bacača dimnih kutijasa hidrauličnom i elek-

are made of polyethylene fiber for protection level III and combined with ceramics for protection level III+ and IV. Ballistic helmets are made of fibers and offer level of protection V50 for velocities up to 550 m/s.

- Air drop and special parachutes.

2. Combat and utility vehicles, armaments, modification, modernization and conversion programs

- Programs for modernization of the T-55 family of tanks, including their Chinese derivatives, as well as of the T-72 family of tanks enable effective use of these vehicles in anti-terrorist operations due to improved ballistic protection by fitting of explosive and reactive armor and other solutions, by integration of commander's panoramic sight/ranger with command/information system which significantly enhances fire control and exchange of information with other elements of battle order in real time.

- Family of heavy armored personnel carriers, based on converted T-55 chassis. First developed vehicle MUNJA provides combat support to combat engineers. It is a very economical transient solution for resolving of numerous tactical situations in urban battlefield. The vehicle carries 8 persons including 3 crew members: driver commander and gunner. Self defense offers protection from rocket launchers, higher than protection offered by most current infantry fighting vehicles, being protected by reactive armor (in perspective, modular armor) and other passive protection devices. It provides solid mobility and it is powered by modular power pack (developed for T-55 tank modernization program). The concept also offers fitting of remotely controlled weapons station.

- Modification (conversion) programs for combat and utility vehicles include fitting of armor protection, mounting of firearms - automatic grenade launchers 30 mm, machine guns cal. 7.62 x 54 mm or 12.7 x 107 mm, cannons cal. 20 mm, mounted in cupolas, lifting platforms, turrets or remotely controlled cupolas for combat and utility vehicles, designed to transport the vehicle to engagement area and for direct fire support to special units.

- Conversion of armored car BRDM-2 into combat vehicle for support of special forces, named VUK, is another economically acceptable solution of contemporary vehicle with solid performance, adapted to specific conditions. Conversion is performed during general overhaul and, generally, covers improvement of vehicle performance (fitting of higher power diesel engine), enhancing of fire power (mounting of slaved, sniper type machine gun cal. 7.62 mm and automatic grenade launcher cal. 30 mm), improved ballistic protection 14.5 mm at front and 12.5 mm on sides, reconstruction of the interior to accommodate 8 persons complete with special equipment and personal arms, installation of GPS and satellite navigation units, fitting of optoelectronic panoramic surveillance system, fitting of smoke charge launchers with hydraulic and electro-pneumatic installations, etc.

- Family of wheeled armored personnel carriers 6x6: In basic version, they are armored troop carriers; by reconstruction they can be developed in combat vehicles for different applications, vehicle capacity is section of 8 infantrymen, concept of armor protection may vary by mounting of add-on panels arranged to meet expected tactical situations.

tropneumatskom instalacijom, itd.

- Familija oklopnih transportera-točkaša formule 6x6: u osnovnoj verziji vozilo predstavlja oklopni transporter, dok se na osnovu nadgradnje osnovne verzije može dobiti familija borbenih vozila različite namene; vozilo omogućava transport odeljenja pešadije sastava do 8 boraca, a koncept oklopne zaštite omogućava variranje nivoa oklopne zaštite montiranjem panela modula dodatnog oklopa u zavisnosti od očekivanih taktičkih situacija. Koncept predviđa ugradnju bacača dimnih puškarnica čime se omogućava samoodbrana vozila u krugu od približno 360 stepeni, što je posebno značajno za borbu u naseljenom mestu. Takođe, moguća je ugradnja uređaja za globalno pozicioniranje (GPS) i satelitsku navigaciju, ugradnju panoramskog sistema za osmatranje, merenje koordinata i praćenje cilja, uređaja za detekciju radarskog zračenja i komandno-informacionog sistema, kao i ugradnju bacača dimnih kutija sa hidrauličnom i elektro-pneumatskom instalacijom, itd. U varijanti izviđačkog vozila, vozilo se može opremiti panoramskim sistemom za osmatranje i merenje. U razvoju se nalazi familija univerzalnih daljinski upravljanih oružnih stanica.

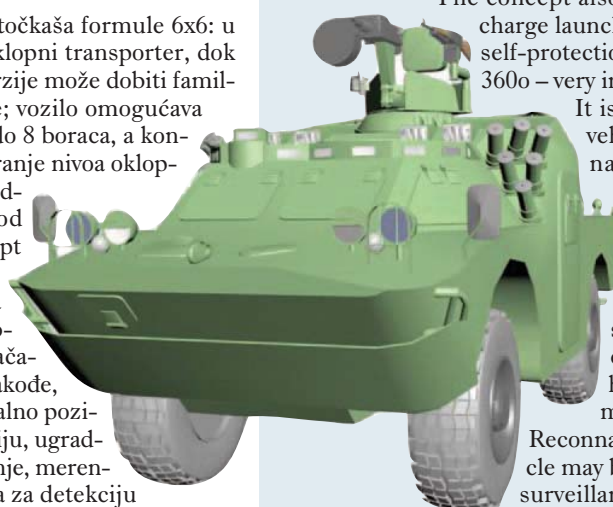
- turela M86/06 razvijena je na bazi turele M86, originalno razvijene za borbeno vozilo vojne policije VPB M86; turelu M86/06 karakteriše dodatna ledna balistička zaštita strelca, kao i modularna koncepcija postolja za naoružanje, koja omogućava brzu zamenu oružja u poljskim uslovima; u turelu se, osim originalno ugrađenog mitraljeza M86 7.62 mm, u zavisnosti od očekivane taktičke situacije, mogu montirati pešadijski mitraljez M84 7.62 mm, mitraljez 12.7 mm NSV sa refleksim nišanom i bacač granata ABG M93 30 mm.

- Turela razvijena kao naoružanje teškog oklopnog transportera/vozila za podršku borbenih inženjera MUNJA, naoružana je automatskim bacačem granata M93 30 mm i pešadijskim mitraljezom M84 7.62 mm. Ista turela originalno je predviđena i za ugradnju u borbeno vozilo za podršku specijalnih snaga VUK, razvijenog na bazi konverzije oklopnog automobila BRDM2

- Univerzalna oružna platforma ugrađena na podizajući hidraulični cilindar (u transportnom položaju platforma je spuštena, u borbnom podignuta), na koju se opciono mogu montirati dvostruki bacač granata 30 mm, bestrzajni top 82 mm, raketni lanseri kalibra 128 mm ili 57 mm ili mitraljez 12.7 mm. Platforma se ugrađuje na terenska vozila sa zadnjom platformom, koja mogu biti realizovana sa ili bez balističke zaštite.

- Familija kupola M91 za ugradnju u oklopne transportere (OT) i borbeno vozila pešadije (BVP); Originalno razvijena za modernizovano borbeno vozilo pešadije BVP M80 A1, predstavlja rešenje pogovo za ugradnju različite OT i BVP, guseničare i točkaše. Do sada je za potrebe ino-kupca kupola ugrađena u oklopni transporter BTR-50, čime je ovaj stari OT praktično konvertovan u amfibijsko jurišno borbeno vozilo.

Kupola je naoružana topom M86 razvojenom u Srbiji na bazi metka za top AK-230, čija balistika omogućava izuzetno visoku efikasnost protiv utvrđenih objekata urbanog i poljskog tipa, lasnirnim sistemom sa modernizovanim raketama



The concept also provides fitting of smoke charge launchers in portholes to provide self-protection within the circle of about 360o – very important for urban combat.

It is also possible to equip the vehicle with GPS and satellite navigation units, with panoramic surveillance, coordinate measuring and target tracking system, command-information system, radar detection system, fitting of smoke charge launchers with hydraulic and electro-pneumatic installations, etc.

Reconnaissance version of the vehicle may be outfitted with panoramic surveillance and measuring system.

Under development is a family of universal remotely controlled weapons stations.

- Cupola M86/06 was developed from cupola M86, originally produced for combat vehicle of military police VPB M86; the M86/06 cupola offers added ballistic protection for gunner's back and modular weapons mount that enables quick change of weapon in field conditions. Cupola can mount the original M86 machine gun cal. 7.62, or infantry machine gun M84 cal. 7.62, NSV machine gun cal. 12.7 mm with reflex sight or grenade launcher ABG M93 30 mm.

- Cupola developed for arming of heavy armored personnel carrier / support vehicle for combat engineers MUNJA contains automatic grenade launcher M93 cal. 30 mm and infantry machine gun M4 7.62 mm. The same cupola was originally developed for combat vehicle of special forces VUK, developed by conversion of armored car BRDM2.

- Universal weapons platform with hydraulic lift cylinder (in traveling position platform is lowered, in combat position it is raised) may be armed alternately with dual grenade launcher cal. 30 mm, recoilless gun cal. 82 mm, rocket launchers cal. 128 mm or cal 57 mm, or machine gun cal. 12.7 mm. This platform is mounted on cross-country trucks with cargo platform and can be executed with or without ballistic protection.

- Family of turrets M91 for installation on armored personnel carriers and infantry fighting vehicles. Originally developed for upgraded IFV type BVP M80 A1, it is a ready-made solution suitable for outfitting different armored personnel carriers and infantry fighting vehicles, tracked or wheeled. So far, it was fitted to APC type BTD-50 of a foreign client, thus converting this ageing armored car into amphibious assault vehicle. Its turret is armed with M86 gun, developed in Serbia, using ammunition for AK-230 the ballistics of which are highly effective against urban and field fortified objects; other armament includes later F version of Malutka missile with thermo baric warhead, effective against fortified targets. That system is effective against hardened targets up to 3000 m away, it has very high hit probability and offers strong fire support in anti-terrorist operations with minimum collateral damage. Main gun has slaved machine gun cal. 7.62 mm while development is under way of a remotely controlled automatic grenade launcher cal. 30

Maljutka, čija varijanta F ima termobaričnu bojnu glavu, efikasnu protiv utvrđenih objekata. Sistemom se mogu gađati otporne tačke na daljinama do 3000 m sa vrlo visokom vjerovatnoćom pogađanja, čime se pruža vatrena podrška protiv terorističkih dejstava uz minimizaciju kolateralne štete. Top je spregnut sa mitraljezom 7.62 mm, dok je u razvoju i daljinski upravljani automatski bacač granata 30 mm integrisan u sistemom za upravljanje vatrom, namenjen dejstvu na protivnika

koji je uglovima zgrada, rovovima i drugim zaklonima.

- Sistem bacača dimnih kutija u kalibru 82 mm može se ugrađivati u različitim konceptima na kupole ili tela borbenih i neborbenih vozila. Ovaj sistem, za koji je razvijena, osim dimne, i granata sa CS-kompozicijom, predstavlja veoma značajno sredstvo za samoodbranu vozila, posebno u uslovima zasednih dejstava u naseljenom mestu.

- Programi oklopljavanja terenskih i transportnih neborbenih vozila - na bazi navedenih iskustava VSCG i policijskih snaga MUP Republike Srbije u protivterorističkim operacijama na Kosovu, odbrambena industrija SCG razvila je niz programa izrade oklopne zaštite i naoružavanja borbenih i neborbenih vozila. Programi oklopljavanja obuhvatili su izradu oklopne zaštite gore navedenih klasičnih terenskih patrolnih vojnih policijskih vozila, kao i oklopljavanje terenskih kamiona domaće i strane proizvodnje iz inventara VSCG i policije, koji omogućavaju zaštitu ukrcanog ljudstva u slučaju zasednih dejstava streljačkom municijom. Treba naglasiti da je trend oklopljavanja kamiona, već prisutan globalno posle iskustava iz Iraka od 2003. godine do danas, bio aktuelna u našoj zemlji od sredine 90'ih godina, posle iskustava na Kosovu. Razvijeni su postupci oklopljavanja do nivoa balističke zaštite protiv streljačke municije 7.62 mm sa projektilom sa olovnom jezgrom uz korišćene čelične ploče, dok se viši nivoi zaštite mogu postići u kombinaciji sa modulima (panelima) dodatnog oklopa izrađenim od keramike i drugih materijala (kompozita ili aluminijuma).

mm, integrated with fire control system and designed for neutralization of hostile manpower sheltered behind buildings, in trenches and other defilades.

- Smoke charge launching system cal. 82 mm may be installed either on turret or hull of various combat and utility vehicles. This system uses smoke and CS-composition charges and represents important self-defense system, especially in ambushes in urban environment.

- Armor protection for cross-country transport and utility vehicles – development based on experience acquired by Yugoslav Army and Serbian police forces in anti-terrorist operations in Kosovo has resulted in a number of armor protection and weapons fitting programs for combat and non-combat vehicles by our defense industry. Armor protection included fitting of armor on conventional cross-country military and police patrol vehicles, as well as fitting of armor on cross-country trucks of domestic and foreign manufacture in service with the military and the police, aimed at providing protection from small arms ambush fire to embarked manpower. It may be noted that armor plating of trucks is globally pursued since the Iraqi war of 2003; in our country; however, it was a pressing matter since middle 90ies after Kosovo experience. Procedures were developed to provide armor protection against 7.62 mm lead core projectiles by using steel plates, whereas higher protection can be achieved in combination with add-on modules (panels) made of ceramics or other materials (composites, aluminium).

3. Observation, reconnaissance and area control systems

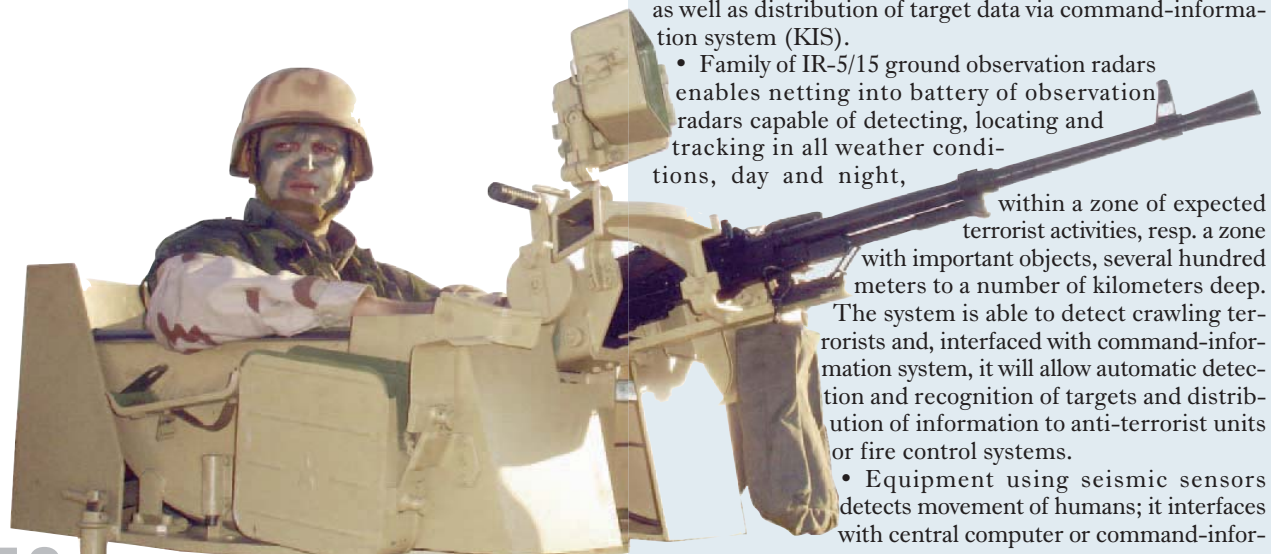
- Panoramic surveillance, coordinates measuring and target tracking equipment is mounted on electro-hydraulic lifting platform is designed for fitting on vehicles and vessels and comprises surveillance sub-system based on TV cameras of narrow and wide angle of view, thermal imaging camera and laser rangefinder. The system terrain observation, automatic tracking and measuring of coordinates, fire control with locally integrated weapons (on board the vehicle) as well as distribution of target data via command-information system (KIS).

- Family of IR-5/15 ground observation radars enables netting into battery of observation radars capable of detecting, locating and tracking in all weather conditions, day and night,

within a zone of expected terrorist activities, resp. a zone with important objects, several hundred meters to a number of kilometers deep.

The system is able to detect crawling terrorists and, interfaced with command-information system, it will allow automatic detection and recognition of targets and distribution of information to anti-terrorist units or fire control systems.

- Equipment using seismic sensors detects movement of humans; it interfaces with central computer or command-infor-



3. Sistemi za osmatranje, izviđanje, kontrolu teritorije

- Panoramski uređaj za osmatranje, merenje koordinata i praćenje cilja, smeštan na elektrohidrauličkoj podižućoj platformi, namenjem ugradnji u vozila i plovne objekte, opremljen osmatračkim podsistemom na bazi TV kamera uskog i širokog vidnog polja, termovizijskom kamerom i laserskim daljinomerom, omogućava osmatranje terena, automatsko praćenje i merenje koordinata cilja, upravljanje vatrom lokalno-integriranim naoružanjem (na istom vozilu) kao i distribuciju podataka o ciljevima preko komandno-informacionog sistema (KIS).

- Familija radara IR-5/15 za osmatranje zemljišta sa mogućnošću umrežavanja u bateriju osmatračkih radara omogućava otkrivanje, lociranje i praćenje u svim meteo uslovima, danju i noću zone očekivanih aktivnosti terorista, odnosno zone značajnih objekata do dubine od nekoliko stotina metara do više kilometara, uključujući otkrivanje terorista koji se kreću puzeći; umreženi sa komandno-informacionim sistemom, omogućavaju automatski režim rada sa otkrivanjem, prepoznavanjem ciljeva i distribucijom podataka prema antiterorističkim jedinicama ili sistemima za upravljanje vatrom.

- Uređaj na bazi seizmičkih senzora za otkrivanje kretanja ljudstva umreženih sa centralnim računarom ili komandno-informacionim sistemom omogućava kontrolu teritorije koja se štiti u svim meteo-uslovima, danju i noću, sa automatskim prenosom podataka o ciljevima prema anti-terorističkim jedinicama ili oružnim sistemima.

- Sistem za zvukometrijsko izviđanje položaja minobacačke i snajperske vatre predstavlja varijantu sistema za zvukometrijsko artiljerijsko izviđanje, posebno prilagođenu osnovnim pretnjama u antiterorističkim operacijama. Osnovna funkcije sistema jesu: korekcija vatre sopstvene artiljerije, bazirana na analizi akustičkih signala generisanih eksplozijom artiljerijskih i raketnih projektila; procena 3D koordinata vatrenog položaja i mesta eksplozije projektila; detekcija, lociranje (procena koordinata) i identifikacija neprijateljske artiljerije, raketnih sistema, minobacača i snajpera, posebno u naseljenim područjima. Tehnički koncept sistema se zasniva na: prostorno-frekvencijskom lociranju akustičkih izvora korišćenjem MUSIC metode; za prostornu selekciju se koristi širokopolasni «beam forming»; lociranje se vrši metodom triangulacije. Derivativ sistema posebno prilagođen otkrivanju položaja snajperske i druge streljačke vatre, kao i minobacačke vatre sastoji se od niza uređaja koji se postavljaju u vidu mreže, pokrivajući naseljeno ili drugi zaštićeno područje postavljanjem jednog uređaja (sistem senzora sa računarom i modemom) na jedinici površine. Podaci o klasi i položaju neprijateljskog delovanja sa greškom reda veličine do nekoliko metara stižu se u komandni centar.

4. Sredstva elektronskog ratovanja

- Sistem za automatsku kontrolu mobilnih komunikacija 7G (12G) koristi se kontrolu mobilnih komunikacija na definisanom prostoru, u frekventnom opsegu između 9 kHz i 7(12) GHz; Sistem za automatsku kontrolu i ometanje mobilnih telefona ima sledeće karakteristike: detekcija NMT450i, AMPS/DAMP, GSM800/1800, CDMA, DECT mobilnih telefona i procena njihovih parametara, kao što su vrsta standarda, broj kanala, nivo signala; ometanje signala bazne stanice kada se informacija šalje izabranom korisniku; zona ometan-



information system and provides area protection in all meteo conditions, day and night, relevant target information are automatically relayed to anti-terrorist units or weapons systems.

- Sound measuring equipment for reconnaissance of mortar and sniper positions is a variant of artillery sound measuring equipment, specially adapted for detection of terrorist threats. Its main functions are: fire adjustment of own artillery based on analysis of acoustic signals from own artillery and rocket projectiles; evaluation of 3D coordinates of firing position and burst position, detection, pinpointing (assessed coordinates) and identification of hostile artillery, rocket launchers, mortars and snipers, particularly in urban areas. Technical concept utilizes spatial-frequency location of sound source employing MUSIC methods; for spatial selection wide-band “beam forming” is used, location is by means of triangulation. Derivative system for detection of sniper and other small arms fire and mortar positions consists of a number of units spread as network covering a settlement of area observed, with one unit (system of sensors, computer and modem) placed per unit of area. Information on the class and position of hostile fire (with an error of several meters) are transmitted to command center.

4. Electronic warfare equipment

- Mobile communications automatic control system 7G (12G) serves for control of mobile communications within designated area, in the frequency range of 9 kHz and 7(12) GHz; system for automatic control and jamming of mobile telephony has the following specifications: detection NMT450i, AMPS/DAMP, GSM800/1800, CDMA, DECT of mobile phones and evaluation of their parameters, such as type of standard, number of channels, signal level, jamming of base station signal when information is transmitted to selected user, jamming zone: 30 m in enclosed space, 1 km in the open, total jamming period 4.8 ms. Mobile communications jam-



Upgraded BTR-50

armoured personnel carrier



- transformation of morally outdated APC into modern infantry fighting vehicle capable of engaging armoured and lightly armoured targets, low flying aerial targets and zones of manpower concentrations
- integration of locally developed turret, with high firepower 30 mm gun and twin launching rails for Malyutka missiles, compatible with both MCLOS and SACLOS variants of the missiles possibility of integration of Malyutka-2M, Malyutka-2T and Malyutka-2F missiles
- modern fire control system, incorporating day/night sight ensuring reliable round-the-clock operation of the gun and missiles
- accommodation of six fully equipped infantrymen
- favorable floating features

ja: u zatvorenom prostoru 30m, napolju 1 km; ukupno vreme ometanja 4,8 ms. Sistem za ometanje mobilne komunikacije Jammini je namenjen za postavljanje u institucijama kao što su: kancelarije, pozorišta, koncertne hale, bolnice, zatvori, crkve; u roku od 300 mikrosekundi Jammini detektuje prisustvo mobilnog telefona, određuje broj frekventnih kanala; interval ometanja traje od 0.8 do 1 sekunde; sistem može da radi ceo dan i u potpunosti je adaptiran za frekventno skakanje;

- Radio ometači protiv daljinski upravljanih improvizovanih eksplozivnih sredstava namenjeni su pre svega za zaštitu konvoja i VIP zaštitu, kao i za zadatke zaštite pri patrolnim i udarnim zadacima u okviru anti-terorističkih dejstva i kontroli prostora. Moguće konfiguracije: samo širokopojasni ometač; ometač i osmatrački prijemnik; automatizovani prijemnik-ometać sa softverskim paketom za brzo frekventno inteligentno pretraživanje spektra i ometanje. Oprema za radioelektronsku zaštitu protiv radio-kontrolisanih improvizovanih eksplozivnih sredstava jeste u osnovi generator šuma, namenjen za zaštitu protiv radio-kontrolisanih improvizovanih eksplozivnih sredstava kao i za zaštitu podataka koji se dobijaju radio putem. Raspoložive su i prenosna i stacionarna varijanta. Može se montirati na bilo koji tip vozila. Ometanje se može vršiti na maksimalnom dooptu do 60 m. Obezbeđena je zaštita podataka od više tipova prisluškivanja. Raspon snage: GVS-BOMBAM-6U/64 W; GVS-BOMBAM-7A/75 W. Frekventni opsezi: 20-250 MHz; 250-500 MHz; 500-750 MHz; 750-1000 MHz; (GVS-ometać -7A) 1000-1400 MHz; (GVS-ometać -7A) 1400-2000 MHz

- Radio-goniometar RGK 2/3, kontejnerskog tipa, namenjen ugradnji u terensko vozilo, omogućava izviđanje, otkrivanje, određivanje položaja, klasifikaciju i prisluškivanje radio-uređaja u frekventnom opsegu 20-500 MHz

5. Sredstva ratne mornarice:

- Brzi patrolni čamci dijapazona deplasmana od 3 do 250 tona, izrađeni od aluminijuma i kompozitnih materijala proizvedeni u srpskim brodogradilištima predstavljaju vrlo pogodne platforme za integraciju različitih sistema za osmatranje, upravljanje vatrom i oružnih sistema (takođe razvojenim u Srbiji, pre svega u vidu derivativa opisanih sistema). Takvi čamci, čime postaju efikasna sredstva za obavljanje niza zadataka iz domena bezbednosti - antiterorističkih, antipiratskih dejstva i zaštite zona i sl. na rekama, jezerima i priobalju.

Opisana sredstva posebno su pogodna za naoružavanje i opremanje OS zemalja koje se poslednjih godina suočavaju sa rastućim problemom terorizma. Opremanjem ovih zemalja srpska odbrambena industrija doprinosi razvoju i boljem funkcionisanju sistema globalne bezbednosti, povećavajući ukupnu borbenu efikasnost oružanih snaga i snaga unutrašnje bezbednosti tih zemalja, a uz ekonomski prihvatljive izdatke, saglasno navedenim iskustvima i pristupu razvoju sredstva NVO navedenih kategorija. Tu treba naglasiti još jednom značajne komparativne prednosti srpske odbrambene industrije u smislu poznavanja zapadnih i istočnih standarda, kao i primenu visokih tehnologija u proizvodnji sredstva NVO itoćnog standarda, što je posebno značajno za partnere koji su u dosadašnjem razvoju oružanih snaga bili okrenuti tim standardima. Na taj način postiže se kvalitetno i brzo opremanje i osposobljavanje partnera za što samostalniji i efikasniji odgovor na izazove savremenog terorizma.

ming system Jammini is intended for installation at institutions such as offices, theaters, concert halls, hospitals, prisons, churches; within 300 microseconds Jammini will detect the presence of mobile phone, determine the number of frequency channels, jamming interval is 0.8 to 1 second; the system can operate entire day and it is fully adapted to frequency hopping.

- Radio jammers against remotely controlled improvised explosive devices are primarily intended for protection of convoys and for VIP protection, as well as for protection during patrolling and assault missions in anti-terrorist operations and area control. Possible equipment configurations: wideband jammer only, jammer and surveillance receiver, automated jammer-receiver with software package for intelligent spectrum scanning and jamming. Equipment for RF protection against improvised remote controlled explosive devices is essentially a noise jammer which can also protect information received by radio. Both mobile and stationary version of this equipment are available which can be mounted on any vehicle. Jamming is effective up to 60 m distance. Data protection is provided from several kinds of interception. Power range: GVS-BOMBAM-6U/64 W; GVS-BOMBAM-7A/75 W. Frequency ranges: 20-250 MHz; 250-500 MHz; 500-750 MHz; 750-1000 MHz; (GVS-jammer-7A) 1000-1400 MHz; (GVS-jammer-7A) 1400-2000 MHz.

- Radio direction finder RGK 2/3, of container type, intended for mounting on a jeep, enables reconnaissance, detection, location, classification and interception of radio sets in the frequency range of 20-500 MHz.

5. Navy equipment

- Fast patrol boats, displacement range 3 to 250 tons, built of aluminium and composite materials in Serbian shipyards, represent superior platforms for outfitting with varied surveillance, fire control and weapons systems (also developed in Serbia, mostly as derivatives of described systems). These boats are very effective in performing of varied security-related missions - anti-terrorist, anti-piracy and protection of rivers, lakes and coastal sea zones.

All types of equipment described above are eminently suited for arming and equipping of armed forces of the countries faced with increasing terrorist threats. By helping to equip such countries, Serbian defense industry will contribute to the development and more efficient functioning of global security and enhance combat effectiveness of armed forces and internal security of the countries involved, against economically acceptable expenditures conforming to outlined experiences and development approaches adopted for the equipment described. Once more, comparative advantages of Serbian defense industry need to be pointed out: familiarity with both Western and Eastern standards, application of high technological standards in manufacturing of arms & defense equipment of Eastern standards, which is of great importance to those partners who in development of their armed forces to date have relied upon those standards. This approach will enable our partners to achieve rapid and qualitative capability for autonomous and effective response to the threats of present-day terrorism

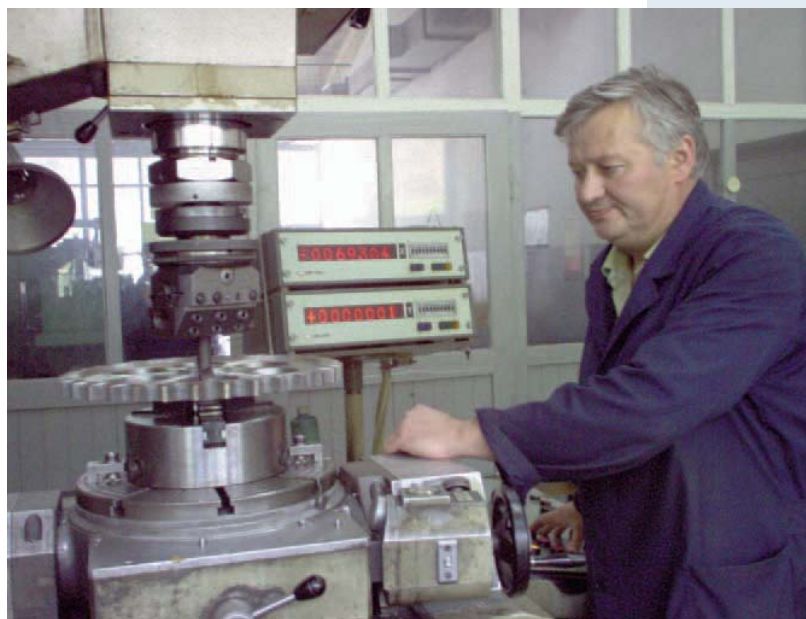
SRBIJA I NJENA ODBRAMBENA INDUSTRIJA U EVROATLANTSKIM INTEGRACIJAMA

Piše
Aleksandar Lijaković
Svetlana Šujak Marković

osle više godina intenzivnih aktivnosti, proteklih meseci je uspešno zatvoren »prvi krug« evroatlantskih integracija Republike Srbije njenim pristupanjem programu »Partnerstvo za mir« i potpisivanjem sporazuma CEFTA u Bukureštu. Takođe, otvorena je kancelarija za vezu sa NATO u zgradi Ministarstva odbrane u Beogradu, dok pregovori o pridruživanju EU napreduju uz dobro poznate probleme vezane za saradnju naše zemlje sa Haškim tribunalom.

Shodno tome očekuje se i značajno intenziviranje saradnje sa zemljama NATO u smislu bolje prodaje naoružanja i vojne opreme proizvedenog u Srbiji državama članicama NATO, odnosno industrijske kooperacije i tehnoloških integracija odbrambene industrije naše zemlje sa vodećim nacionalnim i multinacionalnim kompanijama odbrambene industrije zemalja članica Alijanse. Naša odbrambena industrija tu ima niz komparativnih prednosti. Između ostalog, tu je familijarnost sa standardima razvoja i proizvodnje NVO istočnog (pre svega ruskog) i zapadnog porekla, a tu su i značajni istraživačko-razvojni i proizvodni kapaciteti i kvalitetan stručni kadar.

Poznato je da smo još u periodu od 50-ih do 80-ih godina



SERBIA AND ITS DEFENSE INDUSTRY IN EURO-ATLANTIC INTEGRATIONS

By
Aleksandar Lijaković
Svetlana Šujak Marković

After many years of intensive activities, "first round" of Euro-Atlantic integrations was successfully completed in recent months for the Republic of Serbia by its joining the 'Partnership for Peace' program and signing of CEFTA agreement in Bucharest. Also, a NATO liaison office was opened at the Ministry of Defense building in Belgrade while negotiations for joining the EU proceed shadowed by well-known problems related to cooperation of our country with the Hague Tribunal.

Therefore, significant intensifying of cooperation with NATO countries may be expected in respect of stronger sales of arms and defense equipment produced in Serbia to NATO member states, as well as industrial cooperation and technological integrations of our defense industry with leading national and multinational corporations of the Alliance countries. Our defense industry presents a number of comparative advantages. Among others, it is familiar with development and manufacturing standards for arms and defense equipment of both Eastern (primarily Russian) and Western origin, additionally it possesses significant R&D and manufacturing capacities and skilled human resources.

It is a known fact that in the period between 1950-ies and 1980-ies, namely at the time of completely different global military-political circumstances, our country enjoyed significant cooperation with NATO countries. Just remember the "off-shore" program in the 50-ies and intensive production of cal. 105mm and 155 mm artillery ammunition for armed forces of Greece and Turkey, countries which with then Yugoslavia represented (an informal but practical) Southern Wing of NATO treaty and which, at the time, were technologically lagging behind our defense industry. We can also recall collaboration in production with the French Aerospatial as strategic partner when over 200 Gazelle helicopters (known locally as "Partisan") were produced in our country which supplied large number of helicopter component sets in offset. Other examples of cooperation include supply of "Viper" turboengine components to Boeing, construction of supersonic wind tunnel in Žarkovo, development project of "new com-

prošlog veka, dakle u vreme sasvim drugačije globalne vojno-političke slike, ostvarivali značajnu saradnju sa članicama NATO. Setimo se »off-shore« programa iz 50-tih godina, koji je obuhvatao proizvodnju u našim fabrikama municije po američkoj dokumentaciji, uključujući kalibre 105 mm i 155 mm, za potrebe američkih snaga u Evropi, kao i oružanih snaga Grčke i Turske, zemalja koje su zajedno sa tadašnjom Jugoslavijom (neformalno, ali praktično) činile južno krilo NATO pakta. Setimo se zatim proizvodne kooperacije tokom koje smo, u strateškom partnerstvu sa francuskom firmom Aerospatial, kod nas proizveli preko 200 helikoptera Gazela (kod nas poznat i pod nazivom »Partizan«), a u kontrastnim isporukama isporučili partneru delove za proizvodnju velikog broja tih helikoptera. Tu je i proizvodnja delova turbomlaznog motora »Viper«, zatim proizvodnja hidrauličkih komponenata i elemenata konstrukcije vazuhoplova za kompaniju Boeing, izgradnja supersoničnog aerotunela u Žarkovu, razvoj »Novog aviona«, prenos tehnologija Olin-Winchester za proizvodnju sferičnog baruta u Lučanima, proizvodnja borbenih uniformi za oružane snage zemalja članica NATO, da pomenemo samo neke programe.

Mogućnosti za intenzivnu saradnju Republike Srbije i zemalja članica programa Partnerstvo za mir danas su vrlo realne, imajući u vidu potencijale odbrambene industrije naše zemlje. Integracija istraživačko-razvojnih i proizvodnih kapaciteta srpske odbrambene industrije u aktuelne međunarodne programe razvoja složenih sredstava NVO svakako jeste značajan i jedan od strateških ciljeva naše odbrambene industrije.

Da li to znači da je realno očekivati i intenziviranje sarad-



bat aircraft”, technology transfer of spherical powder from Olin-Winchester to Lučani, production of combat uniforms for NATO members countries, to name but few.

The prospects of more intensive cooperation between Serbia and members of Partnership for peace are very realistic today, keeping in mind the potential of our defense industry. Integration of R&D and manufacturing capacities of Serbian defense industry in current international development programs involving complex weapon systems without doubt represents one of significant strategic objectives for our defense industry.

Is it realistic to expect more intensive cooperation manifested by volume sales of arms to armed services of Western



ALAS

Advanced Light Attack System

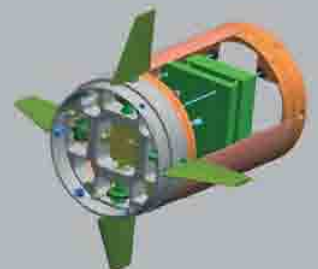
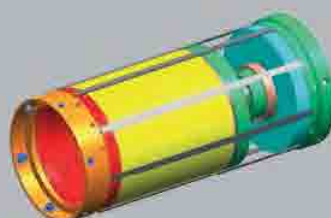
- ALAS missile can be used for engagement of: armoured targets, surface vessels of various displacement, military and industrial facilities of high importance, C3I nodes...
- Adaptability to various launching platforms (ships, high mobility wheeled vehicles, helicopters)



- maximum range up to 25 km (optionally 60 km)
- turbojet based sustainer
- modular warhead design concept
- man-in-the-loop guidance, using fiber optic link for image downlink and commands uplink
- TV homing head (optionally IIR for round the clock target engagement)



YUGOIMPORT-SDPR



nje na planu kvantitativno značajnijih isporuka sredstava NVO za potrebe OS zapadnih zemalja? Na primer, da li je realno očekivati realizaciju masovnijih isporuka naših automatskih pušaka za potrebe OS zemalja zapada? Svakako da to nije jednostavno, budući da standardna vojnička puška predstavlja jedan od najznačajnijih nacionalnih simbola odbrambene industrije određene zemlje, odnosno njenih vojnopolitičkih integracija.

S tim uvezi, želimo da iznesemo neka naša marketinška iskustva. Predstavnik ministarstva odbrane jedne od najmoćnijih evropskih država članica NATO je, tokom posete štandu Jugoimport-SDPR na izložbi IDEX 2005 u Abu Dabiju, videvši neke postupke ispitivanja puške M-21 u Tehničkom opitnom centru u Nikincima, prikazane na promotivnom filmu, izjavio da sa puškom njihovog proizvođača taj postupak nije moguće izvesti. Takođe, predstavnik proizvođača upravo tog streljačkog naoružanja, koji pripada krugu od nekoliko najznačajnijih svetskih kompanija u toj oblasti, rekao je sledeće na jednoj drugoj izložbi, uzevši u ruke karabin M21K sa integrisanom »pikatini« šinom na poklopcu sanduka i podcevnim bacačem granata: »Vi ovu pušku možete da prodajete NATO-u.«

Ulaskom Srbije u NATO program Partnerstvo za mir otvara mogućnost za ponovo uspostavljanje saradnje domaće odbrambene industrije sa vojnim industrijama drugih zemalja sveta. Uspostavljanje poslovne saradnje sa renomiranim kompanijama iz zemalja članica NATO omogućuje fabrikama odbrambene industrije naše zemlje da prošire svoje proizvodne asortimane, modernizuju tehnologiju i proizvodnu opremu, a nadamo se i dovesti do osetnijeg zapošljavanja stručne radne snage.

S druge strane, partneri iz inostranstva imaju u Jugoimport-SDPR, integrotoru razvoja domaće odbrambene industrije i izvozniku njenih proizvoda, kao i u svim fabrikama naše odbrambene industrije, sigurne isporučioce delova, komponenti, gotovih proizvoda pa i složenih sistema NVO.

Nadamo se da će srpska odbrambena industrija u izmenjenim okolnostima na Balkanu i u svetu, ponovo postati respektabilan faktor na međunarodnom tržištu NVO i time povratiti status jednog od značajnijih državnih izvoznih brendova kakav je bila vojna industrija SFRJ pre 90-tih godina prošlog veka.

countries? For instance, is it realistic to expect massive deliveries of our assault rifles to Western armies? This is not a simple matter since military rifle represents a hallmark of national defense industry, respectively of its military-political integrations. Referring to that issue, we can cite some marketing experiences of our own. A MOD representative from one of most powerful European NATO countries, while visiting the Jugoimport-SDPR chalet at IDEX 2005 exhibition in Abu Dhabi and viewing promotion tape showing the test procedure for the M-21 rifle at our test facility in Nikinci, commented that those test procedures could not be performed with military rifle made in his country.

Also, a representative of that particular rifle manufacturer that belongs to the inner circle of most important international companies, while visiting another arms exhibition and taking in his hands our carbine M21K that features integrated "Picatini" rail on breech cover and underslung grenade launcher, stated that "we could sell this rifle to NATO".

Entering of Serbia into NATO program Partnership for peace opens up possibilities for reestablishing of cooperation between our defense industry and defense industries of other countries worldwide. Establishment of business cooperation with famous companies from the countries members of NATO will provide for our defense industry possibility to extend their production programs, modernize applied technologies and their production equipment, and hopefully substantial opening of working places for qualified manpower.

On the other hand, foreign partners will find in Jugoimport-SDPR, the integrator of Serbian defense industry and the exporter of its products, as well as in all factories of our defense industry, reliable supplier of parts, components, ready-made products and complex defense systems.

We hope that in changing environment of both the Balkans and worldwide, Serbian defense industry will again become respectable factor on the international market thus restoring its status as one of Serbian major export brands as the defense industry of SFRY used to be before the nineties of the last century.



NOVINE U AKTIVNOSTIMA JUGOIMPORT- SDPR IZ DOMENA INFORMACIONO- KOMUNIKACIONIH TEHNOLOGIJA

Pišu
Slobodan Krstić
Violeta Kalanj

NEWS CONCERNING THE ACTIVITIES OF YUGOIMPORT- FDSP IN THE AREA OF INFORMATION AND COMMUNICATION TECHNOLOGIES

By
Slobodan Krstić
Violeta Kalanj

U svajanjem Strategije razvoja informacionog društva naša zemlja je učinila značajan korak na svom putu ka integraciji u Evropsku uniju. Vlada Republike Srbije usvojila je pomenutu strategiju 5. oktobra ove godine. Uključivanjem informaciono-komunikacionih tehnologija (IKT) u razvojne strategije naše zemlje obezbeđen je osnovni preduslov za izgradnju savremene nacionalne privrede i modernog društva u skladu sa evropskim standardima.

U okviru Strategije razvoja informacionog društva Republike Srbije, kao deo njenog akcionog plana, konkretno



By adopting the Strategy of Development of IT Society, our country has made a major step forward on its way towards the integration with the European Union. The Government of the Republic of Serbia adopted the above Strategy on October 5 this year. Incorporation of the Information and Communication Technologies (ICT) in the development strategies of our country ensures the basic precondition for building of a modern national economy and modern society in line with the European standards.

Within the framework of the Strategy of Development of IT Society of the Republic of Serbia, as a part of its action plan, the strategic priorities, initiatives, objectives, spheres of competences, and time frames have been specifically defined, including E-education as well. The initiative is related to the education of citizens covering basic ICT skills, in line with the standards of computer literacy, which are compatible with ECDL (European Computer Driving License). The objective of this initiative is to train the citizens in the use of computers in their daily activities and to enable them to, by continuous improvement of their knowledge and skills, remain competitive in the conditions of ever changing IT society. While assessing the priorities and initiatives defined in the Strategy of Development of IT Society of the Republic of Serbia, Yugoimport-FDSP has, as a highly organized modern process-oriented business system, quickly noticed their particular importance both for the company itself and for the society as a whole. As early as



su definisani strateški prioriteti, inicijative, ciljevi, nadležnosti i rokovi koji uključuju i E-obrazovanje. Inicijativa se odnosi na obrazovanje građana za osnovne IKT veštine, u skladu sa nacionalnim standardima kompjuterske pismenosti koji su kompatibilni sa ECDL (European Computer Driving Licence). Cilj ove inicijative je opismeniti građane da koriste kompjutere u svojim svakodnevnim aktivnostima i omogućiti im da, kroz stalno usavršavanje svojih znanja i sposobnosti, ostanu konkurentni na osnovu budućeg informaciono-komunikacionog društva.

Evropska Unija (EU), a potom i UNESCO prihvatili su ECDL standard naveden u Strategiji razvoja informacionog društva Republike Srbije kao osnovni standard informatičke pismenosti. Nosilac nacionalne ECDL licence za Srbiju je JISA - Jedinstveni informatički Savez Srbije. Definisanje ECDL standarda kao osnove budućeg informaciono-komunikacionog znanja u Srbiji predstavlja jednu od strateških prekretnica za brže uključjenje našeg društva u savremene svetske tokove.

Ceneći prioritete i inicijative definisane u Strategiji razvoja informacionog društva Republike Srbije, Jugoimport-SDPR je, kao visoko organizovan savremeni procesno orijentisan poslovni sistem, brzo uočio njihovu veliku važnost kako za samo preduzeće, tako i za društvo u celini. Već 15. septembra 2006. godine, akreditacijom od strane Jedinstvenog informatičkog saveza Srbije, Jugoimport-SDPR je registrovan kao zvanični međunarodni ECDL test centar.

Sertifikacijom po zahtevima ISO 9001:2000 standarda početkom 2005. godine, projektovanjem originalnog procesno orijentisanog informacionog sistema u skladu sa zahtevima sistema menadžmenta kvalitetom i njegovom implementacijom u intranet baziran na visoko sofisticiranim, modernim, bezbednosno i funkcionalno pouzdanim IKT resursima, Jugoimport-SDPR je znatno unapredio efikasnost svog poslovanja što se neposredno odrazilo na povećanje profita i sveukupne vrednosti preduzeća. Sertifikacijom zaposlenih po ECDL standardu, opšte prihvaćenom standardu informatičke pismenosti u Evropi i svetu, Jugoimport-SDPR će dodatno unaprediti efikasnost svog poslovanja i povećati svoju sveukupnu vrednost.

Jugoimport-SDPR je održao konferencija za novinare 25. oktobra 2006. godine na kojoj je promovisana usvojena Strategija razvoja informacionog društva Republike Srbije. Time je Jugoimport-SDPR maksimalno podržao sve definisane prioritete i inicijative, a ujedno i promovisao svoj novootvoreni ECDL test centar. Pored Stevana Nikčevića, generalnog direktora Jugoimport-SDPR i Slobodana Krstića, rukovodioca Samostalnog odeljenja za informatiku i kvalitet, ujedno i koordinatora ECDL test centra Jugoimport-SDPR i člana žirija za dodelu nagrade DISKOBOLOS, pomenu toj konferenciji za novinare prisustvovali su Profesor Dr Marijana Vidas Bujanja, predsedavajući inicijative Elektronska jugoistočna Evropa pakta za stabilnost jugoistočne Evrope i koordinador radne grupe za izradu Nacionalne strategije razvoja informacionog društva, Zoran Savić, jedan od učesnika u kreiranju i izradi strategije, Đorđe Đukić, predsednik Jedinstvenog informatičkog saveza Srbije, Đorđe Ilić, direktor sektora sertifikacije SGS Beograd, kao i članovi

September 15, 2006, through accreditation by the Unique IT Association of Serbia, Jugoimport-FDSP was registered as the official international ECDL Test Center.

By our certification in compliance with the requirements of ISO Standards 9001 : 2000 in the beginning of 2005, by designing the original process-oriented IT system in accordance with the requirements of the quality management system and by its implementation in intranet based on highly sophisticated, advanced, security-wise and functionally reliable ICT resources, Jugoimport-FDSP has considerably improved the efficiency of its business operations, which has been directly reflected on the increase of profit and the overall values of the company. By certification of its employees according to the ECDL standard, the generally adopted standard of IT literacy in Europe and worldwide, Jugoimport-FDSP will additionally improve the efficiency of its business operations and increase its overall value.

Jugoimport-FDSP held a press conference on October 25, 2006, at which it promoted the adopted Strategy of Development of IT Society of the Republic of Serbia. Thereby Jugoimport-FDSP provided maximum support to all the defined priorities and initiatives and, at the same time, promoted its own newly opened ECDL Test Center. Apart from Stevan Nikcevic, the General Manager of Jugoimport-FDSP, and Slobodan Krstic, the Head of the Independent IT & Quality Department and, at the same time, the Coordinator of ECDL Test Center of Jugoimport-FDSP and a member of the jury awarding the DISKOBOLOS award, the Professor Dr Marijana Vidas Bujanja, the Chairperson of the initiative the Electronic Southeast Europe of the Stability Pact of Southeast Europe and the Coordinator of the Working Group for drafting of the National Strategy for the Development of IT Society, Zoran Savić, one of the participants in the creation and drafting of the Strategy, Djordje Djukic, the President of the Unique IT Association of Serbia, Djordje Ilic, the Director of the Certification Sector of SGS Belgrade, as well as the members of the jury granting the annual award DISKOBOLOS, which is awarded for the highest-quality implementation in the area of ICT in Serbia, were also present at the above press conference.

After having undertaken ECDL testing of its own employees, ECDL Test Center of Jugoimport-FDSP will start



žirija za dodelu godišnje nagrade DISKOBOLOS, koja se dodeljuje za najkvalitetnije implementacije u oblasti IKT u Srbiji.

Posle sprovedenog ECDL testiranja svojih zaposlenih, ECDL test centar Jugoimport-SDPR će početi sa prijemom prijava za ECDL testiranje svih zainteresovanih kandidata drugih pravnih lica i građanstva. Osim ECDL testiranja Jugoimport-SDPR tržištu nudi i kvalitetnu ECDL obuku, ECDL literaturu, audio-vizuelne CD za samostalnu i grupnu ECDL obuku kandidata, kao i mogućnost ostalih namenskih obuka i testiranja u skladu sa zahtevima i u dogovoru sa zainteresovanim licima.

Otvaranjem ECDL test centra Jugoimport-SDPR je učinio samo prvi korak kojim daje doprinos u strateškim opredeljenjima naše države u pogledu razvoja informacionog društva.

Imajući u vidu ostale važne prioritete i inicijative definisane u Strategiji razvoja informacionog društva Republike Srbije kao i ogromno iskustvo koje posedujemo u oblasti spoljnotrgovinskog prometa, veliki broj pouzdanih i cenjenih partnera u zemlji i inostranstvu, dobro organizovan i fleksibilan procesno orijentisan poslovni sistem i akumulirano znanje u oblastima informaciono-komunikacionih tehnologija, sistema menadžmenta kvalitetom i ostalih oblasti bitnih za efikasnu organizaciju savremenih poslovnih sistema, Jugoimport-SDPR planira i otvaranje novog profitno orijentisanog segmenta svog poslovanja koji se odnosi na sve aspekte ponuda domaćim i stranim partnerima iz domena informaciono-komunikacionih tehnologija i znanja i domena konsalting usluga u oblasti sistema menadžmenta kvalitetom u skladu sa svetskim standardima.

Jugoimport-SDPR je poznat po tome da usmerava svoje poslovanje na različita tržišta shodno vrsti programa, uslovljenih privrednim i ekonomskim okruženjem i specifičnim faktorima, karakterističnim za određene regione i pojedinačna tržišta. Uspostavljeni dosadašnji poslovni odnosi sa domaćim i stranim partnerima, zasnovani su na visokom stepenu obostranog poverenja i čvrstom kredibilitetu, i ulivaju poverenje našim budućim partnerima.

Informaciono-komunikacione tehnologije pružaju velike mogućnosti i imaju sveopšti uticaj na nacionalne privrede i globalnu konkurentnost. Jugoimport-SDPR će, u narednom periodu, pokušati da integriše sve ključne aktere na domaćem IKT tržištu u cilju zajedničkog partnerskog nastupa na svim tržištima koja mogu da obezbede IKT profit.

Spremnost Jugoimport-SDPR da upotpuni razvoj novim profitabilnim programima, na osnovu svoje dosadašnje uspešnosti i organizovanosti, dokaz je njegove prilagodljivosti savremenim tržišnim i ekonomskim uslovima i težnje da bude ne samo učesnik na tržištu već i stvarni kreator novog društveno ekonomskog okruženja.

Informaciono-komunikaciona tehnologija je jedinstvena po mnogo čemu, što ističe i Strategija razvoja informacionog društva Republike Srbije. Ona ima karakteristike tehnologije 'praga', s potencijalom da brzo promeni čitavu strukturu društva i preoblikuje način na koji je organizovana naša privreda.

Inicijativa vezana za promociju i unapređenje informacionog društva treba da omogući Srbiji da krene dalje u pravcu razvoja i da se potpuno integriše u globalnu ekonomiju mnogo brže nego korišćenjem bilo koje druge tehnologije.

receiving applications for ECDL testing of all interested candidates from other legal entities and the citizens. Apart from ECDL testing, Jugoimport-FDSP is also offering to the market high-quality ECDL training, ECDL literature, audio-visual CDs for individual and group ECDL training of candidates, as well as the possibility of other special-purpose training and testing in compliance with the requirements and upon agreement with the interested parties.

By opening the ECDL Test Center, Jugoimport-FDSP has made only the first step with which it is contributing to the strategic commitments of our state with respect to the development of IT society.

Bearing in mind the other important priorities and initiatives defined in the Strategy of Development of IT Society of the Republic of Serbia as well as the huge experience we have in the area of foreign trade, a large number of reliable and esteemed partners both in the country and abroad, well organized and flexible process-oriented business system, and accumulated knowledge in the areas of information and communication technologies, the quality management system, and other areas of importance for efficient organization of advanced business systems, Jugoimport-FDSP is also planning to open a new profit-oriented segment of its business operations, which is related to all aspects of the proposals to the domestic and international partners in the area of information and communication technologies and know-how and in the area of consulting services in the field of the quality management system in compliance with the international standards.

Jugoimport-FDSP is renowned for streamlining its business operations to various markets subject to the type of the program, conditioned by the industrial and economic environment and specific factors, characteristic for certain regions and individual markets. The so-far established business relations with the domestic and foreign partners, based on a high degree of mutual trust and solid credibility, inspire confidence to our future partners.

The information and communication technologies offer great opportunities and have an overall influence on the national economies and global competition. Jugoimport-FDSP will, in the forthcoming period, endeavor to integrate all the key stakeholders in the domestic ICT market for the purpose of joint partnership appearance in all the markets that can ensure ICT profit.

Readiness of Jugoimport-FDSP to complete its development with new profitable programs, on the basis of its so-far success and organization, is the evidence of its adaptability to the modern market and economic conditions and the endeavors not only to be a participant in the market but also the actual creator of a new social and economic environment.

The information and communication technologies are unique in many aspects, which is also stressed in the Strategy of Development of IT Society of the Republic of Serbia. They have the characteristics of the threshold technologies, with the potential to rapidly change the entire structure of the society and to reshape the way in which our economy is organized.

The initiative related to the promotion and improvement of IT society should enable Serbia to proceed further with the development and to fully integrate in the global economy much faster than by using any other technology.

PROTIVOKLOPNI SISTEM VOĐENE RAKETE BUMBAR

Piše
Aleksandar Lijaković

Osnovna namena i koncept sredstva

Protivoklopni sistem vođene rakete BUMBAR je lako prenosno protivoklopno sredstvo za napadna i odbrambena dejstva na malim daljinama. BUMBAR mogu koristiti najniže taktičke jedinice pešadije u svim borbenim situacijama uz sve prednosti zaklanjanja koje omogućava konfiguracija terena, fortifikacijski objekti i urbana sredina. Mogućnost lansiranja iz zatvorenog prostora daje BUMBARU atribut pravog odbrambenog oružja. Domet do 600 m uz mogućnost povećanja do 1000 m, odlično je prilagođen zoni neposredne protivoklopne odbrane pešadije.

U poređenju sa ručnim bacačima raketa maksimalni domet rakete BUMBAR je dvostruko ili čak trostruko veći, uz ukupnu masu i ukupnu fleksibilnost taktičke upotrebe koja je uporediva sa ručnim lanserima nevođenih raketa i uz efikasnost na cilju koja je uporediva sa teškim sistemima vođenih raketa velikog dometa. Domet sistema BUMBAR praktično pokriva minimalni domet protivoklopnih raketa za velike daljine na kome je verovatnoća pogađanja cilja ovih sistema srazmerno mala.

BUMBAR je prvenstveno protivoklopni sistem, ali njegove osobine omogućavaju izvršenje mnogo šireg spektra borbenih zadataka. Višenamenska upotreba sistema ostvarena je primenom alternativnih bojnih glava za uništavanje neprijateljskih bunkera, otpornih tačaka, utvrđenih objekata i pešadije u poljskim zaklonima. Borbena autonomija i laka prenosivost, zajedno sa fleksibilnošću taktičke upotrebe, mogućnost dejstva iz zatvorenog prostora, uz visoku efikasnost primenjenih bojnih glava, čini BUMBAR pogodnim za

BUMBAR (BUMBLE BEE) ANTI-TANK MISSILE SYSTEM

By
Aleksandar Lijaković

Weapon application and main concept

Anti-armor guided missile system BUMBAR is a light-weight portable offensive and defensive anti-armor weapon for close ranges. BUMBAR may be operated by the lowest infantry tactical units in all combat situations, by making use of cover afforded by terrain configuration, fortified objects and urban environment. Capability of launching in enclosed spaces earns BUMBAR the attribute of a truly defensive weapon. Its range of 600 meters, with possible increase to 1000 meters, is perfectly suited for infantry close range anti-tank defenses.

Compared to hand-held rocket launchers, maximum range of BUMBAR missile is two to three times greater, its total mass and overall flexibility in tactical use are comparable to unguided rocket launchers and its target effectiveness is comparable to large, long-range guided missile systems. Effective range of the system BUMBAR practically covers the minimum range of long-range anti-armor missiles, when their target hit probability is comparatively poor.

BUMBAR is primarily an anti-armor system, its properties, however, allow engaging within a much broader spectrum of combat missions. Multi-purposeness of the system is achieved by application of alternative warheads designed for annihilation of hostile bunkers, points of resistance, fortified objects and infantry in field covers. Highly portable and autonomous in combat, flexible for use in various tactical situations, able to fire in enclosed spaces and provided with highly effective warheads, system BUMBAR is also well suited for anti-terrorist operations, particularly in urban areas. Two additional tactical advantages, not related to conventional anti-armor combat, deserve special mention as particularly prominent in urban anti-terrorist engagements. These are: minimum effective range of only 60 m at which missile can be effectively guided to target and high probability of hitting fast, relatively small targets (light combat vehicles, armed and armored jeep-type vehicles) at short ranges (up to 200 m). Principle of direct guidance along the line of sight to target, comprises heavy warhead (of comparatively greater mass than warheads of so-called controllable anti-armor missiles that impact the armor from upper hemisphere) and provides greater effectiveness against fortified objects, an important factor for anti-terrorist operations.



primenu u antiterorističkim operacijama, posebno u urbanim sredinama. Treba naglasiti još dve taktičke prednosti BUMBARA koje, osim u klasičnoj protivoklopnoj borbi, posebno dolaze do izražaja u savremenim antiterorističkim dejstvima u urbanim sredinama. To su kratak minimalni domet (60 m) na kome se raketa može efikasno voditi do cilja, kao i velika verovatnoća pogađanja brzih relativno malih ciljeva (laka borbena vozila, naoružana i oklopljena terenska vozila) na kratkim dometima (do 200 m); Princip direktnog vođenja do cilja po nišanskoj liniji, koji podrazumeva primenu teške bojne glave (srazmerno veće mase nego u slučaju bojnih glava PO raketnih sistema razvijenih na bazi takozvanih upravljivih raketa, kod kojih se primenjuju lakše bojne glave koje dejstvuju na oklop iz gornje polusfere) omogućava veću efikasnost protiv utvrđenih objekata, posebno značajnu u antiterorističkoj borbi.

Sa stanovišta odnosa cena - efikasnost, primenjeni koncept omogućava da cena BUMBARA bude znatno niža od cene sistema baziranih na upravljivim raketama iste kategorije dometa, a uz veću verovatnoću pogađanja koju omogućava vođenje rakete. Sistemi 3. generacije, kod kojih su primenjene glave za samonavođenje, značajno su skuplji od sistema baziranih na upravljivim raketama.

Taktička upotreba

Oružjem BUMBAR rukuje jedan vojnik iz dvočlanog protivoklopnog tima. Drugi vojnik nosi, u zavisnosti od taktičke situacije, jednu, dve ili tri rezervne rakete u transportno-lansirnim cevima. Na ciljeve do borbenih daljina od 300 m raketa se može lansirati sa ramena strelca, a preko 300 m sa postolja ili oslonca. Raketa se lansira sa ramena, u stojećem ili klečećem položaju, u kojima strelac koristi raspoloživi prirodni oslonac ili, u slučaju urbane sredine, prozor, otvor u zidu ili slično. Mogućnost lansiranja sa ramena znatno proširuje fleksibilnost taktičke upotrebe BUMBARA, skraćuje vreme dejstva, te doprinosi dinamičiji borbenog dejstva. U saglasnosti sa dinamikom dejstva jeste i kratko vreme zamene lansirne cevi posle lansiranja sa novom raketom u lansirnoj cevi.

From the point of cost-effectiveness, the concept applied enables considerably lower price of the BUMBAR miss compared to prices of controllable missile systems of similar range. AT systems of 3rd generation, equipped with homing heads are, in turn, significantly more expensive than controllable missile systems.

Tactical use

One soldier of the two-member antitank team operates the weapon BUMBAR. The other team member carries, depending on tactical situation, one, two or three spare missiles in their transporting/launching tubes. At combat ranges to 300 m, missile may be shoulder launched, for distances exceeding 300 m launching is from the stand. Missile is shoulder launched in standing or kneeling position when operator uses available natural support or, if in a settlement, he takes support of a window, wall opening, etc. The ability of shoulder launching considerably expands flexibility of tactical uses, reduces firing time and contributes to higher combat dynamics. In line with the dynamics of BUMBAR engagement is short time needed to replace the launching tube with a new tube with missile.

Shoulder launching enables effective missile guidance up to 300 m in range, conditioned by stability of the line of sight and limitations of operator. The use of stand will stabilize the line of sight up to 600 m (resp. to 1000 m for the latest version of the missile). Application of bipod or tripod stand and mechanism for target tracking in azimuth and elevation allows effectiveness at maximum range without use any natural of other support, by firing in sitting, kneeling or prone position.

The missile is guided to target by means of guidance and launching mechanism. This device in traveling position is carried by operator, together with bipod/tripod stand, in special knapsack. Depending on tactical situation, missile operator can carry one or two extra missiles, in addition to the knapsack. Thus a two-man team carries up to 5 missiles in combat, achieving high combat autonomy. Before firing, operator attaches the guidance and launching unit to the

tube with missile. In respect of the BUMBAR flexibility of tactical use, significant quality is introduced by image projection from guidance/launching unit's TV camera on operator's eyepiece, located on his helmet. Image is transferred by cable, permitting the operator to assume comfortable position of his head and better view of combat situation immediately prior to missile firing, to make better selection of available supports or covers, including cover from direct small arms fire. Together with minor disclosing of firing position and capability to fire in enclosed area, all these factors increase the probability of survival of missile operator.

Sub-title:

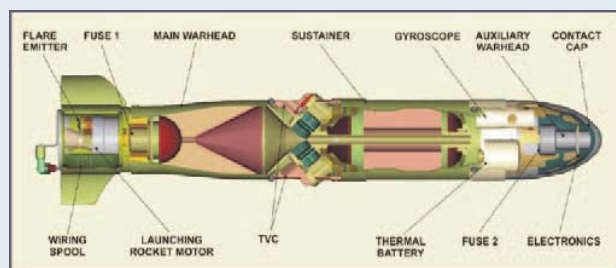
Description of BUMBAR system

The BUMBAR system is based on improved semiautomatic command guidance system (SAC-LOS). After launching, operator only needs to keep reticle of the sight aligned with the target



Lansiranje sa ramena omogućava efikasno vođenje rakete do daljina od 300m, što je uslovljeno stabilnošću nišanske linije, odnosno ograničenjima operatora. Korišćenjem oslonca nišanska linija se stabilizuje i daljina dejstva se povećava na maksimalnih 600 m (odnosno 1000 kod nove varijante rakete). Primena lansirnog postolja sa dvonošcem ili tronošcem, sa mehanizmom za praćenje cilja po azimutu i elevaciji omogućava ostvarivanje dejstva na maksimalnoj daljini u uslovima nepostojanja prirodnih ili drugih oslonaca iz sedećeg/klečećeg ili ležećeg položaja.

Raketa se do cilja vodi pomoću uređaja za vođenje i lansiranje. Ovaj uređaj u marševskom položaju prenosi strelac zajedno sa dvonožnim/tronožnim postonjem, u posebnom rancu. U zavisnosti od taktičke situacije strelac, pored ranca, može da nosi jednu do dve rakete, tako da borbeni dvočlani tim u borbi prenosi do 5 raketa, čime se postiže visoka borbeno autonomija. Kada strelac želi da gađa cilj, on postavlja uređaj za vođenje i lansiranje na raketu u lansirnoj cevi. Sa stanovišta fleksibilnosti taktičke upotrebe BUMBARA, značajan kvalitet unosi rešenje projektovanja slike sa TV kamere uređaja za vođenje i lansiranje na monitor na okularu strelca smešten na borbenom šlemu. Prenos slike izvodi se kablom i omogućava udobniji položaj glave strelca, bolji pregled borbene situacije neposredno pre izvođenja gađanja i širu mogućnost korišćenja raspoloživih oslonaca, odnosno zaklona, uključujući i zaklon od neposredne streljačke vatre. Zajedno sa malim demaskiranjem i mogućnosti lansiranja iz zatvorenog prostora, ova osobina doprinosi povećanju verovatnoće preživljavanja strelca.



and the missile will fly along the line of sight until impact on target. By guidance method, BUMBAR belongs to systems of 2nd generation, however it possesses two property features available to 3rd generation anti-armor missile systems. These are "soft" launching with low muzzle velocity that enables missile launching in closed area and minor unmasking effect of the firing position, as well as guidance/launching locator protection from jamming achieved with the use of CCD matrix sensors, fast image processing computer and robust missile tracer recognition algorithm. Application of appropriate software for signal processing in guidance and launching unit and tracer computer determines missile's position while rejecting jamming. TV camera operation is synchronized with the guidance and tracer system by hybrid electrical circuit in the missile during two second prior to missile launch. Micro-cable for guidance commands to the missile has been retained for effective protection from jamming and lower cost of the missile.

Anti-armor guided missile system BUMBAR uses tandem shaped charge warhead. Warheads are spaced by four cal-



Opis sistema BUMBAR

Sistem BUMBAR zasnovan je na primeni usavršenog polu-automatskog komandnog sistema vođenja (SACLOS). Nakon lansiranja potrebno je da strelac samo drži končanicu nišan-skog uređaja na željenoj tački cilja, dok raketa leti oko nišanske linije do susreta sa ciljem. Prema načinu vođenja, BUMBAR spada u sisteme druge generacije, ali poseduje dve osobine protivoklopnih sistema treće generacije. To su „meki“ način lansiranja rakete malom početnom brzinom koji omogućava dejstvo iz zatvorene prostorije i mali demaskirajući efekat na vatrenom položaju, kao i zaštita uređaja za vođenje i lasiranje rakete od ometanja ostvarena je primenom CCD matričnih senzora brzog računara za obradu slike i robustnog algoritma za prepoznavanje trasera rakete. Primenom odgovarajućeg softvera za obradu signala u računaru uređaja za vođenje i lasiranje i trasera određuje se položaj rakete uz odbacivanje smetnji. Sinhronizacija rada TV kamera uređaja za vođenje i lasiranje i trasera vrši se u trajanju od dve sekunde pre lansiranja rakete. Mikrokabl za prenos komandi na raketu je zadržan zbog efikasne zaštite od ometanja i smanjenja cene rakete.

Protivoklopna vođena raketa sistema BUMBAR, ima tandem kumulativnu bojnu glavu. Rastojanje od četiri kalibra između bojnih glava, postignuto je postavljanjem osnovne bojne glave iza marševskog raketnog motora.

Minimalna daljina gađanja od 60m određena je zonom bezbednosti operatora od dejstva tandem kumulativne bojne glave. Uvođenje rakete u tunel vođenja na rastojanju od 60 m ostvareno je snažnim sistemom za upravljanje vektorom potiska marševskog motora smeštenim u blizini težišta rakete. Novo rešenje sistema za upravljanje vektorom potiska omogućava raketi da „oštro“ manevriše i pri malim brzinama (u odnosu na poznate rakete druge generacije poluprečnik krivine putanje je manji osam puta u prvih 100 m leta). Marševski motor se pali pošto raketa dejstvom startnog motora pređe rastojanju od približno 3 metra od lansera.

Pošto je pravilno usmerio oruđe postavljanjem cilja u centar končanice nišan-skog sistema, strelac treba da pritisne okidač držeći cilj sve vreme u centru končanice, dok raketa ne pogodi cilj. Uređaj za vođenje i laniranje određuje putan-

ibers, with primary warhead positioned behind sustainer rocket motor.

Minimum fringe range of 60m is determined by safety factor for operator from effects of tandem shaped charge warhead. Missile enters the guidance tunnel at 60 m from the muzzle by powerful guidance system controlling thrust vector of sustainer motor, situated close to missile's center of gravity. Novel solution of guidance by control of the thrust vector enables sharp maneuvers even at low speeds (compared to familiar 2nd generation missiles, trajectory radius of turn is eight times tighter during the first 100 m of flight).

Sustainer motor fires at about 3 m from launch tube, the distance reached by ejection motor.

After proper aiming, with target in the center of sighting device reticle, operator depresses the trigger and keeps the target in the center until missile impact. Guidance and launching mechanism determines the trajectory from detected IR energy emitted by tracer mounted at the missile rear. Information on missile trajectory are compared to viewing line set by operator while aiming the weapon on target. Should missile deviate from viewing line, equipment will generate control signal that corrects the trajectory, sent via micro cable attached to missile. Missile is controlled by a pair of interceptors for every nozzle of sustainer motor. Activation of interceptors in sustainer motor exhaust jets during variable periods ensures

minimum missile deviations from the line of target viewing. On impact, contact cap at missile tip is short-circuited, first activating the fuze of secondary

warhead, then of the primary warhead. Secondary warhead is designed to neutralize tank reactive armor, enabling effective penetration of main armor by shaped charge jet of primary warhead. Upon completing missile guidance, operator removes guidance/launching mechanism from launching tube, attaching it to new tube with missile.

The BUMBAR system consists of the weapon, test equipment with spare tools and accessories, training kit and packing.



ju na osnovu detektovane IC energije koju emituje traser smešten na zadnjem delu rakete. Podaci o putanji rakete porede se sa linijom viziranja koju određuje strelac usmeravanjem oružja prema cilju. Ukoliko raketa odstupa od linije viziranja (centrar slike), uređaj generiše upravljačke signale za korekciju putanje koji se šalju mikrokablom prema raketi. Raketom se upravlja sa jednim parom interceptora na svakom od mlaznika marševskog motora. Unošenjem interceptora u izduvne mlazve marševskog motora u različitim trajanjima obezbeđuje se minimalno odstupanje rakete od linije viziranja cilja. Pri udaru u cilj kontaktna kapa rakete se kratko spoji i aktivira upaljač prvo pomoćne, a zatim osnovne bojne glave. Pomoćna bojna glava treba da neutrališe eksplozivni reaktivni oklop tenka i time omogućava efikasno dejstvo kumulativnog mlaza osnovne bojne glave rakete na osnovni oklop tenka. Kada je završeno vođenje rakete, strelac skida uređaj za vođenje i lansiranje sa lansirne cevi i postavlja ga na cev sa novom raketom.

Sistem BUMBAR sastoji se od oružja, merno-ispitne opreme sa rezervnim alatom i priborom, opreme za obuku i opreme za pakovanje

Značajna tehnička dostignuća razvijena i primenjena na sistemu BUMBAR"

- **Tandem kumulativna bojna glava za uništenje savremenih tenkova i tenkova sa ERO**
- **Optoelektronski digitalni TV koordinator rakete** za koji su razvijeni novi računari i softver za vođenje i upravljanje raketom
- **Zaštita koordinatora od ometanja IC mamcima** primenom robustnih algoritama za frekventnu, amplitudsku, položajnu i diferencijalnu diskriminaciju smetnji, koji rade u sinhronizaciji sa IC traserom rakete
- **Savremena rešenja bloka elektronike rakete**, primenom mikroprocesora i namenski razvijenih konektora interfejsa rakete i lansirne cevi
- **Novo rešenje nišanskog durbina sa CCD TV kamerom i LCD** čime su otklonjeni ergonomski problemi i olakšana tehnologija njegove izrade
- **Visoko efikasan sistem za upravljanje vektorom potiska rakete** koji 25% aksijalne komponente potiska pretvara u bočnu upravljačku silu rakete
- **Robustno rešenje pogonske grupe rakete** otporno na temperaturske varijacije ambijenta u operativnom temperaturskom području od -30°S do 50°S
- **Novo rešenje slobodnog žiroskopa** koji se zaleće energijom gasa pod pritiskom iz gasogeneratora, za PO rakete čiji let traje do 10s
- **Novi mikrokabl visoke prekidne čvrstoće**, od ugljeničnih vlakana, za dozvučne brzine rakete do 300 m/s
- **Savremeno rešenje lansirne cevi i njoj pripadajućih ele-**

Significant advanced technical features developed and incorporated on BUMBAR system



- **Tandem shaped charge warhead capable of destroying modern tanks and tanks equipped with explosive-reactive armor**
- **Optoelectronic digital missile TV coordinator** comprising specially developed computers and missile guidance and control software
- **Coordinator protected from IR flare jamming** by application of robust algorithms for frequency, amplitude, position and differential discrimination of jamming, operating in synchronization with missile IR tracer

- **Advanced missile electronics** circuitry using micro-processors and specially developed missile to launch tube interface connectors

- **Novel solution of sighting telescope with CCD TV camera and LCD** eliminates ergonomic problems and facilitates its manufacturing technology

- **Highly efficient missile thrust vector control system** converting 25% of thrust axial component into lateral missile control force

- **Robust solution of missile propulsion** resistant to variations of ambient temperatures, operations within the range of -30°C to 50°C

- **Novel solution of free gyro spinning** under pressure from gas generator, suitable for AT missiles with time of flight up to 10 s

- **New micro cable of high tensile strength**, made of carbon fibers, suitable for subsonic speeds to 300 m/s

- **Advanced launching tube and accessories** made of lightweight materials tube also serves for missile storing and transport



menata od lakih materijala koja je ujedno i kontejner za skladištenje i transport rakete

Predstojeća usavršavanja sistema:

Faza 1. Integracija termovizijske kamere; povećanje dometa na 1000 m; razvoj novih bojnih glava - termobaričke i probojno-rušeće, namenjene za dejstvo na utvrđene objekte; uvođenje pokretne končanice sa automatskim praćenjem cilja u lokator uređaja za vođenje i lansiranje

Faza 2. Integracija glave za samonavođenje

Uređaj za vođenje i lansiranje ima sledeće karakteristike:

- IC senzor CCD TV kamera
- spektralno područje 0,7-1,1 mikrometara
- vidno polje širokougaonog objektivna 10
- ugao nadvišenja ose širokougaonog objektivna 6'
- vidno polje uskougonaog objektivna 1,2
- osa uskougonaog objektivna paralelna sa osom nišanskog durbina
- vidno polje nišanskog durbina 12
- uvećanje nišanskog durbina 3 puta

Taktičko- tehničke karakteristike sistema BUMBAR

- komandno vodena raketa druge generacije sa mikrokablom za prenos komandi
- kalibar rakete 136mm
- minimalni domet 60m
- maksimalni domet..... 600m (u razvoju 1000 m)
- vreme leta do cilja na 600 m..... 4,6 s
- verovatnoća pogađanja nepokretnih i pokretnih ciljeva veća od 95%
- probojnost bojne glave preko 1000mm
- masa lansirnog sistema na vatrenom položaju ... 18 kg
- dužina oruđa u marševskom položaju 1164mm
- broj poslužilaca dva
- mali demaskirajući efekat na vatrenom položaju
- mogućnost gađanja iz zatvorene prostorije
- mogućnost gađanja noću
- masa rakete u transportno-lasirnoj cevi 14 kg
- masa rakete 12 kg
- bojna glava tandem kumulativna
- kalibar osnovne bojeve glave 136mm
- kalibar pomoćne bojeve glave 55mm
- maksimalna brzina rakete 250m/s
- početna brzina rakete 18m/s
- vreme od povlačenja okidača do pogađanja cilja na daljini od 600 m manje od 5 s
- masa tronošca 4 kg
- masa uređaja za vođenje 4 kg
- masa lansirne cevi..... 2 kg
- ugao nadvišenja ose LC..... 10°

Follow-on system upgrading:

Phase 1: Integration of thermal imaging camera, extended range to 1000 m; development of new warheads – thermobaric and concrete-piercing-demolition; new warheads designed for fortifications; introduction of moving reticle with automatic target tracking for locator of missile guidance/launching unit.

Phase 2.: Integration of homing head of 3rd gen. missile

Guidance and launching equipment of the following specifications:

- IR sensor CCD TV camera
- Spectrum range.....0,7-1,1 micrometers
- Wide angle lens field of view10
- Wide angle lens superlevation angle..... 6'
- Narrow angle lens field of view1,2
- Narrow angle lens axis parallel to sighting telescope axis
- Sighting telescope field of view 12
- Sighting telescope magnification.....x 3

Tactical-technical specifications of the BUMBAR system

- Command guidance missile of 2nd generation with micro cable for transfer of commands
- Missile caliber 136mm
- Minimum range 60m
- Maximum rang..... 600m (1000 m under development)
- Time of flight to target at 600 m 4,6 s
- Hit probability for stationary and moving targetsgreater than 0,95
- Warhead penetrationover 1000mm
- Launching system mass in firing position 18 kg
- Weapon length in traveling position 1164mm
- Number of operators..... two
- Low disclosing signature at firing position
- Capable of firing in closed spaces
- Night firing capability
- Mass of missile in transporting/launching tube.. 14 kg
- Missile mass 12 kg
- Warheadtandem, shaped charge
- Primary warhead caliber 136mm
- Secondary warhead caliber..... 55mm
- Missile maximum velocity250m/s
- Missile muzzle velocity.....18m/s
- Time from trigger depressing to impact on target at 600m less than 5 s
- Mass of tripod 4 kg
- Mass of guidance/launching mechanism 4 kg
- Mass of launching tube 2 kg
- LC axis superlevation angle 10|0

IZBOR RADASKOG POLOŽAJA POMOĆU RAĆUNARA

Piše
puk. Jolkić Slobodan, dipl. ing.

Savremeni borbeni uslovi sistema protivzračne odbrane (PVO) nameću izuzetno složene opšte i posebne zahteve, posebno podsistemi vazdušnog osmatranja i javljanja (VOJ). Jedan od osnovnih zadataka projektovanja sistema protivzračne odbrane jeste projektovanje mreže radarskih položaja za borbeni raspored jedinica Voj. Zadatak postaje izuzetno složen ako se postave strogi taktičko-tehnički zahtevi pod-sistemu za vazdušno osmatranje i navođenje (VOJIN). Jedan od najstrožih zahteva jeste otkrivanje u realnom vremenu i neprekidno praćenje ciljeva malih refleksnih površina, na izuzetno malim visinama, na daljinama koje omogućavaju optimalnu reakciju sistema PVO. Zadatak postaje još složeniji ako se zna da je osnovni uslov za preživljavanje sistema Voj u ratnim dejstvima manevar jedinica Voj pokretom. Ovaj zahtev višestruko povećava broj radarskih položaja (RP), odnosno uslojava potrebnu mrežu radarskih položaja za date uslove osmatranja i praćenja.

Projektovanje mreže radarskih položaja

Primarni parametri koji diktiraju projektovanje mreže su zakrivljenost zemljine površine, profil reljefa, refleksna površina cilja i tipovi raspoloživih antenskih sistema radara. Sekundarni parametri su trenutno stanje ispravnosti radarskih sistema i stanje atmosfere. Od ovih parametara neposredno zavisi broj radarskih položaja i radara za zadate taktičko-tehničke zahteve. Zakrivljenost zemljine površine kao parametar koji određuje mrežu radarskih položaja utiče tako da se ciljevi ispod radarskog horizonta ne mogu osmatrati. Iz formule za pad zemljine krivine može se izračunati da se na daljini od 100 km ne mogu videti ciljevi visine ispod 800 m, odnosno 591 m, ako se u obzir uzima povijanje elektromagnetnih talasa (radaski horizont). Ako pretpostavimo da je zona za koju se projektuje mreža radarskih položaja idealno ravničarska, vidimo da već prvi parametar traži više radarskih položaja ako je zahtevana visina otkrivanja mala, a daljina otkrivanja relativno velika.

Kako se taj odnos kreće pokazaćemo na sledećim primerima. Neka je površina zahtevane zone otkrivanja na visinama 600 m recimo 90000 km² (300 km x 300 km), površina koju jedan radar pokriva za tu visinu je manje od krug prečnika 200 km i površine 31400 km². U taktici Voj se umanjuje na 2,6 zbog potrebe preklapanja radarskog polja, pa je površina za

COMPUTER-AIDED SELECTION OF RADAR POST MODERNIZATION PROGRAMME

By
Col. Slobodan Jolkić, B.Sc

The current combat conditions of air-defense systems (ADSs) impose particularly complex overall and special requirements, particularly for the subsystems of air surveillance and reporting (AS&R). One of the basic tasks when designing an air-defense system is to design the system of a net of radar posts for combat deployment of AS&R units. This task becomes particularly complex if strict tactical and technical requirements are set for the subsystem of air surveillance and guidance (AS&G). One of the strictest requirements is the detection in real time and continuous tracking of targets of small radar cross-sections, on particularly low altitudes, at ranges that enable optimal response of ADS systems. This task becomes even more complex if it is known that the basic condition for survival of an AS&R system in military actions is the maneuver of AS&R units by movement. This requirement multiply increases the number of radar posts (RP), i.e. makes more complex the required net of radar posts for the given conditions of surveillance and tracking.

Designing the Net of Radar Posts

The primary parameters that dictate designing of the net are the curvature of the earth's surface, the cross-section of the relief, radar cross-section of the target, and types of the available radar antenna systems. The secondary parameters are the current proper operating state of the radar systems and the state of the atmosphere. The number of radar posts and radars directly depends on the above parameters for the set tactical and technical requirements. The curvature of the earth's surface as the parameter, which defines the net of radar posts, has such an influence that the targets below the radar horizon cannot be surveilled. From the formula for the decline of the earth's curvature, it is possible to calculate that, at a range of 100 km, targets at an altitude below 800 m, or 591m, cannot be seen if bending of the electromagnetic waves is taken into account (radar horizon). If we assume that the zone for which the net of radar posts is designed is ideally lowland, we see that already the first parameter requires more radar posts if the required altitude of detection is low, and the detection range is relatively long.

We shall demonstrate how this relationship works on the following examples: Let us assume that the square area of

jedan radar u stvari 26000 km². Iz odnosa površina zone i površine koju radar pokriva dobija se potreban broj radara. U ovom slučaju 3, odnosno 4 radara za pouzdano prekrivanje. Ako bi zahtev bio da visina otkrivanja bude 147 m, u tom slučaju za istu zonu trebalo bi nam 13 radara.

Konfiguracija terena, odnosno reljef kao drugi primarni parametar, takođe utiče na složenost mreže radarskih položaja povećanjem broja radara, zbog stvaranja radarskih maski (Slika broj 1).

U taktici VOJ, broj radarskih položaja u odnosu na ravničarski teren, uvećava se za 20-25% zbog uticaja reljefa, što, u našem primeru, sada iznosi oko 16. Refleksna površina cilja, odnosno taktičko-tehnički zahtev da se ciljevi malih refleksnih površina otkrivaju i prate na optimalnoj daljini, takođe značajno utiče na broj radarskih položaja u mreži. U to se možemo uveriti analizom vertikalnog dijagrama zračenja proračunatog na osnovu radarske jednačine gde se kao promenljivi parametar uzima refleksna površina cilja.

Proračunat dijagram zračenja dat je na slici 2. Sa slike se vidi da ako cilj leti na visini 1000 m refleksne površine 15-20 m², on će biti otkriven na daljini 125 km. Ako je refleksna površina samo 5 m², onda će cilj biti otkriven na 65 km.

Tip antenskih sistema radara takođe utiče na broj radarskih položaja.

Antenske sisteme koji koriste refleksnu površinu okolnog tla za formiranje dijagrama zračenja ne možemo postaviti bilo gde, već tamo gde nam reljef dozvoljava. Stoga možemo zaključiti da je za jednostruko prekrivanje, bez rezervne radske mreže i mreže koja ne vrši manevar pokretom, potrebno odrediti relativno veliki broj radarskih položaja u zadatoj zoni osmatranja za relativno skromne taktičko-tehničke zahteve. Uključimo li strožije zahteve, posao projektovanja radarske mreže višestruko se uvećava.

Do skoro su komandne jedinice VOJ mrežu radarskih položaja i radarsku mrežu projektovale i analizirale klasičnom metodom koja zahteva dugotrajno računanje i obimno crtanje horizontalnih dijagrama otkrivanja. U toku agresije, zbog izuzetne dinamike manevra pokretom i čestog narušavanja mreže vatrenim dejstvima, metoda klasičnog određivanja radarskih položaja praktično je dala vrlo slabe rezultate. Uspostavljanje narušene radarske mreže u ratu uglavnom se baziralo na iskustvima Komandi jedinica VOJ stečenim u miru.

the required zone of detection at the altitudes of 600m is, let's say, 90,000 km² (300 x 300 km), the square area covered by one radar for that altitude is a circle of a diameter of 200 km and of an area ($P = r^2 \pi$) of 31,400 km². In AS&R tactics, π is reduced to 2.6 because of the need to coincide the radar field and, therefore, the square area for one radar is actually 26,000 km². The required number of radars is obtained from the ratio between the square area of the zone and the area covered by the radar. In this case, 3 or 4 radars for reliable coverage. If the requirement for the altitude of detection were 147 m, in such a case, we would need 13 radars for the same zone.

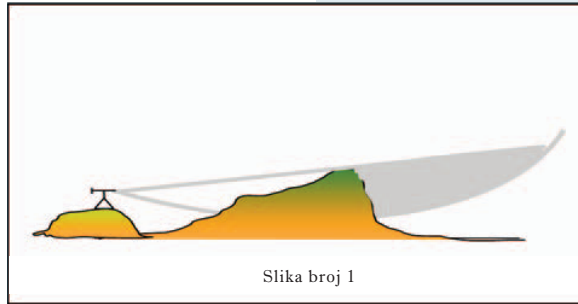
The terrain configuration, or the relief as the second primary parameter, also influences the complexity of the net of radar posts by increasing the number of radars, because of creation of radar dead zones (Figure No. 1).

In AS&R tactics, the number of radar posts with respect to the lowland terrain, is increased by 20-25% because of the influence of the relief, which is now around 16 in our case. The target radar cross-section, or the tactical and technical requirement for the targets of small radar cross-sections to be detected and tracked at an optimal range, also has a significant influence on the number of radar posts within the net. We can ascertain this by the analysis of the vertical coverage diagram calculated on the basis of a radar equation in which the target radar cross-section is taken as a variable parameter.

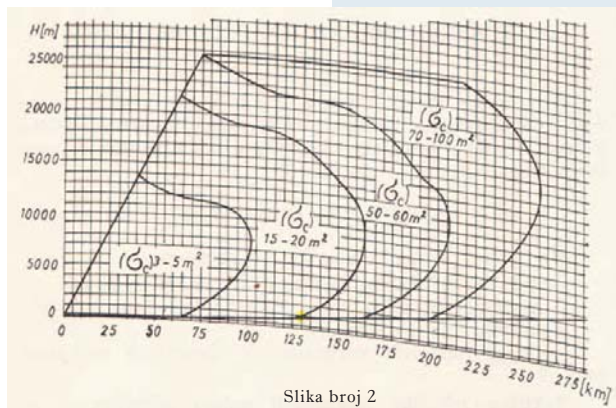
The calculated coverage diagram is given in Figure 2. The Figure shows that if a target flies at an altitude of 1,000 m, and has a radar cross-section of 15-20m², it will be detected at a range of 125 km. If the radar cross-section is only 5 m², then the target will be discovered at a range of 65 km.

The type of the radar antenna systems also has influence on the number of radar posts. The antenna systems that use the reflexive surfaces of the surrounding ground to form the coverage diagram cannot be put anywhere, but only there where the relief permits us to do so. Therefore, we may conclude that for single-layer coverage, without a standby radar net and the net that is not maneuvering by movement, it is necessary to determine a relatively large number of radar posts in the given surveillance zone for relatively modest tactical and technical requirements. If we include stricter requirements, the job of designing a radar net is multiply increased.

Until recently, the command units of AS&R had designed and analyzed the net of radar posts and radar network by applying the conventional method that requires a long-time



Slika broj 1



Slika broj 2

Klasična metoda određivanja radarskog položaja

Klasična metoda određivanja radarskog položaja zasniva se na određenim geografskim merenjima na karti i terenu na osnovu kojih se računaju i iscrstavaju horizontalni dijagrami otkrivanja za date visine. Sam proces započinje grubom procenom reljefa zone i izvidanjima na terenu radi određivanja potencijalnih radarskih položaja. Nakon donošenja odluke o lokaciji položaja, komanda pristupa izradi horizontalnih dijagrama mogućnosti otkrivanja za najmanje četiri do pet visina. Pri tom, horizontalni dijagrami otkrivanja vrše se za dva do tri tipa radara. Dijagrami se rade tako što se na svakih 2 do 4 stepena u krugu od 360° na geografskoj karti snima vertikalni presek reljefa. Očitani podaci unose se na dijagram radarskog horizontanta na kome se iscrstava vertikalni presek reljefa. Da bi se dobili podaci vertikalnog preseka reljefa za 360° potrebno je gornji postupak ponoviti najmanje 72 puta ako se snimanje vrši na svakih 5°.

Na iscrstani vertikalni presek reljefa, u određenom azimutu, postavlja se vertikalni dijagram zračenja crtan na paus papiru (Slika 6) za određeni tip radara i zadatu refleksnu površinu cilja. Pomoću ovih podataka crta se horizontalni dijagram mogućnosti otkrivanja radara sa određenog radarskog položaja (Slika 7).

Iz izloženog postupka može se oceniti obim posla koji komande jedinica VOJ treba da urade da bi se došlo do dijagrama mogućnosti otkrivanja jedne radaraske mreže koristeći klasičnu metodu (Slika 5).

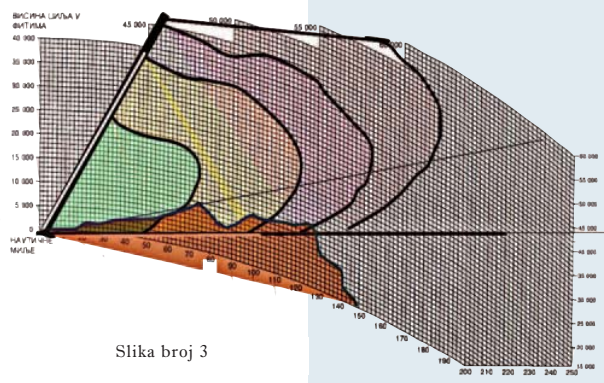
Takođe se može naslutiti obim posla kada jedinice vrše manevar pokretom, ili se isključuju iz rada iz bilo kojih razloga. U tom slučaju, postupci se moraju ponovljati i iscrstavati novi dijagrami na osnovu kojih komandant donosi odluke.

calculation and extensive drawing of horizontal coverage diagrams. In the course of an aggression, because of the particular speed of the maneuver by movement and frequent disruption of the net by fire actions, the method of conventional determination of radar posts has yielded practically very poor results. Recovery of a disrupted radar net in war was predominantly based on the experiences of the commands of the AS&R units acquired in peacetime.

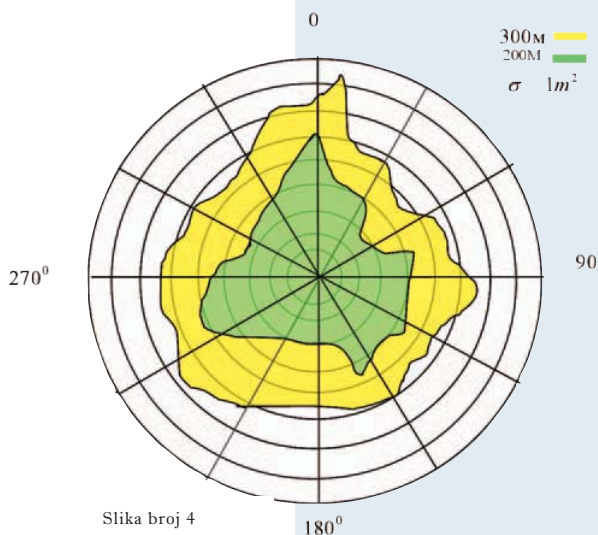
Conventional Method of Determining a Radar Post

The conventional method of determining a radar post is based on certain geographic measurements on the map and in the field on the basis of which the horizontal coverage diagrams are calculated and drawn for the given altitudes. The very process starts with rough assessment of the relief of the zone and reconnaissance in the field for the purpose of determining the potential radar posts. After brining the decision on the location of the post, the command proceeds with the elaboration of the horizontal probability coverage diagrams for minimum four to five altitudes. Thereby, the horizontal coverage diagrams are done for two to three types of radars. The diagrams are made in such a way that at every 2 to 4 degrees within the circle of 360° on the geographic map, the vertical cross-section of the relief is recorded. The readout data are entered in the diagram of radar horizon in which the vertical cross-section of the relief is drawn. In order to obtain the data of the vertical cross-section of the relief for 360°, it is necessary to repeat the above procedure minimum 72 times if recording is done at every 5°.

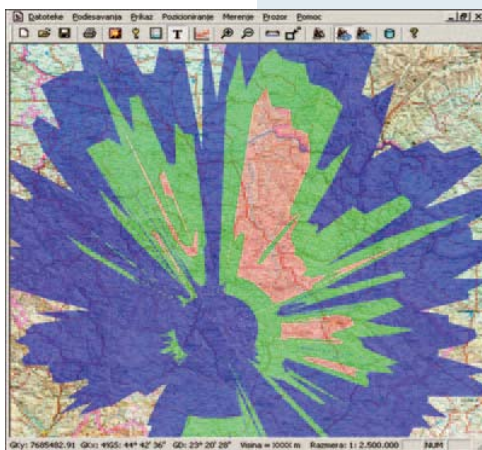
The vertical coverage diagram drawn on tracing paper (Figure 6) for a certain type of radar and the given target radar cross-section is superimposed on the drawn vertical cross-section of the relief, at a certain azimuth. With the help of those data, the horizontal probability coverage diagram of radar from a certain radar post (Figure 7) is drawn



Slika broj 3



Slika broj 4



Slika broj 5

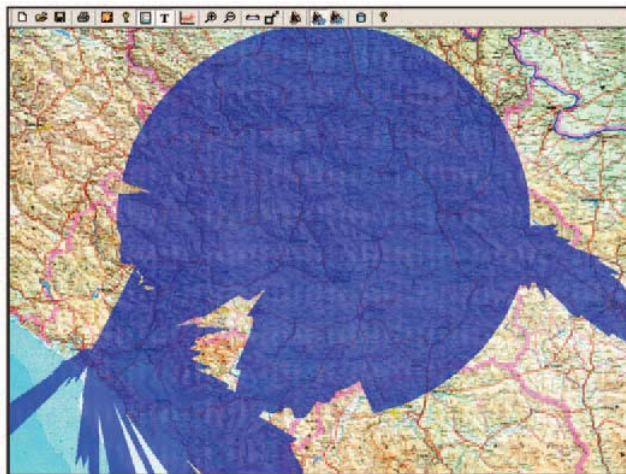
Softverski paket IORP - metoda pomoću računara

Razvojem računarske tehnike otvorila se mogućnost primene računara za kreiranje radarske mreže. Paralelno sa razvojem računarske tehnike razvijali su se i geografski informacioni sistemi koji su omogućili pravljenje trodimenzionalnih interaktivnih topografskih karata bez prostornih, vremenskih ili tematskih ograničenja. Ova dva uslova bila su dovoljna da se pristupi izradi softverskog paketa za izvršavanje zadatka izbora i ocene radarskih položaja (IORP). Izradom softverskog paketa IORP obezbeđen je alat oficiru roda VOJ da vrlo brzo i efikasno kreira radarsku mrežu osmatranja. Softver omogućava brzo dobijanje svih relevantnih podataka o mogućnosti radarske mreže i podataka za upravljanje mrežom u realnom vremenu.

Projektovanjem softverskog paketa IORP trebalo je ostvariti sledeće: definisati koncepciju modela virtualnog geografsko-informacionog sistema sposobnog da izvrši preciznu predikciju radarske vidljivosti; ostvariti predikciju radarske vidljivosti na osnovu modela radara, karakteristike cilja, stanja atmosfere i trodimenzionalnog modela terena; vrniti 2D i 3D vizualizaciju dobijenih rezultata i interaktivan rad korisnika sistema radi optimizacije radarske mreže u okviru postavljenih TTZ.

Softverski paket komunicira sa korisnikom kroz sledeće dijaloge: modelovanje radara, modelovanje ciljeva, modelovanje atmosfere, izbor radarskih položaja, postavljanje radara na definisani radarski položaj, izračunavanje horizontalnog dijagrama, definisanje slojeva za otkrivanja i dvodimenzionalni prikaz.

Modelovanje radara predstavlja definisanje tehničkih karakteristika radara, od kojih se formira radarska mreža. Ciljevi se karakterišu tipom i efektivnom refleksnom površinom. Na osnovu stanja atmosfere, program proračunava njen uticaj na mogućnost otkrivanja radara (radarske mreže), u različitim atmosferskim prilikama. Radarski položaji se definišu jedinstvenim nazivom pod kojim se čuvaju u bazi podataka. Pomoću ovih dijaloga korisnik može vrlo brzo da odgovori na to šta se dešava sa mogućnostima otkrivanja definisane radarske mreže u slučaju njenog narušavanja. Praktično,



Slika broj 6

From the presented procedure, it is possible to assess the volume of work that the commands of the AS&R units should do in order to get to the probability coverage diagram of radar net using the conventional method (Figure 5).

It is also possible to have a presentiment of the volume of work when the units do the maneuver by movement or switch off the operation for any reason whatsoever. In such a case, the procedures must be repeated and new diagrams must be drawn based on which the commander brings his decisions.

IORP Software Package – Computer-Aided Method

The development of computer techniques has opened up the possibility to apply computers to create radar net. In parallel with the development of computer techniques, the geographical information systems (GIS) were also developing, which have enabled making of three-dimensional interactive topographic maps without spatial, time or thematic limitations. These two preconditions were sufficient to proceed with the elaboration of a software package for performance of the task of selection and assessment of radar posts (IORP). By making IORP software package, a tool has been provided for an officer from AS&R arm of service to create radar surveillance net very quickly and efficiently. The software enables fast obtaining of all the relevant data on the potentials of radar net and the data for net management in real time.

By designing IORO software package, the following should have been achieved: to define the concept of the model of virtual geographical and information system capable of making a precise prediction of radar visibility; to achieve a prediction of radar visibility on the basis of the radar model, characteristics of the target, state of the atmosphere and the three-dimensional model of the terrain; authentic 2D and 3D visualization of the obtained results and interactive work of the system users for the purpose of optimization of the radar net within the set tactical and technical requirements.

The software package communicates with the user through the following dialogues: radar modeling, target modeling, atmosphere modeling, selection of radar posts, deployment of radars on the defined radar posts, calculation of the horizontal coverage diagram, definition of the layers for detection and the two-dimensional presentation.

Radar modeling represents the definition of technical characteristics of the radars, of which the radar net is formed. The targets are characterized by type and effective radar cross-section. On the basis of the state of the atmosphere, the program calculates its influence on the probability of detection by radars (radar net), in different atmospheric conditions. Radar posts are defined by a unique name under which they are stored in the database. With the help of these dialogues, the user can very quickly give an answer as to what happens with the probabilities of detection by defined radar net in case of its disruption. Practically, this means that the commanding of AS&R units has an efficient tool, which enables management of the radar net in real time.

The graphical presentation of the horizontal coverage diagram on a geographic map is determined by layers.

to znači da komandovanje jedinicama VOJ raspolaže efikasnim alatom koji mu omogućava upravljanje radarskom mrežom u realnom vremenu.

Grafički prikaz horizontalnog dijagrama otkrivanja radara na geografskoj karti određen je slojevima. Slojevi mogu sadržati jedan ili više radara, odnosno, kompletnu radarsku mrežu. Parametri sloja su visine za koje se proračunava horizontalni dijagram, atmosfera i cilj, kao i stil iscrtavanja (boja, tip šrafure, debljina linije).

Proces izračunavanja započinje selekcijom željenog broja postavljenih radara u mreži i selekcijom opcije izračunavanja. Opcija izračunavanja podrazumeva definisanje rezolucione ćelije po daljini i azimutu. Za grube procene mogućnosti zadaju se šire rezolucione ćelije i program se izvršava veoma brzo (za par sekundi). Za proračunavanje velike tačnosti zadaju se uske rezolucione ćelije po azimutu i daljini i proračun traje duže (oko minut). Izračunata zona otkrivanja može biti prikazana u dve i tri dimenzije. Izgled horizontalnog dijagrama otkrivanja jednog radara za više visina dat je na slici 6, a radarske mreže za jednu visinu na slici 7.

Sve dobijene rezultate moguće je štampati na papiru, što je obično i krajnji rezultat projektovanja radarskih mreža. Naravno, standardnim postupcima korisnika računara dobijeni rezultati mogu se poslati nekom drugom korisniku elektronskim putem, ako su računari umreženi.

Nakon izračunavanja horizontalnog dijagrama otkrivanja, program omogućava trodimenzionalnu analizu dobijenih rezultata. Ova analiza omogućava dobijanje horizontalnih i vertikalnih preseka mogućnosti otkrivanja pojedinačnih radara i uzroka nastalih radarskih maski.

Pažljivim čitanjem i upoređivanjem klasične metode projektovanja radarske mreže i metode pomoću računara, može se zaključiti da je realizovan jedan moćan računarski alat za projektovanje radarskih mreža. Ovaj računarski program omogućava upravljanje radarskim mrežama u najsloženim operativno-taktičkim situacijama, u realnom vremenu. Pored toga, ovaj program može se koristiti za određivanje zona radarske vidljivosti «plavog» pod uslovom da se iz obaveštajnih izvora dobiju tačne lokacije radarskih položaja i tipovi radara plavog.

Realizovani program predstavlja dobru osnovu za realizaciju ekspertskih programa višestruke namene koji mogu biti sastavni delovi programa sistema C4I. Ovakvi programi postoje u svetu i upoređenjem njihovih mogućnosti i mogućnosti ovog programa vidi se da je program IORP u samom vrhu.

Izradi programa prethodio je doktorski rad docenta Elektronskog fakulteta mr. dipl. ing. Rančić Dejana. Program je realizovala ekipa programera sa Elektronskog fakulteta iz Niša. U izradi zahteva i definisanju matematičkih modela učestvovao je docent elektrotehničkog fakulteta u Beogradu pukovnik dr. Aleksandar Kostić puk. Lipovac Lazar dip. ing. spec. i puk. Jolkić Slobodan dipl. ing.

The layers may contain one or more radars or the complete radar net. The parameters of a layer are the altitudes for which the horizontal diagram is calculated, the atmosphere, and the target, as well as the style of drawing (color, type of hatching, line thickness).

The process of calculation starts with the selection of the desired number of the deployed radars within the net and selection of the option of calculation. The option of calculation implies the definition of the resolution cell by range and azimuth. For rough assessment of probability, wider resolution cells are set and the program operates very quickly (for a few seconds). For a calculation of great accuracy, narrow resolution cells are set by range and azimuth and the calculation lasts longer (around one minute). The calculated zone of detection can be presented in two or three dimensions. The view of the horizontal coverage diagram of a radar for a number of altitudes is given in Figure 6, and of a radar net for one altitude in Figure 7.

It is possible to print all the obtained results on paper, which is usually the actual ultimate result of designing radar nets. Naturally, the results obtained through the standard procedures of the user of a computer can be sent to another user electronically if the computers are networked.

After the calculation of the horizontal coverage diagram, the program enables three-dimensional analysis of the obtained results. This analysis enables obtaining of the horizontal and vertical cross-section of the probability of detection of individual radars and causes for occurrence of radar dead zones.

By careful reading and comparison of the conventional method of radar net designing and the computer-aided method, it can be concluded that a powerful computer tool has been created for radar net designing. This computer program enables management of radar nets in the most complex operational and tactical situations, in real time. Additionally, this program can be used for determination of the zones of radar visibility of "blue" under the condition that the exact locations of radar posts and type of radar blue are obtained from the intelligence sources.

The produced program represents a good basis for creation of multi-purpose expert programs that can be integral parts of the program of C4I system. Such programs exist in the world and by comparing their capabilities and the capabilities of this program, it can be seen that IORP program is among the very top ones.

Making of the program was preceded by the doctoral thesis of the Assistant Professor of the Faculty of Electronics, Dejan Rancic, M.Sc. The program was made by a team of programmers from the Faculty of Electronics in Nis. The Assistant Professor of the Faculty of Electrical Engineering, Colonel Dr Aleksandar Kostic, Colonel Lazar Lipovac, B.Sc. spec., and Colonel Slobodan Jolkić, B.Sc., participated in the elaboration of the requirements and definition of the mathematical models.

STANJE I TENDENCIJE MODERNIZACIJE RADARSKO- RACUNARSKIH SREDSTAVA SISTEMA PVO

Piše
puk. Jolkić Slobodan, dipl. ing.

Osnovu svakog sistema za kontrolu vazdušnog prostora u ratu i miru čini osmatračka mreža radarsko-računarskih sredstva velikog dometa. U miru radarska sredstva rade neprekidno obezbeđujući dežurni sistem PVO i sistem obuke. Angažovani broj radara zavisi od niza faktora, pre svega od strategijskog opredeljenja zemlje u organizaciji protivvazdušne odbrane u ratu i dežurnog sistema PVO u miru. U svakom slučaju, ovaj broj nije mali i u srednje razvijenim zemljama kreće se od 20-40 radara instaliranih na radarskim položajima i jednog do tri sistema za automatsku obradu podataka u operativnim centrima. Ovom broju radara treba dodati i broj akvizicijskih radara iz sastava artiljerijsko-raketnih jedinica koji se koriste kao dopuna sistema kontrole vazdušnog prostora.

Radarsko-računarska sredstva proizvedena u periodu 1960 - 1980 realizovana su u skladu sa tehnološkim dostignućima tog vremena. Sredstva su uglavnom realizovana na bazi snažnih predajnih elektronskih cevi izvedenih u specijalnoj tehnologiji. Tom tehnologijom raspolagali su samo vodeći svetski proizvođači ove opreme. Vek trajanja ovih predajnih cevi maksimalno dostiže 10.000 radnih časova. Naša iskustva su pokazala da je ovaj broj radnih časova nerealan jer je životni vek ovih cevi u našim eksploatacionim uslovima jedva dostizao do 5.000 radnih časova.

Pored skupih predajnih cevi (10.000,00 - 20.000,00 USD magnetroni, 60.000,00 - 120.000,00 USD, CFA, TWISTRON), u radarskim predajnicima za modulatorski sklop i antensku skretnicu takođe su se koristile elektronske cevi određenog veka trajanja čija cena nije zanemarljiva, a proizvodi ih samo određeni broj proizvođača u svetu. U prijemnom delu radarskih uređaja upotrebljavani su specijalni elektronski sklopovi bazirani na cevnoj tehnologiji složene

THE CURRENT STATUS AND TRENDS IN MODERNIZATION OF AIR-DEFENSE RADAR SYSTEMS

By
Col. Slobodan Jolkić, BSc.Eng.

The basis of every air space control system, both in war and peace, represents the surveillance network of long-range computerized radar systems. In peacetime, radars are operated around the clock, feeding the information for the air defense system on alert, and for providing of training. The number of radars deployed depends on many factors, above all on the strategic concept of a country regarding the organization of its air-defense system in wartime and the peacetime air-defense system on alert. In any case, this number is not small, and in a middle-income country, this number ranges from 20 to 40 radars, installed at radar sites, and one to three automatic data-processing systems in command and control centers. A number of target-acquisition radars should

be added to the above number, deployed in artillery rocket units, which are used to supplement the air space control system.

Radar and automatic data-processing units, produced in the period from 1960 to 1980, were developed in line with technological achievements of that period. The units were based mostly on the powerful electronic transmitting tubes, made using a special technology. This technology was available only to the leading producers of this equipment. The life of those transmitting tubes could be

maximum 10,000 operating hours. However, our experiences have shown that this life estimate is unrealistic, since the life of such tubes in our conditions of exploitation could barely reach 5,000 operating hours.

Besides the expensive transmitting tubes (USD 10,000 - 20,000 magnetrons, 60,000 - USD 120,000, CFA, TWISTRON), in radar transmitters, the modulator assembly and antenna switch also employed electronic tubes of a certain life, the price of which was not insignificant either,



tehnološke izvedbe. Ove elektronske komponente takođe pripadaju klasi komponenata koje su mogli proizvesti ili još uvek proizvode samo specijalizovani proizvođači. Stoga se može zaključiti da su održavanje i opravka radarskih uređaja proizvedenih u periodu 1960 - 1980 bili, a i danas su visoko zavisni od izvornih proizvođača.

Proizvođači radarskih uređaja savremene tehnologije napustili su proizvodnju rezervnih delova za radare stare tehnologije, što dodatno opterećuje sistem održavanja ovih radara. Iz ovih razloga skoro sve armije koje su bile opremljene radarima stare tehnologije, opredelile su se za sukcesivnu nabavku novih ili modernizaciju starijih radara. Međutim, nabavka novih radara ograničena je cenom i određenim vrstama zabrane koje diktiraju politički faktori. Obzirom da je proces završetka radarskih sredstava dugotrajan (od pet do deset godina), ove zemlje imaju stalnu potrebu za modernizacijom radara u okviru redovnog remonta, pogotovo ako na tržištu ne mogu da nabave rezervne delove.

Opremljenju za modernizaciju radarskih sistema doprineo je nagli razvoj računarske tehnologije dostupne na svetskom tržištu, a naročito upotreba i dostupnost digitalnih signal procesora. Pored toga, razvojem poluprovodničkih predajnika modularnog tipa sa kompresijom impulsa, održavanje radarskih sistema postalo je višestruko jeftinije jer nema potrošnje katode i nužne zamene predajnih cevi posle određenog broja radnih časova. Ova činjenica predstavlja dodatni razlog za modernizaciju postojećih radarskih sistema.

Naša zemlja se opredelila za modernizaciju radarskih sredstava zbog cene novih radara i mogućnosti da sopstvenim snagama modernizuje postojeće radare. Da bi neko mogao da konstruiše ili modernizuje ovako složene elektronske uređaje dovoljno je da raspolaže odgovarajućim softverskim kapacitetima te da, nabavkom hardvera i izradom sopstvenog softvera, uspešno reši ove zadatke i ravnopravno konkuriše ostalim proizvođačima na svetskom tržištu. Upravo u ovoj činjenici leži naša šansa jer raspolažemo respektivnim kapacitetima za realizaciju vrlo složenih softverskih proizvoda.

U periodu 1990 - 2004 Vojska je razvila elektronske uređaje (prikazane na slikama) na bazi digitalnih signal procesora koji u potpunosti mogu da zamene sledeće tehnološki zastarele radarske uređaje:

- radarske prijemnike cevne tehnologije i neke prijemnike izvedene u diskretnoj poluprovodničkoj tehnologiji,
- radarske pokazivače na bazi katodnih cevi visoke perzistencije,
- radarske ekstraktore primarnih i sekundarnih eho signala izvedenih u diskretnoj poluprovodničkoj tehnologiji,
- kompletne procesore za obradu radarskih signala i zaštitu radara od elektronskog ometanja,
- konzolne pokazivače u operativnim centrima na bazi katodnih cevi,
- uređaje za automatsko slanje i prikazivanje radarskih podataka korisnicima,
- softverske pakete centralnih računara za automatsku obradu radarskih podataka u operativnim centrima,



and which were produced by a limited number of producers in the world. Radar receivers employed special electronic assemblies, which were based on tube technology of complex workmanship. Those electronic components also belong to the class of components, which could be produced, or which are still produced only by specialized manufacturers. Therefore, it can be concluded that the maintenance and repair of radars, manufactured in period between 1960 and 1980, were, and still are, heavily dependent on their original producers.

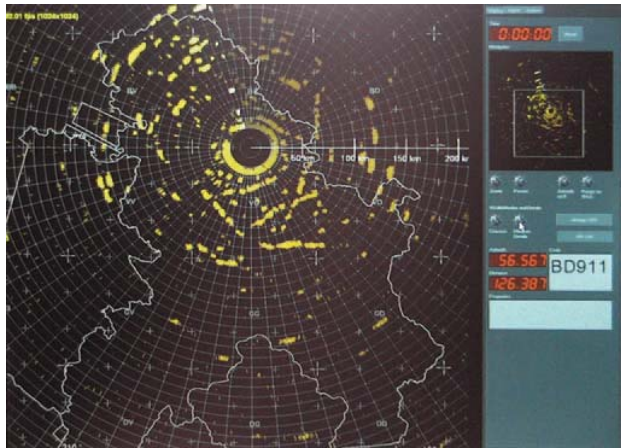
The producers of modern technology radars have ceased to produce spare parts for the radars of old technology, which puts an additional strain on the system of maintenance of those radars. For this reason, almost all the armed forces, which were equipped with the radars of old technology, have decided either to successively acquire new radars, or to modernize the old ones. However, the acquisition of new radars is hampered by their price and by certain sorts of a ban, which is imposed by political factors. Taking into account that the process of replenishment of radar assets is a long one (from five to ten years), these countries have a permanent need for radar modernization, within the framework of regular overhauls, especially if they cannot obtain spare parts in the market.

Determination to modernize radar systems was given a boost by an unprecedented development of computer technologies available in the international market, and especially the usage and the availability of digital signal processors. Additionally, by development of modular semi-conductor transmitters, featuring pulse compression, the maintenance of radar systems has become much cheaper, since there is consumption of cathode-ray tubes, and no need for replacement of transmitting tubes after a certain number of operating hours. This fact represents another reason in favor of modernization of the existing radar systems.

Our country has opted for the modernization of radars due to the price of the new radars and because of its ability to modernize the existing radars by its own means. In order to be able to design or modernize such complex electronic devices, it is sufficient to have adequate software capacities and, after procuring the necessary hardware and developing of indigenous software, to successfully complete these tasks, and to compete in the world market with other manufacturers on equal footing. Exactly here lies our chance, since we have respectable capacities for development of very complex software packages.

In the period from 1990 to 2004, the Armed Forces developed the electronic systems (shown on the pictures) based on digital signal processors, which can completely replace the following, technologically obsolete, radar equipment:

- Radar receivers, based on tube technology, and certain receivers, made using the discrete semi-conductor technology,
- Radar indicators based on high-persistence cathode-ray tubes,
- Radar extractors of primary and secondary echo signals, made using the discrete semi-conductor technology,
- Complete processors for analysis of radar signals and



- softverske pakete za komandovanje i upravljanje sistemom PVO iz operativnih centara,
- elektromehaničke doboš memorije centralnih računara za automatsku obradu radarskih podataka u operativnim centrima,
- test opremu i opremu za simulaciju,
- elektroagregate različite snage, rotacione pretvaračefrekvencije i
- zastarelu modemsku opremu.

Trenutno je u razvoju poluprovodnički predajnik koji će zameniti magnetronske predajnike i omogućiti potpunu nezavisnost radarske tehnike cevne tehnologije od izvornog proizvođača. Dobijanjem poluprovodničkog predajnika iz sopstvenog razvoja u kombinaciji sa već razvijenim sredstvima, realno je očekivati da se u vrlo kratkom roku (narednih 5 godina ako se obezbede materijalna sredstva) tehnološki nivo postojećih radarsko-računarskih sistema podigne na najviši nivo. To je istovremeno i šansa našim proizvodnim kapacitetima elektronskih uređaja da se ravnopravno pojave na svetskom tržištu sa proizvodima koji su uveliko traženi i čija će tražnja imati uzlazni trend u narednih deset do petnaest godina.

Glavna pitanja koja se ovde mogu postaviti su sledeća:

- da li smo konkurentni sa cenom koju dajemo potencijalnim kupcima;
- koji politički faktori mogu uticati na realizaciju opremanja naše vojske i prodaju proizvoda stranom kupcu;
- raspoložemo li finansijskim sredstvima za finalizaciju, integraciju i robusiranje već razvijenih radarskih uređaja;
- da li smo u stanju da objedinimo postojeće kapacitete proizvođača ovih elektronskih uređaja u jedinstvenu celinu;
- da li smo u stanju da organizujemo da ova celina izvršava pojedinačne zadatke samostalno kao zasebna jedinica a da u integraciji kompletnog sistema modernizacije radarskih sredstava deluje kao jedinstveni tim;
- možemo li realno da procenimo pojedinačan doprinos svakog učesnika u realizaciji projekta.

Ako smo u stanju da damo realne odgovore na ova pitanja i da na taj način procenimo i smanjimo rizik koji svaki projekat nosi u sebi, možemo se nadati da ćemo ubrzo produžiti vek upotrebe naše radarske tehnike za narednih 15 godina, kao i da ćemo sigurno biti konkurentni na stranom tržištu.

radar protection against electronic jamming,

- Console indicators in the command and control centers, based on cathode-ray tubes,
- Units for automatic transmission and presentation of data to the users,
- Software packages for central computers for automatic processing of radar data in the command and control centers,
- Software packages for command and control of air defense assets from the command and control centers,
- Electromechanical drum memories of central computers for automatic processing of radar data in the command and control centers,
- Testing and simulation equipment,
- Electric power generators of various output, rotational frequency converters, and
- Obsolete modem equipment

At the moment, the semiconductor transmitter is under development, which will replace the magnetron transmitters, which will, in turn, enable the radar systems to become independent from the tube technology previously supplied by the original manufacturer. By obtaining the indigenously developed semiconductor transmitter, in combination with already developed systems, it is realistic to expect that, in a very short time period (5 years, if adequate funding is provided), the technological level of the existing radar and computer systems will be elevated to the highest level. At the same time, this is an opportunity for our producers of electronic devices to appear in the world market on equal footing with the products for which there is a huge demand, which will have an upward trend of in the next 10 to 15 years,.

The main issues that could be raised here are the following ones:

- Are we competitive with the price we offer to the potential buyers;
- What are the political factors, which might influence the process of equipping of our Armed Forces and sales of our equipment to foreign buyers;
- Do we have the financial resources to finalize, integrate, and ruggedize the already developed radar systems;
- Are we capable to pool the existing production capacities of electronics manufacturers;
- Are we capable to organize this pool of manufacturers to carry out individual tasks independently as separate units, and to operate as a pool during the integration of the complete system of modernization of radar systems;
- Can we make a realistic estimate of the contribution of every participant in the implementation of this project.

If we are capable of answering these questions realistically, and thus assess and lower the risk, which is incorporated in every project, we can hope that soon we will extend the useful life of our radar systems for the following 15 years, as well as that we will certainly be competitive in the world market.



Malyutka-2M

increased terminal efficiency up to 800 mm RHA



Malyutka-2F

New Malyutka variant, with HE warhead featuring enhanced blast effect



Malyutka-2T

tandem shaped charge warhead capable of penetrating more than 800 mm RHA behind ERA box



YUGOIMPORT-SDPR

Main Features:

- Maximum effective range 3 km
- SACLOS (semi-automatic command to line of sight) guidance, reducing level of physiological strain of the operator
- Unchanged concept of operation, with significantly enhanced capabilities, providing Malyutka with important role on the modern battlefield
- Integration with various platforms: tracked or wheeled vehicles, helicopters, small surface combatants

BRODSKI SISTEMI I NAORUŽANJE U USLOVIMA ASIMETRIČNOG RATOVANJA

Piše
Predrag Milićević

Analizirajući savremene trendove borbenih operacija na moru, analitičari ističu narastajuću pretnju asimetričnog ratovanja, pod kojim se podrazumeva korišćenje nekonvencionalne taktike i sredstava za napad na ratne brodove različitog deplasmana i namene. Savremena praksa prepoznaje asimetrično ratovanje na moru kao jednu od najvećih pretnji modernim mornaricama, opremljenim sredstvima projektovanim za uslove rata na otvorenom moru protiv jednako dobro opremljenog neprijatelja. Opšti utisak je da je većina velikih pomorskih sila današnjice svesna nove pretnje koja može da im naruši dominaciju, o čemu govori i izjava odlazećeg glavnokomandujućeg američke mornarice admirala Vernona Klarka da najveću pretnju američkoj mornarici predstavlja asimetrično ratovanje.

Novu dimenziju oblikovanju modernih mornarica daje i narastuća pretnja pirata («gusara») i krijumčara, koji u drskim prepadima ne prezaju od napada na mnogo veće trgovačke brodove, služeći se prvenstveno streljačkim naoružanjem. U pojedinim regijama svetskog okeana, problem pomorskog piratstva je poprimio alarmantne razmere tako da je inicirana međudržavna saradnja s ciljem smanjenja ovog vida kriminala. Upravo u cilju sprovođenja ovakvih mera u Jugoistočnoj Aziji u blizini prolaza Malaka, inače poznatog po čestim napadima na trgovačke brodove, realizovane su zajedničke patrolne indijske i singapurske mornarice.

Među osnovna sredstva kojima pribegavaju razne terorističke organizacije i pirati, u operacijama protiv ratnih i velikih trgovačkih brodova ističu se mali, brzi čamci naoružani streljačkim naoružanjem sposobni da se približe potencijalnoj meti neopaženo, koristeći ograničenja osmatračkih sredstava na brodu i da otvore vatru po ranjivim mestima, kao što su komandno mesto, skupa oprema ili posada, u cilju

SHIPBORNE EQUIPMENT AND COMBAT SYSTEMS IN ASYMMETRIC THREAT ENVIRONMENT

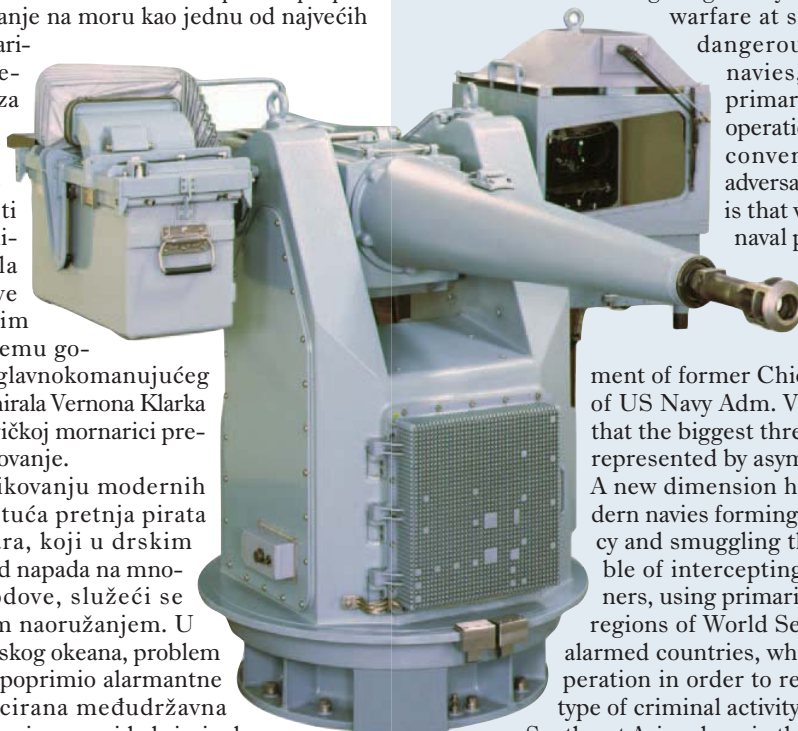
By
Predrag Milićević

Analysis of current trends in combat operations at sea, shows emerging threat of asymmetric warfare, which comprises use of non-conventional tactics and means to attack warships of different displacement and purpose. Modern warfighting theory recognizes asymmetric warfare at sea as one of the most dangerous threats to modern navies, which are equipped primarily to conduct combat operations at open sea against conventionally equipped adversary. General impression is that vast majority of today's naval powers is well aware of threat which might hamper their domination, which is corroborated by statement of former Chief of Naval Operations of US Navy Adm. Vernon Clark who said that the biggest threat to the US Navy was represented by asymmetric warfare.

A new dimension has been added to modern navies forming due to emerging piracy and smuggling threat, which are capable of intercepting large commercial liners, using primarily small arms. In some regions of World Sea, piracy problem has alarmed countries, which have initiated cooperation in order to reduce presence of this type of criminal activity. One such example is

Southeast Asia, where in the area of Malacca Strait which is known for frequent piracy attacks, Indian and Singaporean navies have launched joint patrols.

Among main assets used by terrorist organizations and pirates, in their attacks on warships and merchant ships, are fast, maneuverable boats armed with small arms which are capable of un-noticeable approach to potential target, using certain limitations in shipborne surveillance system, and open fire aiming for most vulnerable spots such as command post, complex-expensive equipment and crew, with basic aim of temporary or permanent incapacitation of ship to perform its combat mission. This type of boats are equally dangerous in "suicide" missions, when filled with explosive they



privremenog ili trajnog onesposobljavanja broda da vrši svoju funkciju. Ovi čamci su opasna pretnja brodovima i u samoubilačkim misijama, kada se «filovani» eksplozivom približavaju meti velikom brzinom, i u stanju su da nanesu ozbiljne štete i brodovima velikog deplasmana. Tipičan primer ovakve pretnje je napad na američki razarač Cole, klase Arleigh Burke, deplasmana preko 9000 tona usidren u adenskoj luci, nesumnjivo jedan od najozbiljnijih napada na američku mornaricu u post hladnoratovskom periodu. Pretnju u uslovima asimetričnog ratovanja predstavljaju i letelice, koje mogu biti laki putnički/poljoprivredni avioni ili bespilotne letelice koje su u stanju da se karakterističnim profilom leta «provuku» ispod brodskih osmatračkih sredstava i nanesu udar po najvažnijim mestima na brodu. Iako moderna istorija ne beleži pokušaje ovakvog tipa u cilju uništenja brodova velikog deplasmana, iskustvo 11. septembra čini da se i ovakvom tipu pretnji posveti dužna pažnja.

Imajući u vidu da je većina mornarica svoja sredstva i oružne sisteme razvijala prema uslovima ratovanja na otvorenom moru, suprotstavljajući se konvencionalnoj pretnji, da bi se na efikasan način pariralo novoj pretnji razvijeni su sistemi koji pretenduju da postanu pouzdana poslednja linija odbrane broda kako od konvencionalnih tako i od nekonvencionalnih sredstava.

Analizirajući sisteme za blisku zaštitu brodova u novim uslovima, uočavaju se sledeći trendovi razvoja:

- odbrana od brzih i manevarišućih ciljeva, kako vazdušnih tako i površinskih, prvenstveno se oslanja na automatske topove srednjih kalibara sa velikom brzinom gađanja, pri čemu se većina proizvođača oslanja na modularan koncept, koji korisnika ne ograničava u izboru kalibra oruđa;

- u cilju povećanja preciznosti topovi se sprežu sa sofisticiranim optoelektronskim senzorskim sistemima koji obezbeđuju pouzdanu detekciju, identifikaciju i praćenje kako vazdušnih tako i površinskih ciljeva danju, noću i u uslovima smanjene vidljivosti. Rad noću i u uslovima smanjene vidljivosti realizuje se korišćenjem termkovizijske kamere, koje uglavnom funkcionišu na talasnim dužinama od 8 do 14 mikrona;

- uočljivo je da se radari ne koriste tako često kao deo osmatračkog sistema za odbranu on nekonvencionalnih pretnji, što se može objasniti izvesnim tehničkim nedostacima radara pri osmatranju akvatorije pri malim elevacijama, što odgovara taktičkim uslovima asimetričnog ratovanja, ali i potrebom za kompaktnošću sistema za upravljanje vatrom s ciljem što manje potrošnje energije i smeštaja na ograničenu zapreminu, što predstavlja jedan od imperativa kada se razmatra ugradnja brodskih sistema;

approach potential target at high speed, and are capable of inflicting significant damage even to major surface combatants. This tactic is exemplified by the attack on USN destroyer Cole, of Arleigh Burke class, with full displacement of over 9000 tons which was anchored in the port of Aden. That was undoubtedly one of the most effective attacks on US Navy in post Cold War global environment.

Threat in asymmetric warfare is posed also by aircraft, either light commercial or agricultural airplanes, or even unmanned aerial vehicles which are capable of flying below shipborne surveillance system field of view, by using optimized flight profile, and attack the most vulnerable areas of the ship. Although modern history doesn't report such high profile attacks, the events of 9-11 deserve due attention to this type of threat.

Bearing in mind that most of the navies have developed their shipborne equipment and combat systems in accordance with the requirements of combat at open sea, in conventional type armed conflict, new systems had to be developed which would assume the role of ship's last line of defence against both conventional and non-conventional i.e. asymmetric threat.

Analysis of systems for ship close protection in modern threat environment, following trends in development are easily recognizable:

- defence from fast, maneuverable targets, both surface and airborne, is based on medium caliber automatic guns, with rapid firing capability, where many designers have adopted modular approach which will enable free choice of weapon caliber;

- in order to increase system's overall efficiency, guns are connected with sophisticated optoelectronic sensor systems, which will provide reliable detection, identification and tracking of both airborne and surface based targets, day, night and under adverse weather conditions. Operation at night, and in adverse weather conditions is performed by use of thermal imaging camera, operating in 8-14 microns band;

- radars are rarely use as the ship's surveillance system





- da bi se obezbedila visoka verovatnoća pogađanja cilja, u uslovima pokretne platforme kakav je brod koji beleži valjanje, propinjanje i skretanje, zahtev za stabilizacijom i nišanske i linije gađanja predstavlja neminovnost;
- operator sistema za blisku zaštitu broda uglavnom je smešten u unutrašnjosti broda, čime ne samo da je obezbeđeno daljinsko upravljanje, već je i smanjen broj poslužilaca uz redukovane logističke troškove i značajno unapređenje nivoa ukupne zaštite;
- realizacija samog gađanja može biti ili centralizovana kada sistem bliske zaštite broda automatsku komandu gađanja dobija od broskog sistema za komandovanje i kontrolu ili individualna kada se gađanje vrši oslanjajući se na lokalni multisenzorski sistem za upravljanje vatrom, koji je povezan sa sistemom bliske zaštite broda;
- na osnovu operativnih iskustava, većina korisnika zadržava mogućnost lokalne «manuelne» kontrole topa kao rezervnog radnog režima. Takođe, na zahtev korisnika, ovim sistemima se mogu dodati vodene rakete kratkog dometa bilo protivoklopne bilo protivvazdušne rakete kratkog dometa sa pasivnim samonavodjenjem, u cilju povećanja efikasnosti sistema i proširenja zone dejstva.

U nastavku je dat pregled nekih realizovanih rešenja, kao i nekih projekata koji se nalaze u fazi razvoja a pripadaju sredstvima za blisku zaštitu brodova od konvencionalnih i asimetričnih napada.

Nemačka industrijska grupacija Rheinmetall-DeTec potencijalnim korisnicima nudi tri različita koncepta kao univerzalni odgovor na konvencionalne i nekonvencionalne pretnje.

Švajcarska filijala, Oerlikon Contraves (Contraves ili contra aves, što u prevodu sa latinskog znači protiv ptica) nudi brodski top Milenijum, poznat i pod oznakom GDM-008. Radi se o topu kalibra 35 mm, optimizovanog sa municijom nove generacije tipa AHEAD, jednim od najjačih komercijalnih aduta ove kompanije. Koncept AHEAD podrazumeva projektil opremljenim vremenskim upaljačem koji se programira na ustima cevi, putem trostepenog induktivnog navoja, pri čemu je vreme aktiviranja upaljača određeno u okviru sistema za upravljanje vatrom na osnovu parametara kretanja cilja i balistike topa. Košuljica projektila je prefragmentisanog tipa, sa 152 volframska cilindra mase 3.3 grama oštrih ivica, čime je postignut maksimalan efekat pri dejstvu na vazdušne ciljeve. U brodskoj varijanti, Oerlikon Contraves predlaže integraciju topa Milenijum sa optoelektronskim

against non-conventional threats, which can be explained not only by certain drawbacks while scanning aquatory at low elevation angles, which corresponds to tactical characteristics of asymmetric warfare, but the need for compact structure with low energy consumption also;

- in order to attain high kill probability, from the platform at motion which moves in pitch, roll and yaw, stabilization of line of sight and line of fire are mandatory;

- system operator is placed within the hull, thus enabling not only remote control, but reduced manning requirement, lower logistic support costs and significant improvement of overall protection level;

- firing sequence can be centralized, when close-in protection system relies on automatic firing command issued by combat management system or individual when firing is performed solely relying on local multisensor surveillance system, which is tied to close-in protection system;

- based on operational experience, most users are unwilling to relinquish local or manual mode of operation, resorting to it in case that primary operating mode fails to operate correctly. Also, there is option of enhancement of close-in protection systems by integration of medium range missiles (up to 10 km) either anti-tank or air defence which will result in increase of system's efficiency and kill envelope enlargement.

Overview of several solutions available on the market will follow, as well as projects which are in development phase and belong to close-in protection system.

German industrial group Rheinmetall-DeTec offers potential customers three different concepts of close protection as universal answer to both conventional and asymmetric threats.

Its Swiss subsidiary, Oerlikon Contraves company (Contraves, derived from contra aves which in latin stands for against birds) offers Millennium naval gun, also known under designation GDM-008. It is a 35 mm naval gun, optimized with new generation ammunition of AHEAD concept, one of the most commercially viable products of this company. AHEAD concept entails projectile fitted with time fuze, programmed at the muzzle, by use of three stage inductive coil where time of activation is calculated within fire control system based on target motion features and gun ballistics. Shell is of pre-fragmented type, with 152 tungsten pellets weighting 3.3 grams each, with maximum effect against aerial targets. In shipborne version, Oerlikon Contraves proposes integration of Millennium naval gun with optoelectronic system MSP500, which has proved itself in several tests which simulated real operational environment, to be capable of detecting and tracking targets such as fast, maneuverable boats used in asymmetric warfare. Company cites that in tests performed in 2002. on experimental vessel Sea Slice, just off Pacific coast, MSP500 system was capable of detecting and tracking targets such as submarine periscope, which speaks favorably of system's characteristics i.e. its capability that in conjunction with 35 mm naval gun creates efficient close-in protection system. First buyer of Millennium naval gun was Danish Naval Material Command, which acquired four guns for integration with new Absalon class vessels two each, one on the bow and other above helicopter hangar, which will function in conjunction with CEROS200 electro-optic system developed by Swedish company Saab.

sistemom MSP500, koji je u više testiranja koji su simulirali realne uslove pokazao sposobnost da otkriva i pouzdano prati ciljeve kao što su mali, brzi čamci kakvi se koriste u uslovima asimetričnog ratovanja. Proizvođač, čak navodi, da je u okviru testiranja 2002. godine u pacifičkom priobalju na eksperimentalnom plovilu Sea Slice, elektrooptički sistem MSP500 bio u stanju da otkriva i prati cilj kakav je podmornički periskop, što govori o respektivnim karakteristikama ovog sistema koji u sprezi sa topom 35 mm predstavlja efikasan sistem za blisku odbranu broda. Prvi kupac topa Milenijum je danska mornarica, koja planira da na oba nova broda klase Absalon ugradi po dva topa, i to jedan na pramcu a drugi u krmenom delu na helikopterskom hangaru, koji će funkcionisati u sprezi sa elektrooptičkim sistemom CEROS 200 koji je razvila švedska kompanija Saab.



Nemačka kompanija Mauser je sredinom 90-tih godina, na osnovu analiza nemačke mornarice o budućim potrebama, započela razvoj sistema MLG27 (Mauser Light Gun) koja kao osnovu koristi automatski top 27 mm, revolverskog tipa, kakav se ugrađuje u avione Tornado i Tajfun (Eurofajter).

U okviru kupole relativno male mase, oko 850 kg, ugrađen je top i optoelektronski sistem, nemačke kompanije Atlas Elektronik, sa dnevnim i noćnim kanalom, laserskim daljimerom i uređajem za praćenje ciljeva.

Topom se daljinski upravlja, iz unutrašnjosti kabine, sa mogućnošću ručnog ili automatskog praćenja. Obezbeđeno je dejstvo po azimutu od 340 stepeni, dok je polje dejstva po elevaciji ograničeno između -15 i +60 stepeni, čime je osigurano respektivno polje dejstva po ciljevima u vazdušnom prostoru. Efikasno dejstvo protiv lakih brodova i vazdušnih ciljeva je 2500 m, dok je dejstvo protiv obalskih ciljeva efikasno na dometima do 4000 m. Munijski komplet od 90 metaka omogućava osam zahvata ciljeva sa rafalima od jedanaest metaka. Kompanija Mauser rešenje MLG27 reklamira kao osnovno naoružanje na brodovima manjeg deplasmana kao što su patrolni brodovi, dok je na većem brodovima kao što su korvete i fregate služi kao pomoćno naoružanje, prvenstveno namenjeno za samoodbranu. Jedini kupac za sada je nemačka mornarica, koja je naručila 83 komada za ugradnju na brodove različitog tipa, između ostalog fregate F123 i F124 kao i na novu korvetu K130. Sledeći korak u razvoju, koji kompanija Mauser nudi potencijalnim korisnicima je top MLG25 predstavljen početkom 2005. godine, sa topom 25 mm Bushmaster I sa dvostrukim hranjenjem i munijskim kompletom od 220 metaka, spregnut sa optoelektronskim senzorskim sistemom koji je postavljen iznad oruđa.

Treće rešenje, koje nudi grupacija Rheinmetall-DeTec predstavlja koncept Astrapi, u okviru koga se predlaže integracija širokog spektra senzora i «efektora» pod kojima se podrazumeva artiljerijsko i raketno naoružanje, koje je prema navodima proizvođača sposobno da odgovori strogim zahtevima korisnika u pogledu efikasne borbe protiv nekonvencionalnih-«terorističkih» ciljeva.

German company Mauser has initiated in mid-90s development of MLG27 (Mauser Light Gun) system, based on analysis of German Navy, which is built around four-chamber revolver type automatic gun identical to those built into combat aircraft Typhoon and Tornado.

Within relatively lightweight turret, of around 850 kg mass, gun and optoelectronic system, supplied by german company Atlas Elektronik, are installed. Optoelectronic system has day channel, night channel, laser rangefinder and target tracking system.

Gun is remotely operated, from within the cabin, with optional automatic or manual target tracking. Field of action covers 340 degrees in azimuth, and from -15 to +60 degrees in elevation, ensuring respective kill envelope. Maximum effective range against light surface targets and aerial targets is 2500 m, while coastal targets can be engaged at ranges up to 4000 m. Combat load of 90 rounds enables eight engagements with ripples of 8 rounds. Mauser company presents MLG27 as main armament on smaller displacement boats such as patrol boats, while on vessels such as corvettes and frigates it serves as auxiliary armament with self-defence as main function. The only buyer, so far, is German Navy which has ordered 83 systems for installation on boats of different types, such as frigates F123 and F124 as well as new corvette K130.

Next step in development, presented to potential customers at the beginning of 2005, is MLG25 system, with double-feed 25 mm Bushmaster I automatic gun and combat load of 220 rounds, coupled with optoelectronic system mounted above the gun.

Third solution, offered by Rheinmetall-DeTec is Astrapi concept, envisaging integration of different types of sensors with "effectors" which comprise artillery and missile systems, which is according to manufacturer capable of efficient engagement of different targets, including non-conventional i.e. terrorist targets.

Comprehensive family for close-in protection of naval vessels, by the name of Typhoon which development was initiated in mid 90-s with the use of certain solutions from overhead weapon station OWS25 developed for armoured fighting vehicles, is offered by Israeli company Rafael. Typhoon debuted in 1995, integrated on Super Dvora fast patrol boat of Israeli Navy, when its operation was tested in conjunction with El-Op's optoelectronic system MSIS. Up to now, Typhoon featured several types of guns such as: 20 mm GIAT M621, M693, 30 mm Oerlikon KCB, 30 mm Bushmaster Mk44, Mauser Mk30 Model F as well as triple barreled 12.7 heavy machine gun GAU-19/A. Rafael also offers integration of anti-armour missile with maximum effective range up to 8 km of NT-D type (Neged Tank Dandy, anti-tank Dandy) which was recently labeled with official designation Spike-ER. Also, Typhoon can be integrated with short range air defence missiles, of "fire-and-forget" type such as Stinger, Strela, Iгла. All necessary calculations are performed by ballistic computer installed on

Respektivnu familiju sistema za blisku zaštitu brodova, Typhoon, nudi i izraelska kompanija Rafael, čiji je razvoj započeo sredinom 90-tih godina oslanjajući se na rešenje daljinski upravljane kupole OWS25, namenjene za ugradnju na oklopna borbena vozila. Svoju premijeru, Tajfun je 1995. godine doživeo u varijanti sa topom 25 mm Bushmaster I na patrolnom brodu izraelske mornarice Super Dvora, kada je njegovo funkcionisanje testirano u sprezi sa optoelektronskim sistemom MSIS kompanije El-Op. Do danas, sa Tajfunom je integrisano više različitih tipova topova kao što su: 20 mm GIAT M621, M693, 30 mm Oerlikon KCB, Bushmaster Mk44, Mauser Mk30 Model F, kao i trocevni mitraljez 12.7 mm GAU-19/A. Kompanija Rafael nudi i integraciju sa topom protivoklopnih raketa dometa do 8 km klase NT-D (Neged Tank – protivtenkovski, Dandy), koji sada ima zvaničnu oznaku Spike-ER, kao i protivvazdušnih raketa kratkog dometa sa pasivnim IC samonavođenjem klase Strela, Igla ili Stinger. Sve neophodne proračun izvodi balistički kompjuter postavljen na samom topu, dok se osmatranje i praćenje može vršiti ili preko sistema postavljenog na samom topu ili oslanjajući se na brodski osmatrački sistem, bilo u optoelektronskoj bilo u radarskoj formi. Prema raspoloživim podacima, pored izraelske mornarice koja je finansirala razvoj ovog sistema, među korisnike Tajfuna ubrajaju se i tradicionalni korisnici izraelskog naoružanja kao što su Indija, Singapur, Australija i Šri Lanka koja je kao platformu za sistem Tajfun izabrala ruski top kalibra 23 mm.

Poznati svetski proizvođač brodskih topova, italijanska kompanija Oto Melara, oslanjajući se na višedecenijsku tradiciju i iskustvo, kao odgovor na moderne pretnje ratnim brodovima uključujući i asimetrično ratovanje, nudi rešenje u formi hibridnog artiljerijsko-raketnog sistema koji nosi oznaku Mod 584. Stručna javnost je detaljnije upoznata sa ovim sistemom tokom razmatranja arhitekture borbenog sistema novih korveta klase Baynunah mornarice Ujedinjenih Arapskih Emirata, koji se u borodgradilištu u Abu Dabiju grade prema francuskoj licenci.

Budući da se radi o korisniku koji je s jedne strane suočen sa pretnjom asimetričnog ratovanja, u regionu Zaliva zabeleženom još sredinom 80-tih godina kada su se mali iranski čamci neuspešno zaletali u pravcu velikih američkih brodova, kao i njegove spremnosti da za svoju bezbednost izdvoji značajna sredstva, posebna pažnja posvećena je sistemu za blisku zaštitu brodova. Odbrana broda, zamišljena kao višeslojna, se pored raketnog sistema ESSM i topa 76 mm, u poslednjoj liniji oslanja na do tada malo poznati sistem Mod 584 u čijem su razvoju uzeta u obzir mnoga savremena iskustva. Prema raspoloživim podacima, sistem za blisku zaštitu brodova Mod 584 može da koristi dva varijante topova u kalibru 30 mm, i to Mauser Mk30 i ATK Bushmaster Mk44 (varijanta koju je izabrala mornarica UAE) sa borbenim kompletom od 140 metaka, dok je u varijanti sa topovima 25 mm Oerlikon KBA ili ATK Bushmaster M242 borbeni komplet povećan na 200 metaka. Sistem podržava više radnih režima, počevši od daljinskog upravljanja na osnovu podataka dobijenih od centralizovanog sistema za komandovanje i kontrolu pa sve do upravljanja na osnovu podataka dobijenih od elektrooptičkog senzorskog sistema postavljenog na samom topu. Još jedna potvrda o sveprisutnosti modularnog koncepta, po kojem korisnik u skladu sa doktrinarnim opredeljenjima kao i taktičkim, tehničkim i finansijskim ograničenjima bira konačnu konfiguraciju

the gun, while surveillance and tracking can be executed by system mounted either on the gun or relying on shipborne surveillance system, either radar or optoelectronic. According to available data, besides Israeli navy which financed the development of this system, other customers of Typhoon can be found amongst traditional users of Israeli weaponry such as India, Singapore, Australia and Sri Lanka, which used Russian gun 23 mm as a platform for Typhoon.

A renowned gun manufacturer, Italian company Oto Melara, relying on its tradition and experience has come up with a solution for threats facing modern navies in the form of hybrid, artillery-missile system which carries the designation Mod584. This system was presented to the public in detail during the discussions regarding combat system architecture of new corvettes of Baynunah class, ordered by UAE Navy, which will be built by ADSB in Musaffah shipyard under French license.

Bearing in mind that the user, UAE Navy, is faced with threat of asymmetric warfare which has been reported in Gulf region in mid 80's when small Iranian craft unsuccessfully tried to perform suicide attacks on larger US ships and also the fact that UAE is capable of earmarking significant amount of money into development of its armed forces special attention has been paid to ship close-in protection system. Ship's defence has been contemplated as multi-layered one, where besides ESSM missile system and 76 mm medium caliber gun last layer of defence relies on Mod584 which embodies many advanced solutions, stemming from analysis of modern combat environment. As artillery armament, Mod584 can use two types of 30 mm guns Mauser Mk30 and ATK Bushmaster Mk44 (chosen by UAE Navy) with combat load of 140 rounds, while 25 mm gun Bushmaster M242 permits combat load of 200 rounds. System supports several operation modes, starting with remote control based on data supplied from centralized command and control system, right up to electro-optic gun slewing using gun-mounted system. This can be seen as yet another proof of ubiquitous modular approach, where user in accordance with its doctrinary approach and tactical, technical requirements and financial constraints will choose final system configuration. This, developmental modular approach is slowly migrating from bigger platforms such as: aircraft, ship, tank to subsystem and armament level owing primarily to advanced software packages enabling "virtual" design in accordance with customer's requirements, succeeded by rapid prototyping and acceptance tests. The manufacturer offers additional firepower improvement by installing launchers for MANPADS class air defence missiles, thus additionally strengthening last line of defence. UAE Navy has opted for Igla-S missiles, which are credited with successful coping with targets such as cruise missiles. Within project of equipping new generation frigates of Formidable class, which are built in Singapore under French license, local company ST Kinetics has offered system known as NRWS (Naval Remote Weapon Station). Main armament is 30 mm gun, which has coaxially mounted 7.62 mm general purpose machine gun, with efficient range up to 2500 m, and 200 rounds per minute rate of fire. The gun is remotely controlled, from within the hull. As with other systems of this class, the user has the option to mount MANPADS class air defence missiles in order to improve firepower and increase kill envelope.

sistema, koji se sa velikih sistema kao što su avion, brod, tenk polako «seli» na nivo podsistema opreme i naoružanja zahvaljujući pre svega softverskim paketima koji omogućavaju «virtuelno» projektovanje u skladu sa zahtevima korisnika, na osnovu čega se u relativno kratkom roku izrađuje prototip koji kreće u testiranje i konačno proizvodnju. Proizvođač nudi dodatno povećanje vatrene moći ugradnjom lansera za protivvazdušne rakete klase «ispali i zaboravi», čime se dodatno ojačava poslednja linija odbrane. Mornarica UAE je na svojim oruđima ugradila po četiri lansera za ruske rakete Igl-S, koje se od ranijih verzija odlikuju sposobnošću da se uspešno nose sa ciljevima kakve su krstareće rakete.

U sklopu opremanja fregata nove generacije klase Formidable, koje se u Singapuru grade prema francuskoj licenci, lokalna kompanija ST Engg odnosno njena filijala ST Kinetics je singapurskoj mornarici kao konkurenciju izraelskom sistemu Tajfun, u ulozu poslednje linije odbrane broda kako od konvencionalnih tako i od asimetričnih pretnji, ponudila rešenje pod oznakom NRWS (Naval Remote Weapon Station). Kao osnovno naoružanje usvojen je top kalibra 30 mm, sa kojim se može spregnuti koaksijalni mitraljez 7.62 mm, sa efikasnim dometom do 2500 m, i brzinom gađanja do 200 metaka u minutu. Topom se upravlja daljinski, iz unutrašnjosti broda. Kao i na drugim rešenjima, i ovde je korisniku ostavljena mogućnost da sa topom spregne protivvazdušne rakete klase «ispali i zaboravi», čime bi se značajno unapredila vatrena moć i povećala zona dejstva.

Od ostalih rešenja ovog tipa, prisutnih na svetskom tržištu, izdvaja se i koncept francuske kompanije GIAT promovisan pod oznakom NARWHAL (Naval Remote Weapon Highly Accurate, Lightweight) koji omogućava ugradnju topova 20, 25 ili 30 mm, integrisanih sa lakim postoljem koji omogućava ugradnju i na brodove manjeg deplasmana.

Ponuda Jugoimport-SDPR

Imajući u vidu narastajuću pretnju asimetričnog ratovanja na moru, Jugoimport-SDPR u oslanjajući se na domaće naučno-istraživačke, razvojne i proizvodne resurse, razmatra različite mogućnosti opremanja i naoružavanja brodova različitog deplasmana u cilju pružanja adekvatnog odgovora na ovu savremenu pretnju.

Aktuelna razmatranja vezana za asimetrično ratovanje na moru kao jedan od preduslova za uspešnu borbu ističu potrebu za senzorskom fuzijom, u cilju formiranja jednoznačne slike bojišta-akvatorije, na osnovu čega se donose odluke o eventualnom daljem angažovanju borbenih platformi, koje mogu biti smeštene u vazduhu, na kopnu, na ili ispod površine mora. S tim u vezi, domaća odbrambena industrija kao pouzdan izvor podataka o kretanju neprijateljskih plovila različitog deplasmana (kao i eventualnih niskoletećih ciljeva) nudi osmatračko-nišanski sistem MOMS koji u sebi objedinjuje CCD kamere za širokougaono i uskougono osmatranje, termovizijsku kameru (koja funkcioniše na talasnoj dužini od 8 do 14 mikrona) kao i laserski daljinomer koji se koristi za određivanje dometa. Zahvaljujući kompaktnom dizajnu i maloj masi MOMS se može instalirati na širokom spektru plovila, počevši od malih, brzih patrolnih čamaca gde predstavlja jedini izvor informacija pa sve do brodova većeg deplasmana (korvete, fregate) gde ovaj uređaj funkcioniše u sprezi sa radarima većeg dometa, čime se dobija integrisano osmatračko rešenje spremno da se koristi i u

Of other systems, available on the world market, one should mention NARWHAL (Naval Remote Weapon Highly Accurate, Lightweight) concept developed by French company GIAT, providing integration of 20, 25 and 30 mm guns, mounted on light pedestal thus enabling integration with small displacement ships.

Jugoimport-SDPR offer

Baring in mind emerging threat of asymmetric warfare at sea, Jugoimport-SDPR in cooperation with local scientific-research, development, design and production capacities is actively analyzing various options of equipping and arming ships of various displacement in order to achieve maximum possible reaction to this modern threat.

Modern considerations regarding asymmetric warfare at sea name sensor fusion as prerequisite for successful target engagement, namely to create unified situational awareness picture based upon which further decisions on actual target engagement using weapon platforms, be they aerial, land based, surface or sub-surface, will be made. In order to have reliable source for detecting and tracking movements of enemy surface targets as well as low flying aerial targets, Serbian defence industry has developed MOMS surveillance-sighting system which embodies wide and narrow field of view CCD daylight cameras, thermal imaging camera (operating at 8-14 microns wavelength) and laser rangefinder. Owing to compact design and low weight, MOMS can be integrat-



modernim, konvencionalnim operacijama karakterisanim intenzivnim ometanjem i protivelektronskom borbom. Kao prirodan korak dalje nameće se integracija osmatračko-nišanskog sistema MOMS sa komandom višeg nivoa (smeštene bilo na drugom brodu bilo na kopnu), korišćenjem hardversko-softverske infrastrukture komandno-informacionog sistema, u cilju maksimizacije efekta korišćenja sopstvenih snaga.

U domenu oružnih sredstava, Jugointport-SDPR svojim partnerima može da ponudi ugradnju širokog spektra sredstava, među kojima ističemo: mitraljeze 7.62mm, teške mitraljeze 12.7mm, automatske bacače granate 30mm i višecevne bacače raketa kalibra 128mm koji pored gađanja neprijateljskih plovila i vatrene podrške sopstvenim jedinicama mogu da se koriste i u sklopu operacija širih razmera protiv neprijateljskih snaga na kopnu. Za gađanje ciljeva na domaćima do 60 km mogu se koristiti vodene rakete tipa ALAS, koje imaju izuzetno visok nivo preciznosti, zahvaljujući specifičnom sistemu upravljanja realizovanom korišćenjem optičkog kabla kojim se na operatorov panel prenosi slika sa glave za samonavodjenje u jednom smeru, dok se u drugom smeru prenose komande na raketu. Kao inovativan pristup rešavanju problema asimetričnog ratovanja valja istaći i koncept ugradnje teških mitraljeza 12.7mm na brodove većeg deplasmana, tipa fregata, čime je i ovim velikim brodovima koji su tradicionalno prvenstveno angažovani u borbama na otvorenom moru pružena mogućnost adekvatnog odgovora na novu globalnu bezbednosnu pretnju.

U red novih rešenja koje Jugointport-SDPR nudi u cilju borbe protiv asimetričnog ratovanja na moru može se svrstati i sredstvo koje po svom izgledu i načinu upotrebe podseća na harpun, tradicionalno oružje čoveka u borbi sa morskim nemanima. Međutim, danas se ovakvo sredstvo koristi u borbi sa čamcima koji se koriste za krijumčarenje ljudi i raznih vrsta roba, sa osnovim ciljem da se mreža koju ovo sredstvo nosi zaplete među propelere ovih čamaca, onemogućujući na taj način njihovo dalje kretanje i stvarajući preduslove za dalju policijsku akciju hapšenja krijumčara i spašavanja tereta. Stoga ovo rešenje možemo svrstati u red «nesmrtonosnog oružja» za borbu protiv pirata i krijumčara, odnosno u misijama u kojima će savremene svetske mornarice sve češće učestvovati.



Čamac Koral naoružan teškim mitraljezom 12.7 mm, koji se nalazi u upotrebi u nigerijskoj policiji u zadacima kontrole obalne zone protiv krijumčara i pirata

ed with wide spectrum of surface vessels, ranging from small, fast patrol craft where it represents sole source of target information right up to greater displacement vessels (corvettes, frigates) where this device operates in conjunction with long and medium range radars thus creating integrated surveillance solution effective in modern operations, credited with intensive jamming and electronic countermeasures. Next phase in development could be integration of MOMS with higher level command (either shipborne or land based) by use of hardware-software infrastructure of combat management system, in order to maximize use of allied troops.

In the area of weapon platforms, Jugointport-SDPR can offer its potential customers installation of wide range of systems among which are: 7.62mm general purpose machine gun, 12.7mm heavy machine guns, 30mm automatic grenade launchers and 128mm multiple rocket launchers which can be effectively used not only in asymmetric warfare missions but in standard maritime operations at sea and fire support for embarked troops ashore. For longer range engagements, Jugointport-SDPR can offer ALAS missile system, effective at ranges up to 60 km, with novel guidance system using two-way fiber optic link, which transmits image seen by homing head in and guidance commands to the missile. One innovative solution to tackle asymmetric warfare, offered by Jugointport-SDPR, is installation of 12.7mm heavy machine guns on frigate sized combatant, thus enabling these big ships which are primarily engaged in “green water” or “blue water” operations to adequately respond to modern security challenge.

Among new systems offered by Jugointport-SDPR, we should also mention system which by its appearance and modus operandi closely resembles harpoon, traditional weapon of man to fight various beasts at sea. Nowadays, this weapon is used to combat small boats which are used by criminals in smuggling of various types of illegal goods and human trafficking. Main purpose of this “weapon” is to deploy dense web which will cause propeller of smuggling vessel to “jam” thus stopping it effectively. This solution represents “non-lethal” approach to fighting various types of smugglers and criminals, missions in which modern global navies will be more and more engaged.

Koral light patrol boat armed with 12.7 mm heavy machine gun, in use with Nigerian police in missions against smugglers and pirates

VIZIJA USPEŠNOG RAZVOJA

Piše
Bojana Đokić

A VISION OF SUCCESSFUL DEVELOPMENT

By
Bojana Đokić

Kraj svake poslovne godine pravi je trenutak za sumiranje rezultata ostvarenih u proteklom periodu. Za gospodina Bogoljuba Vasiljevića, diplomiranog mašinskog inženjera i doskorašnjeg direktora Sektora za razvoj, inženjering i tehničku podršku u Jugoimport-SDPR, kraj 2006. godine trenutak je i za sumiranje rezultata bogate profesionalne karijere duge skoro četrdeset godina.

Svoje školovanje i radno angažovanje Bogoljub Vasiljević vezao je za vojnu industriju naše zemlje i dokazao da je upornim radom, velikim trudom i strpljenjem moguće ostvariti rezultate kojima želimo da dosegneмо maksimum. Gospodin Vasiljević – Bube kako ga saradnici draže oslovljavaju, bio je spreman da za naš kompanijski časopis iznese utiske i podeli iskustva nastala tokom

svoje bogate karijere, da nam iznese svoju viziju i perspektive razvoja naše kompanije. Nadamo se da će nakon odlaska u penziju, sredinom iduće godine, gospodin Vasiljević i dalje učestvovati u aktivnostima Jugoimport-SDPR jer je bila čast imati ga u svojim redovima.

Gospodine Vasiljeviću, pripadate prvim generacijama koje su svoje srednje, a kasnije i fakultetsko obrazovanje vezale za potrebe vojne industrije nekadašnje Jugoslavije. Ako Jugoimport-SDPR predstavimo kao deo vojno-privrednog sektora, onda ste praktično ceo radni vek proveli u okviru vojne industrije.

Da, tako je. Završio sam Srednju tehničku školu u Kragujevcu, koja je bila pod nadležnošću tadašnjeg Državnog sekretarijata narodne odbrane (DSNO). Tu školu su pohađala deca iz svih krajeva bivše Jugoslavije, tačnije sa lokaliteta Bosne i Hercegovine, Hrvatske i Srbije gde su se tada podizala ili obnavljala preduzeća vojne industrije. Mogu reći da su ljudi koji su završili STŠ u Kragujevcu bili nosioci razvoja i organizovanja proizvodnje u fabrikama vojne industrije. Dobar deo moje generacije nastavio je studije na mašinskom fakultetu u Beogradu, odsek vojno mašinstvo, kao stipendisti DSNO. Daleke školske 1962/63. godine, sa profesorom Acom Stamatovićem, prvi put sam posetio Centralni poligon za ispitivanje NVO u Nikincima.



The end of each business year is the right time to sum up the results accomplished in the period that is behind us. For Mr. Bogoljub Vasiljevic, a mechanical engineer and, until recently, Director of the Development, Engineering and Technical Support Division in Jugoimport-SDPR, the end of 2006 is the right time to sum up the results of a rich and almost forty-year long career.

Bogoljub Vasiljevic has been tied to the defense industry of this country since his schooldays and the beginning of his career, and has shown that persistent work, great effort and patience can lead to top results. Mr. Vasiljevic – or Bube, as his associates like to call him – was willing to present his impressions and share his experience with the readers of our

company magazine, as well as to present his vision and prospects of our company.

It was a great honor to have Mr. Vasiljevic in our ranks and we hope that his retirement in the coming year will not prevent him from taking part in the business activities of Jugoimport-SDPR.

Mr. Vasiljevic, you belong to those first generations which have been tied to the former Yugoslav defense industry since their high-school and university days. Considering that Jugoimport-SDPR is a part of military-economic sector, we can say that you have spent all your active life in defense industry.

Yes, you are right. I finished the Technical High School (THS) in Kragujevac, which at the time came within the competence of the State Secretariat of National Defense (DSNO). This school was attended by students from all over former Yugoslavia, or to be more precise, from those areas of Bosnia and Herzegovina, Croatia and Serbia where defense companies were being built or restored. I can say that the graduates from the THS in Kragujevac were the champions of development and production in defense industry factories. A large part of my class proceeded with the studies at the Faculty of Mechanical Engineering in Belgrade, Military Engineering Department, as DSNO

Kako sam imao obavezu da, kao vojni stipendista, radim 16 godina u preduzećima Vojne industrije i da se aktiviram u čin poručnika JNA, prvi problem je nastao u određivanju preduzeća gde ću raditi. DSNO mi je ponudio mogućnost izbora između preduzeća "Marko Orešković" iz Ličkog Osika i "Slavko Rodić" iz Bugojna što sam a priori odbio. Posle dužeg razmatranja dogovoreno je da svoj profesionalni put započnem u "Prvom partizanu", Užice (PPU), gde sam radio prvih deset godina svog radnog veka.

U početku vašeg profesionalnog angažovanja vojna industrija tadašnje Jugoslavije imala je dosta problema. Na koji način ste se kao mlad inženjer suočili sa situacijom koja vas je zatekla u "Prvom partizanu" i na kojim poslovima ste sticali prva radna iskustva?

Početak rada nije bio nimalo ružičast. Na istoj sednici Radničkog saveta kada sam primljen u radni odnos, oktobra 1967. godine, doneta je odluka o otpuštanju 250 radnika zbog smanjenja obima posla. Kako je tada fabrika „Igman“ iz Konjica sa istim proizvodnim programom i kapacitetom tri puta većim od kapaciteta PPU imala primat u proizvodnji za potrebe JNA i popunjavanja stokova, "Prvom partizanu" je saopšteno da mora tražiti nove programe ako želi da opstane, i to vlastitim snagama, bez finansijske pomoći države. Za "Prvi partizan" je to bio podsticaj da uđe u osvajanje proizvodnje manevarske municije sa čeličnom čaurom, prvo sa plastičnim zrnom, a potom bez zrna, koja i danas egzistira. Ovaj novo osvojeni proizvodni program spasao je od gašenja „Prvi partizan“ - namensku proizvodnju. Tada su osvojeni osnovni kalibri 7,62x39mm M68, 7,9x57mm M69, 7,62x51mm i 7,62x54mm, a kasnije i ostali kalibri u skladu sa zahtevima tržišta. Uporedo smo

scholarship holders. Far back in the schoolyear 1962/63 I visited, with professor Aca Stamatovic, the military Central Test Ground in Nikinci for the first time. As a military scholar, I was obliged to commit 16 years of my career to the defense industry companies and to come into active service with the Yugoslav National Army (JNA) as a lieutenant. So, the first difficulty for me was to decide on the company where I would start my work. DSNO offered me to choose from the "Marko Oreskovic" company from Licki Osik and the "Slavko Rodic" company from Bugojno, which I a priori refused. After considerable thought, it was decided that I should start my professional life with "Prvi partizan" in Uzice (PPU), where I worked for the first ten years of my career.

At the beginning of your professional life, the Yugoslav military industry of the time met with many problems. What was it like to come into grips with the state of affairs you found at "Prvi partizan"? What were the projects in which you gained your first working experience?

The beginning of my career was not optimistic pink at all. In October 1967, at the same Workers' Council session when I was employed, a decision was reached to lay off 250 workers due to reduced volume of production. Having the same manufacturing program and a three times bigger capacity than the PPU, the „Igman“ factory from Konjic had a lead in production for the needs of the JNA, so "Prvi partizan" was told to look for new programs to survive, applying its own strength, without financial support of the State. This encouraged "Prvi partizan" to start mastering production of blank ammunition with steel cartridge cases,

first with the plastic bullets and then without the bullets. This newly acquired production program, which is still extant, saved „Prvi partizan“ from being closed down. This is when the production of basic calibers such as 7.62x39mm M68, 7.9x57mm M69, 7.62x51mm and 7.62x54mm was also mastered, followed later by other calibers dictated by the market. We had a parallel production of service ammunition. As a young engineer with a three-year working experience, I was appointed a technical manager of Defense Production Division where I took over technology-oriented activities i.e. production facility modernization, as well as the mentioned ammunition development and design programs. When it was decided to dislocate the production, as the head of a working team I was entrusted with the task of defining the Technological Project on the basis of which infrastructure facilities were to be designed. The experience I gained with these capital investment projects at that time was very useful for my future career.



radili i bojevu municiju. Kao mlad inženjer sa trogodišnjim radnim iskustvom, postavljen sam za tehničkog direktora Namenske proizvodnje gde sam, pored poslova na razvoju i konstrukciji municije, preuzeo i poslove tehnologije, odnosno modernizacije proizvodnog pogona. Kada je doneta odluka o izmeštanju proizvodnje, meni je poveren zadatak vođenja radnog tima za definisanje Tehnološkog projekta, što je bila osnova za projektovanje infrastrukturnih objekata. Iskustvo koje sam tada stekao u investicionim poslovima veoma mi je koristilo u daljem radu.

Krajem 1977. godine prelazite u Saveznu direkciju za promet i rezerve proizvoda sa posebnom namenom (SDPR). Radeći na poslovima planiranja razvoja vojne industrije imali ste priliku da svoja znanja i mogućnosti realizujete u Alžiru, Uzbekistanu i drugim zemljama sa kojima smo imali dobru poslovnu saradnju. Na kojim ste projektima bili angažovani?

Na predlog Vojno privrednog sektora SSNO moje radno angažovanje nastavlja se u Saveznoj direkciji za promet i rezerve proizvoda sa posebnom namenom, odakle sam odmah upućen u Alžir u okviru Tehničke pomoći Direkciji vojne industrije Alžira. Tamo sam proveo tri godine. Na osnovu ličnog iskustva predložio sam formiranje prototipske proizvodne linije za malu municiju, kao prvu fazu izgradnje buduće fabrike municije u Alžiru. Medjutm, ovaj predlog nije podržan od strane SDPR koji je preferirao da se odmah ide na izgradnju fabrike municije velikog kapaciteta, polazeći od iskustva iz Iraka, gde smo tada bili u zamahu sa investicionim radovima. Nažalost, alžirci su se tada obratili firmi FN iz Liježa i realizovali zamisao.

U SDPR sam se vratio 1980. godine i bio sam raspoređen u Sektor inženjeringa, Odeljenje za pripremu i ugovaranje inženjering poslova. U periodu od 1980. do sredine 1996. godine radio sam na mnogim ponudama i zaključenju ugovora iz domena transfera tehnologije za proizvodnju sredstava NVO, kao i na ponudama i ugovorima za izgradnju i opremanje fabrika po principu „ključ u ruke“. Najveći deo ponuda odnosio se na investitore iz Iraka, Libije, Irana, Angole, Etiopije, zemalja Južne Azije i Dalekog istoka. Sredinom 1996. godine upućen sam u Uzbekistan u zajedničko preduzeće „Himprojekt“, koje je formirano sa državnim Institutom za hemijsko inženjerstvo, sa ciljem prodora na to tržište sa našim tehnologijama. Zbog oskudice finansijskih sredstava kod obe strane ova zajednička firma nije opstala. Po povratku iz Uzbekistana, 1998. godine, odmah sam se uključio u projekat K-30, transfer tehnologije municije 30x165mm za topove 2A42, 2A72 i Gš301, za kineskog partnera. Saugovorači na ovom projektu su bili: „Sloboda“ iz Čačka, „Milan Blagojević“ iz Lučana, „Krušik“ iz Valjeva i „Zastava“ iz Kragujevca. Realizacija ovog projekta se odvijala za vreme sankcija i bombardovanja Jugoslavije 1999. godine što je dovelo do posebnih problema. Ipak, prevazišli smo sve i ugovor je, na naše i zadovoljstvo kineskog investitora, potpuno završen i naplaćen. Na ovom projektu aktivno je učestvovao i puk. Anastas Paligorić.

Poslednje godine rada u Jugoimport-SDPR proveli ste na mestu Direktora Sektora za razvoj, inženjering i tehničku podršku. To je period kada je naše preduzeće ulagalo velike

At the end of 1977 you moved to the Federal Directorate of Supply and Procurement (SDPR). Being engaged in planning the defense industry development you were given an opportunity to apply your knowledge and abilities in Algeria, Uzbekistan and other countries we had good business relations with. Which projects were you engaged in?

At the proposal of the Military Economic Division of the SSNO (Federal Secretariat of National Defense) my career was continued with the Federal Directorate of Supply and Procurement, which sent me immediately to Algeria as part of the Technical Assistance Program to the Algerian Defense Industry Directorate. I spent three years there. Based on my personal experience, I proposed setting up of the prototype processing line for small caliber ammunition, as the first stage of the future ammunition factory in Algeria. However, this proposal was not accepted by SDPR, which preferred to erect a high-capacity ammunition factory right away, based on its experience from Iraq, where our capital investment works were in full swing. Unfortunately, the Algerians then approached the FN company from Liege and accomplished their own plan.

I returned to SDPR in 1980 and was assigned to the Engineering Division, Department for contracting of engineering projects. From 1980 to mid 1996 I was involved in preparing various offers and contracts in the field of transfer of technology for armaments and defense equipment, as well as in offers and contracts for erection and furnishing of different factories, on «turn-key basis“. Most of the offers were for the employers in Iraq, Libya, Iran, Angola and Ethiopia, as well as in South Asian and Far East countries. In mid 1996 I was sent to Himproject in Uzbekistan, our joint-venture company established together with the state Institute for Chemical Engineering with the aim of promoting our technologies. For lack of funds on both sides, this joint-venture did not survive. After coming back from Uzbekistan in 1998, I joined the K-30 project for a Chinese partner which covered the transfer of technology for 30x165mm ammunition for 2A42, 2A72 and Gš301 guns. Our co-contractors in this project were: „Sloboda“ from Čačak, „Milan Blagojević“ from Lučani, „Krusik“ from Valjevo and „Zastava“ from Kragujevac. This project took place during the sanctions and the bombing of Yugoslavia in 1999, which created real difficulties for us. However, we managed to overcome all the obstacles and finalize the contract, collecting all the payment to the mutual satisfaction of our side and the Chinese employer. I have to mention that colonel Anastas Paligoric had an active part in this project.

You spent your final years in Jugoimport-SDPR as the Director of Development, Engineering and Technical Support Division. This was the time when our company spared no effort trying to mitigate the well-known effects of the nineties of the last century. Now it is safe to say that our ambitions, good organization and, most of all, the range of products we can offer, paved our way for returning to the global market as a serious, competitive and reliable partner. In your opinion, which projects can now be marked as especially important?

napore da ublaži posledice nastale devedesetih godina prošlog veka iz dobro poznatih razloga. Sada se sa sigurnošću može reći da smo velikim ambicijama, dobrom organizovanošću i, pre svega, programom koji možemo da ponudimo, uspeali da stvorimo dobre osnove da se na svetskom tržištu ponovo pojavimo kao ozbiljan, konkurentan i pouzdan partner. Koji projekti po vašem mišljenju da imaju poseban značaj u našoj poslovnoj ponudi?

Poslednjih desetak godina imali smo velike poslovne aktivnosti na setu ugovora sa Libijom (saradnja sa njihovim Razvojnim centrom), Indonezijom na ponudi isporuke i transfera tehnologije za proizvodnju sferičnog baruta, Pomenuo bih i marketinške i ugovorne aktivnosti vezane za tržište Južne Amerike. Najzad smo, posle dugog marketinškog rada, uspeali da plasiramo opremu za municiju malih kalibara proizvedenu u "Prvom partizanu" i očekujemo uspešan nastavak saradnje. Poslednje dve godine sam aktivno angažovan na realizaciji ugovora za isporuku samohodne top-haubice 155mm B-52 NORA koja je ušla u serijsku proizvodnju. Ovaj projekat zahtevao je veliku upornost i istrajnost u angažovanju Jugoimport-SDPR u procesima planiranja i kontrole proizvodnih aktivnosti saugovorača. Da smo imali većih ingerencija u upravljanju i organizaciji proizvodnje, verujem da bi proizvodnja bila vremenski kraća. U svakom slučaju, iz ovog projekta mogu se izvući pouke za dalji rad na sličnim zahtevima.

Gospodine Vasiljeviću, recite mi na kraju kako sagledavate perspektive Jugoimport-SDPR u budućnosti i šta je vaša poruka za one koji nastavljaju sa mesta gde vi završavate svoju uspešnu dugogodišnju profesionalnu karijeru?

S obzirom na promene uslova za obavljanje spoljnotrgovinskog prometa NVO, a imajući u vidu činjenicu da stotina firmi u Srbiji ima licencu za bavljenje ovim poslovima, kao i činjenicu da su preduzeća vojne industrije dobila mogućnost da samostalno ponude svoje proizvode i usluge i na kraju, da Ministarstvo odbrane ima pretenzije da se samostalno bavi ovim poslovima, rad našeg preduzeća veoma je otežan i složen. Nije ni malo lako naći van zemlje dovoljno poslova i naći u zemlji domaće firme koje će kvalitetno i na vreme isporučiti robu i izvršiti usluge. Stoga mislim da je potpuno ispravno rešenje orijentacija postavljena u Jugoimport-SDPR da se oformi odeljenje za razvojne aktivnosti koje, po mom mišljenju, treba što pre dopuniti organizovanjem jednog proizvodno-remontnog pogona za određena sredstva NVO, ne ulazeći u osnovne tehnologije šest preduzeća odbrambene industrije Srbije. Samo samostalnom opremljenošću i umešnošću organizovanja kooperacije sa nedostajućim tehnologijama moguće je ostvariti perspektivu mogućnosti prihvatanja i realizacije raznovrsnih poslova, što je nada za bolje sutra. Ovo mislim kao nadogradnju na postojeću infrastrukturu preduzeća. Pri tom, uvek se mora budno pratiti odnos proizvodnih i neproizvodnih radnika u preduzeću koji mora biti korektan radi ekonomičnog poslovanja firme.

Želeo bih na kraju da istaknem da iskreno verujem u dalju uspešnost poslovanja Jugoimport-SDPR a sa svoje strane spreman sam da i dalje pomognem prema potrebi i zahtevu SDPR.

In the past ten years we had significant business activity regarding a set of contracts with Libya (cooperation with their Development Center) and with Indonesia - regarding delivery of ball powders and the pertaining transfer of technology. I would also like to mention our marketing and contracting pursuits related to South America. After extensive marketing activities, we finally managed to sell our processing equipment for small caliber ammunition, manufactured by "Prvi partizan", and we expect to continue this cooperation successfully. In the past two years I took an active part in the implementation of contracts signed for supply of self-propelled gun Howitzer 155mm B-52 NORA, which has now reached the mass production stage. This project required great determination and persistence on the part of Jugoimport-SDPR, in the planning and control of our co-contractor's production activities. Had we been given a chance for greater influence on production management and organization, I believe that production would have taken less time. Anyway, we should draw a lesson from this project for some future projects with similar requirements.

Mr. Vasiljevic, how do you see the prospects of Jugoimport-SDPR, and what would be your message to those who will resume your work, when you end up this long, fruitful career?

The circumstances for carrying out the foreign trade of armaments and defense equipment have changed. We should also have in mind the fact that about a hundred other Serbian companies are licensed for this line of work, as well as the fact that the defense industry companies are given the opportunity to sell their products and services independently, and finally that the Ministry of Defense has similar aspirations, the position of our company is extremely hard and complex. It is not easy to find projects abroad or to find indigenous companies which can supply high-quality goods or services in due time. This is why I think that Jugoimport-SDPR has made a good decision establishing a development department, which should, in my opinion, be added a production and overhaul facility for certain armaments and defense equipment, without touching the basic technologies of the six defense industry companies in Serbia. Only if fully equipped and independent, as well as skilled enough to set up a cooperation with the missing technologies it would be possible to create the conditions for implementation of various projects. This is our hope for a better future. Apart from this, I think that a balance between production and non-production workers should always be kept so as to make the company's operations most cost-effective.

In the end, I would like to point out quite clearly that I honestly believe in Jugoimport-SDPR's successful future. As for me, I am ready and willing to offer my help if and when needed.

EDePro- DOMAĆE ZNANJE ZA CEO SVET

Piše
Goran Memon, dipl.ing.

Istorijat

Preduzeće EDePro (Engine Development and Production) ima dugogodišnju tradiciju u razvoju, projektovanju i proizvodnji turbomlaznih i raketnih motora. Koreni preduzeća sežu trideset godina unazad, kada je osnovana Laboratorija za mlaznu propulziju Mašinskog fakulteta Univerziteta u Beogradu. Danas je preduzeće EDePro prešlo u uspešnu, međunarodno priznatu firmu koja se bavi istraživanjem, razvojem, proizvodnjom i prometom novih, modernizacijom postojećih sredstava naoružanja i vojne opreme (NVO), kao i primenom visokotehnoloških rešenja u protivgradnoj zaštiti i drugim civilnim namenama.

Profil kompanije

Preduzeće EDePro je godinama među vodećim organizacijama u projektovanju i proizvodnji turbomlaznih i raketnih propulzivnih sistema različitih tipova i namena. Fleksibilnost u projektovanju omogućila je postizanje visokih performansi realizovanih rešenja, a s druge strane obezbedila je mogućnost brze realizacije projekata i aktivnosti u odbrambenoj i srodnim industrijama. Težište delovanja preduzeća je stalno oslanjanje na vrhunski stručni kadar

EDePro - LOCAL KNOWLEDGE FOR THE WHOLE WORLD

By
Goran Memon, B.Sc. Eng.

History

The Company EdePro (Engine Development and Production) has a long tradition in the development, design, and production of turbojet and rocket engines. The foundations of the Company were laid thirty years ago, when the Laboratory for Jet Propulsion was founded at the Faculty of Mechanical Engineering of the University in Belgrade. Today, EdePro has grown into a successful, internationally renowned Company, which is engaged in the research, development, production, and trade in the new, and modernization of the existing munitions and defense equipment, as well as in the application of high-tech solutions in hailstorm defense, as well as in other civilian applications.

Company Profile

The EdePro Company has been, for years, among the leading organizations engaged in the design and production of turbojet and rocket propulsion systems of different types and applications. The flexibility in the design has enabled the accomplishment of high performances of the realized solutions, and, on the other hand, it has enabled the possibility of fast realization of projects and activities in the defense



122mm MULTIPLE ROCKET LAUNCHER WITH UPGRADED ROCKETS



YUGOIMPORT-SDPR

- Grad-M, with new propellant grain and combustion chamber, providing maximum range up to 28 km
- Grad-2000, with new propellant grain and redesigned nozzle assembly, providing maximum range up to 40 km
- available launchers with 8, 32 and 40 barrels, mounted on various wheeled or tracked vehicles, compatible with standard and long range 122 mm rockets



u aktuelnim oblastima, i filozofiju sopstvenog, originalnog razvoja, što rezultuje visokim nivoom efikasnosti u radu i kvalitetom realizovanih projekata. U preduzeću danas rade predstavnici nekoliko generacija stručnjaka i specijalista, tako da EDePro zapošljava više doktora nauka, magistara i specijalista u tehničkim delatnostima značajnim za njegov rad. Pored toga, određeni broj stručnjaka preduzeća je angažovan u izvođenju redovne nastave na Mašinskom fakultetu Univerziteta u Beogradu, kao i u okviru izvođenja doktorskih i magistarskih studija. Direktor EDePro, redovni profesor dr Branislav Jojić, ujedno je i šef katedre za vazduhoplovstvo Mašinskog fakulteta u Beogradu.

Strateška opredeljenja preduzeća EDePro su:

- *Istraživanje i razvoj u oblasti sistema mlazne propulzije na bazi tečnih i čvrstih pogonskih materija,*
- *Projektovanje i proizvodnja turbomlaznih motora male snage i potiska namenjenih za pogon bespilotnih letelica, jedrilica, helikoptera i maketa letelica,*
- *Razvoj, projektovanje i proizvodnja bespilotnih letelica različitih namena,*
- *Razvoj, projektovanje i proizvodnja savremenih sredstava i sistema naoružanja i vojne opreme (NVO).*
- *Remont i modernizacija postojećih sredstava i sistema NV.*
- *Realizacija edukativnih programa, stručnih, specijalističkih i naučnih kurseva iz oblasti delatnosti preduzeća i transfer različitih tehnologija.*

Poslovna politika preduzeća EDePro definiše aktivnosti u proizvodnom, edukativnom i razvojnom sektoru delatnosti.

Proizvodni program preduzeća predstavljaju realizovani projekti: proizvodnja kompozitnih raketnih goriva, projektovanje i proizvodnja sklopova i podsklopova više tipova protivgradnih raketa, projektovanje i proizvodnja gasogeneratora (base-bleed jedinica) za artiljerijske projekte, remont raketnih motora i gasogeneratora raketa tipa vazduh-vazduh i zemlja-vazduh, proizvodnja raketnih motora za artiljerijske rakete različitih kalibara.

Razvojni programi obuhvataju aktuelne istraživačke projekte: *turbomlazni motor TMM-040 MONGOOSE malih dimenzija i klase potiska 40 daN, sistem višenamenskog navođenog projektila ALAS, žirostabilisana artiljerijska raketa R-107 kalibra 107mm za višecvni bacač raketa (VBR) dometa 11 km, hibridni artiljerijski projektil kalibra 155 mm RA/BB sa raketnim motorom i jedinicom gasogeneratora, raketa R-400 dometa 140 km.*

Edukativni programi predstavljaju aktivnosti usaglašene sa obrazovnim planom Mašinskog fakulteta u Beogradu, a usmereni su ka obrazovanju i usvršavanju kadrova iz oblasti mlazne propulzije. Korišćenjem naprednih CAD/CAM projektnih metoda polaznicima kurseva se prezentiraju najsavremenije metode projektovanja i sve to kroz praktičan rad na realnim konstrukcijama i razvojnim programima. Takođe, polaznicima se omogućava da interaktivno učestvuju u implementaciji novih tehnologija i sadržaja u procesu projektovanja. Na osnovu bogatog iskustva formiranog školovanjem više generacija inostranih studenata iz različitih zemalja, preduzeće EDePro garantuje visok nivo kvaliteta stečenog znanja kod svih polaznika.

and related industries. The Company's main effort is to permanently rely on the top-notch experts in the topical areas, and to pursue the philosophy of its own, original development, which results in a high level of efficiency in work and the quality of realized projects. Today, the Company employs the representatives of few generations of experts and specialists and, hence EdePro employs a substantial number of PhDs, masters of science, and specialists in fields, which are important for its operations. Besides, a certain number of Company's experts are teaching at the Faculty of Mechanical Engineering of the University in Belgrade, as well as within the postgraduate studies. The Director of EdePro, the full-time Professor Branislav Jojić, PhD, is also the head of the Department of Aeronautics at the Faculty of Mechanical Engineering in Belgrade.

The strategic commitments of EdePro are:

- *Research and development in the field of jet propulsion, based on liquid and solid fuels;*
- *Design and production of low-output and thrust turbojet engines intended for UAV, motor glider, helicopter, and mock-up power plants;*
- *Development, design, and production of unmanned aerial vehicles for different applications;*
- *Development, design, and production of modern munitions and weapon systems and defense equipment;*
- *Overhaul and modernization of the existing munitions and weapon systems;*
- *Various training programs, expert, specialist, and scientific courses in the areas of the Company's expertise and transfer of different technologies.*

The business policy of EdePro Company defines the activities in the production, educational, and development sectors.

The product range of the Company is represented by realized projects: *production of composite rocket fuels, design and production of assemblies and subassemblies for a number of types of anti-hailstorm rockets, design and production of gas generators (base bleed units) for artillery ammunition, overhaul of missile engines and gas generators for air-to-air and surface-to-air missiles, production of rocket motors for artillery rockets of different calibers.*

The development program includes our current research projects: small TMM-040 MONGOOSE turbojet engine of the thrust class of 40 daN, multi-purpose ALAS guided missile system, gyro-stabilized artillery rocket R-107 of 107mm caliber for multi-barreled rocket launchers with the maximum range of 11 kilometers, hybrid artillery ammunition of 155 mm caliber RA/BB with rocket motor and gas generator unit, R-400 ballistic missile of the maximum range of 140 km.

The educational programs are represented by activities, which are harmonized with the curriculum of the Faculty of Mechanical Engineering in Belgrade, and they are intended for education and specialization of research staff in the field of jet propulsion. By using the advanced CAD/CAM design methods, the course attendants are presented with the latest design methods, and everything is done through practical work on real designs and development programs.

262 mm multiple rocket launcher ORKAN

- 50 km maximum range (version with 65 km in development)
- cluster warhead with either 288 DPICM bomblets or 24 anti-tank mines (unitary HE warhead in development)
- possibility of launcher integration with various wheeled or tracked chassis



YUGOIMPORT-SDPR



ORKAN

Preduzeće EDePro poseduje tehnološki savremene laboratorije za ispitivanje karakteristika turbomlaznih i raketnih motora, čvrstih raketnih goriva kao vazduhoplovnih materijala. Laboratorija za ispitivanje turbomlaznih motora poseduje naprednu platformu za ispitivanje turbomlaznih motora u realnim eksploatacionim uslovima. Savremena akviziciona i merna oprema omogućava merenje i zapisivanje velikog broja parametara u realnom vremenu. Stoga su laboratorije ove namene preduzeća EDePro, među malobrojnijim laboratorijama u ovom delu Evrope.

Proizvodni programi

Najveći deo proizvodnog i razvojnog programa preduzeća EDePro oslonjen je na proizvodnju termoplastičnog kompozitnog raketnog goriva razvijenog po sopstvenoj, originalnoj tehnologiji. Postojeća proizvodna linija obezbeđuje visokoserijsku proizvodnju različitih tipova pogonskih punjenja raketnih motora i generatora gasa. Ovi proizvodi karakterišu se visokim specifičnim impulsima, odličnim mehaničkim osobinama, visokom pouzdanošću i dugotrajnim vekom upotrebe. Najnovija istraživanja usmerena su ka osvajanju segmentnih pogonskih punjenja (relativno manjih dimenzija), čime bi bilo omogućeno formiranje velikogabaritnih, modularno građenih punjenja raketnih motora. Takav pristup obezbeđuje procentualno manja ulaganja i manje složeno proizvodno okruženje. Projektovanje, razvoj i proizvodnja savremenih raketnih motora, pored ostalog, uslovljeni su dobrim poznavanjem materijala i tehnologija izrade delova, čija je osnovna funkcija termička zaštita nosećih konstrukcija. Posebnost ovakvih tehničkih rešenja i posedovanje iskustva u realizaciji usmerili su preduzeće u pravcu



Also, the course attendants are enabled to interactively participate in the implementation of new technologies and contents in the design process. Based on a rich experience, gained by educating multiple generations of foreign students from different countries, EdePro guarantees a high level of quality of the knowledge acquired by all course attendants.

EdePro Company has technologically advanced laboratories for testing of the characteristics of turbojet engines and rocket motors, solid rocket fuels as well as the materials used in aircraft construction. Turbojet engine testing lab has an advanced platform for testing of turbojet engines in realistic operational conditions. The modern acquisition and measuring equipment enables measuring and recording of a large number of parameters in real time. Therefore, these laboratories of EdePro Company are among the rare ones of this kind in this part of Europe.

Production Programs

The largest part of EdePro's production and development program is relying on the production of thermoplastic, composite rocket fuel, developed based on its own, original technology. The existing production line enables a large-volume production of different types of fuels for rocket motors and gas generators. These products are characterized by high specific impulses, excellent mechanical properties, high reliability and long service life. The latest research is aimed at mastering of the production of segmented solid propellants (of relatively smaller dimensions), which would enable making of high-volume, modular built propellants of rocket motors. Such an approach ensures smaller investments percentage-wise and a less complex production environment. The design, development, and production of modern rocket motors are, among other things, conditioned by a good knowledge of the materials and parts making technologies, whose basic function is thermal protection of the bearing structures. The special feature of such engineering solutions and the experience in realization have oriented the Company towards its own design, development of an indigenous technology for production of parts and sub-assemblies made out of thermo-protecting, composite polymer materials, which fulfill their function through the process of ablation. At the same time, the existing technological line is also compatible with the technology for production of elastomer elements for defense industries. Such a concept enables the implementation of all above programs within the framework of a single production unit.

122 mm Artillery Rocket "GRAD"

One of the most important products of EdePro is the rocket motor for 122 mm artillery rockets, GM and G-2000, intended for use from multiple rocket launcher systems BM-21 "GRAD". The GM rocket is a modified original rocket M-21 OF, in which the original charge and chamber of the rocket motor were replaced, which increase of the maximum range by 40%. The G-2000 rocket represents a unique solution in the range of 122 mm caliber rockets, with the range exceeding 40 kilometers (increase of the maximum range in comparison with the original rocket is 100%).

sopstvenog projektovanja, razvoja tehnologije proizvodnje delova i podsklopova od termozaštitnih, kompozitnih polimernih materijala koji svoju funkciju ostvaruju kroz proces ablacije. Paralelno, postavljena tehnološka linija omogućava i tehnologiju proizvodnje specijalnih elastomernih elemenata za namensku industriju. Ovakav koncept omogućava realizaciju svih navedenih programa u okviru jedinstvene proizvodne celine.

Artiljerijska raketa kalibra 122 mm "GRAD"

Jedan od najznačajnijih proizvoda firme EDePro predstavlja raketni motor za artiljerijske rakete kalibra 122 mm GM i G-2000 namenjene za upotrebu u višecevnim raketnim lansirnim sistemima BM-21 „GRAD“. Raketa GM je modifikovana originalna raketa M-21 OF kojoj je zamenjeno pogonsko punjenje i komora raketnog motora, uz povećanje maksimalnog dometa od 40%. Raketa G-2000 predstavlja jedinstveno rešenje u kalibru 122 mm dometa preko 40 km (povećanje maksimalnog dometa u odnosu na originalnu raketu je 100%).

Protivgradne rakete

Preduzeće EDePro, u kooperaciji sa poslovnim partnerima, je vodeća organizacija u jugoistočnoj Evropi za proizvodnju protivgradnih sistema. Realizovani proizvodi se decenijama uspešno koriste u okviru redovne protivgradne zaštite u našoj zemlji i u inostranstvu. Postoje dva tipa protivgradnih raketa (A-6 i A-8) čija je upotreba jednostavna i pouzdana. Zbog svojih kvaliteta (performansi, pouzdanosti i bezbednosti) ove rakete svakim danom osvajaju nova tržišta širom planete.

Gasogenerator (base-bleed jedinica) za artiljerijske projekte

Preduzeće EDePro proizvodi gasogeneratore za artiljerijske projekte od kalibra 76 mm do 155 mm. Performanse proizvedenih gasogeneratorskih jedinica su vrhunske i omogućavaju povećanje dometa više od 30% u odnosu na klasičan artiljerijski projektil. Pouzdanost pripaljivanja i rada gasogeneratorskih jedinica na putanji je stoprocentna. Maksimalni domet projektila sa ovim gasogeneratorima je veći nego sa gasogeneratorskim jedinicama drugih svetskih proizvođača. Najveće serije gasogeneratorskih jedinica su proizvedene za projekte kalibara 105 mm i 155 mm. Trenutni proizvodni kapacitet preduzeća je preko 40,000 punjenja na godišnjem nivou.

Remont i modernizacija postojećih sistema NVO

Preduzeće EDePro je kadrovski i tehnološki opremljeno za realizaciju remonta i modernizacije postojećih složenih sistema NVO, naročito u domenu raketnog pogona. Zapažen rezultat ostvaren je učešćem u uspešnom remontu raketa vazduh-vazduh druge generacije R-60K i R60MK. U osnovi, remont ovih raketa sastojao se u zameni postojećeg raketnog motora novoproducentnim raketnim motorom preduzeća EDePro koji svojim performansama u potpunosti odgovara tehničkim zahtevima za raketu R-60K i R60MK. Pored toga, proizvedeno je i potpuno novo punjenje generatora gasa koje ima bolje performanse od originalnog.

Anti-Hailstorm Rockets

EdePro Company, in cooperation with its business partners, is the leading company in South-Eastern Europe for the production of anti-hailstorm systems. The realized products have been used for the regular protection against hailstorms for decades, both in our country and abroad. There are two types of anti-hailstorm rockets (A-6 and A-8), which are easy to use and reliable. Because of their qualities (performances, safety, and reliability), these rockets are finding new markets every day, throughout the planet.

Gas Generator (Base-Bleed Unit) for Artillery Ammunition

EdePro Company produces gas generators for artillery ammunition, with calibers ranging from 76mm to 155 mm. The performances of the produced gas generators are superior and they provide an increase in range of over 30% with respect to a conventional artillery shell. The reliability of ignition and operation of gas generators on the trajectory is 100%. The maximum range of the ammunition with these gas generators is longer than of those of other world manufacturers. The biggest series of gas generators have been produced for ammunition of 105mm and 155mm calibers. The current production capacity of our Company is over 40,000 charges per annum.



Razvojni programi

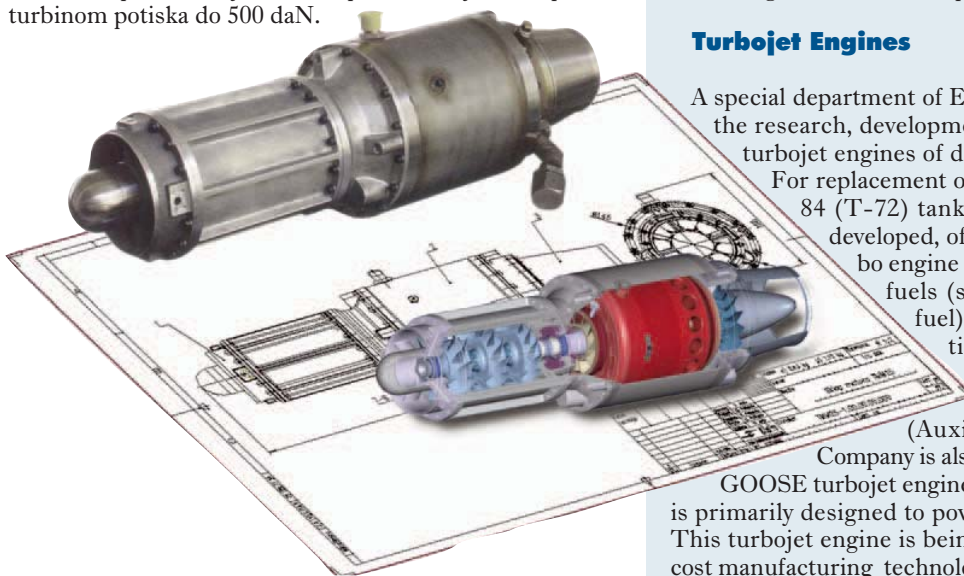
U svojoj poslovnoj orijentaciji preduzeće EDePro značajan deo resursa usmerava ka istraživačkim i razvojnim programima koji su danas nužni uslov opstanka na sve zahtevnijem i izbirljivijem tržištu. U tom cilju preduzeće je usmerilo delatnost u dva prioritetna pravca. Prvi pravac je dalji razvoj raketnih motora na bazi čvrste i tečne pogonske materije, kao i razvoj novih, čvrstih kompozitnih raketnih goriva visokih energetske performansi. Drugi pravac je razvoj turbomlaznih motora prvenstveno za sisteme bespilotnih letelica. Pored ova dva osnovna pravca preduzeće EDePro paralelno razvija integralne sisteme bespilotnih letelica, vođene mete različitih namena, kao i lake i ultralake letelice (helikoptere i avione).

Raketa R400

Značajan razvojni program predstavlja balistička raketa dometa 140 km u kalibru 400 mm. Pogon rakete je raketni motor sa čvrstim pogonskim punjenjem modularnog tipa. Ova raketa je jedinstveno rešenje u klasi taktičkih raketa velikog dometa i predstavlja savremeno sredstvo za podršku konopnih snaga.

Turbomlazni motori

Posebno odeljenje preduzeća EDePro bavi se istraživanjem, razvojem, projektovanjem i proizvodnjom turbomlaznih motora različite konstrukcije i namene. Za potrebu zamene postojećeg agregata na tenku T-72 (M-84) razvijen je turbomotor snage TM-40 snage 40kW. Ovaj turbo motor koristi ravnopravno više vrsta goriva (benzin, kerozin, dizel gorivo). Osim za navedenu primenu, ovaj turbomotor može se koristiti kao pogonska jedinica za različite tipove APU (Auxiliary Power Unit). Preduzeće razvija i turbomlazni motor TMM-040 MONGOOSE potiska 40 daN, prvenstveno namenjen za pogon bespilotnih letelica. Ovaj turbomlazni motor razvija se u low cost tehnologiji izrade čime se postiže konkurentna tržišna cena. Takođe, na ovom motoru proverava se koncept gradnje jednovratilnog turbomlaznog motora sa trostepenim aksijalnim kompresorom i jednostepenom turbinom potiska do 500 daN.



Overhaul and Modernization of the Existing Munitions and Defense Equipment

EdePro Company has the adequate manpower and technologies to conduct overhaul and modernization of the existing complex munitions and defense equipment, especially in the field of rocket propulsion. The noted result was achieved during participation in the successful overhaul of the second-generation air-to-air missiles R-60K and R-60MK. Basically, the overhaul of these missiles consisted of the replacement of the existing missile engine with the new missile engine, produced by EdePro, whose performances meet all the technical criteria for missiles R-60K and R-60MK. Additionally, a brand new gas generator charge was produced, which has better performances than the original one.

Programs under Development

In its business orientation, EdePro Company devotes a significant part of its resources towards research and development programs, which are nowadays the necessary precondition for survival in an ever more demanding and selective market. This is why the Company has focused its core business on two priorities. The first one is further development of rocket motors based on solid and liquid fuels, as well as the development of new, solid composite rocket fuels, of high power performance. The second priority is the development of turbojet engines, above all for unmanned aerial vehicle systems. Apart from these two priorities, EdePro Company develops, in parallel the integral unmanned aerial vehicle systems, guided targets for different purposes, as well as light and ultra-light aircraft (aircraft and helicopters).

Missile R-400

An important development program is the ballistic missile, of the range of 140 kilometers, in 400 mm caliber. The missile is powered by a modular solid fuel missile engine. This missile is a unique solution within the class of tactical long-range ballistic missiles, and it represents a modern asset for ground combat support.

Turbojet Engines

A special department of EdePro Company is working on the research, development, design, and production of turbojet engines of different designs and purposes.

For replacement of the existing generator on M-84 (T-72) tanks, a turbo engine TM-40 was developed, of an output of 40 kW. This turbo engine can equally use several types of fuels (standard fuel, kerosene, diesel fuel). Apart from the above application, this turbo engine can be used as a propulsion unit for different types of APUs (Auxiliary Power Units). The

Company is also developing TMM-040 MONGOOSE turbojet engine of the thrust of 40 daN, which is primarily designed to power unmanned aerial vehicles. This turbojet engine is being developed by using the low-cost manufacturing technology, which will contribute to its

Raketni sistem ALAS

Projekat razvoja protivoklopnog sistema poslednje generacije-ALAS u potpunosti je realizovalo preduzeće EDePro na osnovu sopstvenog višegodišnjeg istraživanja na planu razvoja mlazne pogonske grupe (razvoj turbomlaznog motora TMM-040 MONGOOSE), velikog inženjerskog iskustva u projektovanju vazduhoplovnih i raketnih sistema, kao i praćenja savremenih svetskih trendova razvoja bespilotnih sistema različitih namena. Sam sistem ALAS kategorizovan je kao taktički sistem za podršku dejstva pešadije čije je osnovno sredstvo savremeni navodeni projektil sa sopstvenim propulzivnim pogonom. Sistem ALAS namenjen je za izolaciju bojišta i protivoklopnu borbu na srednjim i velikim daljinama (do 25km), kao i za dejstva po važnim tačkastim ciljevima u dubini teritorije protivnika. Takođe, sistem ALAS poseduje mogućnost funkcionisanja u više modova rada. Autonomno navođenje na fiksne ciljeve, aktivno navođenje na izabrani cilj i slobodno pretraživanje terena sa izborom željenog cilja. Višenamenska funkcija ovog sistema ogleda se u mogućnosti menjanja prioriternih ciljeva tokom same misije (na bazi odluke operatera) i mogućnosti manevrisanja u zoni dejstva, izmene vrste i tipa bojne glave prema vrsti cilja na osnovu visoke modularnosti sekcije korisnog tereta, kao i mogućnosti izbora programirane putanje na osnovu unošenja podataka poznatog cilja i parametara putanje unošenjem podataka u memoriju on-board računara leta pre početka same misije. Sistem ALAS poseduje savremeni TV podsistem za pretraživanje, zahvat ciljeva i navođenje na cilj, dok se komandni signali sa zemlje kao i slika sa TV podsistema sa rakete prenose putem optičkog kabla do zemaljske stanice. Sistem ALAS je koncipiran da može da funkcioniše kao nezavistan odbrambeno-napadački sistem: za protivoklopnu borbu, za protivbrodsku borbu kao i za dejstva po nepokrenim ciljevima. Sistem ALAS se lako integriše u veće formacijske jedinice i punu snagu i efikasnost pokazuje u sadejstvu sa uvezanim sistemima za izvidanje, od kojih dobija potrebne informacije o lokaciji ciljeva.

competitive market price. Also, this engine is being used to test the concept of a single-shaft turbojet engine, with three-stage axial compressor and a single stage turbine, with the thrust of up to 500 daN.

ALAS Missile System

The project of the development of the last-generation antitank system ALAS is realized completely by EdePro Company, based on its own several-years long research in the field of development of jet propulsion group (development of the TMM-040 MUNGOOSE turbojet engine), long engineering experience in the design of aeronautical and rocket systems, as well as on the following of the latest world trends in the field of the unmanned systems for different applications. The ALAS system itself is categorized as a tactical infantry support system, whose main component is the modern guided missile with its own propulsion. The ALAS system is intended for battlefield isolation and for combat against armored vehicles on medium and long ranges (up to 25 km), as well as for engagement of important spot targets in the depth of the enemy territory. Additionally, the ALAS system is a multimodal system. Autonomous guidance on fixed targets, active guidance on selected targets, and the free search of the field, with the selection of the desired target. The multimode function of this system is reflected in the possibility to change the priority targets in the course of the mission (based on the decision of the operator), and the possibility of maneuvering in the zone of action, of change of the kind and type of the warhead, depending on the type of the target, which is based on a high level of modularity of warhead section, as well as on the possibility to choose the programmed trajectory, based on input of the data on the known target, and trajectory parameters, by inputting data into the memory of the on-board flight computer before the execution of the mission. The ALAS system possesses a modern TV subsystem for search, target acquisition and guidance, while the command signals from the ground, as well as the TV subsystem picture

from the missile, are transmitted through an optic cable to the ground station. The ALAS system is envisaged to be able to operate as an independent defensive/offensive system: in anti-armor combat, anti-ship combat, as well as against static targets. The ALAS system is easy to integrate into larger units, and it shows its full strength and efficiency in coordinated action with networked reconnaissance systems, which feed it with the necessary data on target locations.



MODERNA FABRIKA ŠIROKOG PROIZVODNOG PROGRAMA I VELIKIH MOGUCNOSTI

INDUSTRIJA HIDRAULIKE I PNEUMATIKE
„PRVA PETOLETKA“ – TRSTENIK
PPT – NAMENSKA a.d.

Piše
**Ana Vasilev
Milenko Beloica**

PPT-Namenska je akcionarsko društvo u sastavu Holding kompanije Industrija hidraulike i pneumatike „Prva Petoletka“ - Trstenik. Osnovana je 23. marta 1949. godine kao državno preduzeće za proizvodnju borbenih aviona i aviona za obuku. Nakon formiranja, doneta je odluka da se avioni proizvode u Mostaru („SOKO“), a Petoletki je poverena proizvodnja hidroinstalacija i stajnih trapova za avione. Da bi se uposlili svi proizvodni kapaciteti, fabrika je proizvodila i drugi proizvodi za potrebe JNA kao što su: ledni plamenobacaji, mitraljeska postolja, bacači bombi, računari za artiljerijska oruđa itd.

Petoletka je jačala službe istraživanja i razvoja i značajno proširila program proizvodnje. Pored proizvodnje za potrebe JNA širila je proizvodnju za civilne namene, razvijajući hidrauličke i pneumatske uređaje i sisteme za drumska i šinska vozila, poljoprivredne, građevinske, rudarske i druge mašine i procese.

Na temelju tehnološke opremljenosti i stečenih znanja u projektovanju i proizvodnji stajnih trapova i hidraulike za vojnu primenu, razvijenu su novi programi za civilno tržište. Tako su formirane posebne fabrike u okviru Prve Petoletke

MODERN FACTORY WITH WIDE MANUFACTURING PROGRAM AND GREAT CAPABILITIES

HYDRAULICS AND PNEUMATICS INDUSTRY
„PRVA PETOLETKA“ – TRSTENIK
PPT – NAMENSKA A.D.

By
**Ana Vasilev
Milenko Beloica**

PPT-Namenska is a shareholding company within the Holding Company Hydraulics and Pneumatics «Prva Petoletka» - Trstenik. It was founded on March 23, 1949 as a state enterprise built to manufacture combat and trainer aircraft. Upon its forming, the government decided that aircraft would be produced in Mostar („SOKO“)

and PPT was entrusted with manufacture of aircraft hydraulic installations and landing gear. In order to employ all its production capacities, the factory undertook production of a variety of products for the needs of the Yugoslav People's Army, such as backpack flame throwers, machine gun stands, grenade launchers, calculators for

artillery weapons, etc.

Petoletka engaged to strengthen its research and development services and broaden its manufacturing range. In addition to producing for the YPA needs, it expanded its production for civil markets by developing hydraulic and pneumatic equipment for road vehicles and railways, for agricultural, civil engineering, mining machinery and processes.



TEHNOLOŠKA OPREMLJENOST I TEHNOLOŠKE MOGUĆNOSTI

PPT-Namenska poseduje savremen mašinski park, dobro opremljene ispitne i metrološke laboratorije za proizvodnju najslabijih uređaja i sistema za vojno i civilno tržište.

Mašinska obrada u PPT-Namenska predstavlja skladan spoj visoko obrazovanih stručnih radnika i mašinskog parka prema aktuelnom stanju tehnike u svetu. Za svaku tehnološku obradu koju zahtevaju savremeni hidraulički i pneumatički uređaji, na raspolaganju je širok izbor mašina za struganje, glodanje, bušenje, proširivanje, okruglo, ravno i kopirno brušenje, lepovanje, honovanje, provlačenje, kalibrisanje, rolovanje, sačmarenje, zavarivanje (autogeno, elektroeroziju i td. Samo jedan manji deo su precizne univerzalne mašine konvencionalnog tipa, dok su veći broj NC i CNC mašine.

Obradni centri različitih tipova koriste se za obradu korpusnih delova sa velikom tačnošću. Ekstremno visoka tačnost kod pojedinih delova ostvaruje se samo ukoliko se proizvodnja odvija u klimatizovanim uslovima. Zbog toga jedan broj mašina u PPT-Namenskoj radi u specijalno opremljenim prostorima u kojima je moguće temperaturu mašine, rashladnog sredstva, radnog komada, alata i pribora održavati stalno na 20°C. U prvom redu, u takvim uslovima izvodi se precizno ravno, okruglo i kopirno brušenje, koordinatno bušenje i brušenje, CNC glodanje i bušenje, honovanje i lepovanje i uparivanje, montaža i ispitivanje servorazvodnika.

Proizvodnja hidrauličkih i pneumatičkih uređaja i sistema ne bi bila moguća bez odgovarajućih postupaka termičke obrade i galvanske zaštite. Najveći deo savremenih tehnoloških postupaka iz ove oblasti već godinama se vrlo uspešno koristi i razvija u PPT-Namenska. Tako su u primeni meko i normalizaciono žarenje, poboljšanje, kaljenje u sonom kupatilu, zaštitnom gasu i vakuumu, indukciono kaljenje, cementacija i karbonitriranje u gasu, kratkotrajno i dugotrajno gasno nitriranje, nitriranje po Tenifer postupku i boriranje u prahu. Postojeća oprema ispunjava najstrožije zahteve domaćih i svetskih standarda. U oblasti galvanskih prevlaka razvijeni su postupci hromiranja, niklovanja, cinkovanja,



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Based on technological dedication and expertise acquired in design and manufacture of landing gear and hydraulics for military aircraft, new programs for commercial markets were developed as well. Special plants were established within Prva Petoletka for production of hydraulics, industrial and braking system pneumatics, power actuators, sealing components, tools, industrial electronics, articulated joints and other products. With expansion of the manufacturing range, new facilities were built and employment was provided to increasing numbers of workers. The products of Prva Petoletka attained the world-class quality and the Company used to and continues to achieve significant export sales for its products.

Numerous products developed at Prva Petoletka were granted for production by other factories; even new factories were erected to produce them. So, for example, industrial vacuum cleaners, reduction gear and super-finishers were granted to Equipment and Parts Factory in Brus (1963), hydraulic lifts to Univerzal of Banja Luka (1963), hydraulic brakes for automobiles to '21 October' in Kragujevac (1964), piping to 'Fadip' in Novi Bečej (1964), tractor hydraulic pumps to IMT of Belgrade (1964), hydraulic shock absorbers to 'Shock Absorbers Factory' in Priština (1964-1967), implements to Implements Factory in Aleksandrovac (1964), hydraulic components to a factory in Novi Pazar (1981), special-purpose components to a factory in Bijelo Polje (1983) and articulated joints to a factory in Leposavić (1988).

PPT-Namenska has expanded its manufacturing range so that presently it is a factory well equipped with machines, laboratories and other facilities, employing skilled work force. PPT-Namenska, one of 18 shareholding companies within the Holding Company 'Prva Petoletka' has at its disposal about 49,000 m² of business area, over 400 machines and 810 workers; it turns our high-quality products for the domestic but predominantly for international markets.

TECHNOLOGICAL OUTFIT AND TECHNOLOGICAL CAPABILITIES

PPT-Namenska possess modern machines and well-equipped laboratories and metrology labs needed to produce and test most complex equipment and systems built for defense and commercial markets.

Machining processes at PPT-Namenska comprise a well-matched interface of highly skilled workers and machines, in keeping with state of the art in the world. For every technological operation requisite for advanced hydraulic and pneumatic equipment, there are available varied turning, milling, drilling, boring, round, flat and copy grinding, lapping, honing, broaching, calibrating, rolling, pelting, welding (gas, arc, friction), chemical etching, etc. machines. Conventional precision universal machine tools comprise only small portion of production equipment, most of equipment consists of NC and CNC machines.

Different types of processing centers are used to machine casings with high precision. Extreme accuracy of certain components is achievable only in clean air-conditioned rooms. For this reason a number of machines at PPT-Namenska are located in specially equipped rooms where machine, cooling liquid, work piece, tools and accessories operate in constantly kept temperature of 20°C. This environment is primarily used for flat, round and copy precision



bruniranja fosfatiranja. Kontrola kvaliteta i u ovoj oblasti ostvaruje se na najsvremenijim aparatima u toku odvijanja i po završenom procesu.

Prostorije za montažu uređaja su posebno obezbeđene tako da omogućuju besprekorno održavanje čistoće. Pojedina odeljenja za montažu specifičnih uređaja, kao što su oni za vazduhoplovstvo, imaju potpuno kontrolisanu i klimatizovanu atmosferu.

PPT-Namenska ima opremu za ispitivanje i kontrolu proizvedenih uređaja i sistema u fazi razvoja (homologacije) i serijske proizvodnje u skladu sa MIL standardima, kao što su: probni stolovi za funkcionalna ispitivanja hidrauličkih, pneumatskih i gorivnih uređaja i sistema; probni stolovi za ispitivanje stajnih trapova (bacanja, udari, zamor i trajnost); laboratorija za ispitivanje kočnica, guma i točkova aviona; probni stolovi za ispitivanje na udare, vibracije, ubrzanje.

Pored klasične kontrolne opreme, PPT-Namenska ima i laserski merni sistem, trokoordinatne merne mašine, profilprojektore, konturografe, mikroskope.

PPT-Namenska poseduje metrološku laboratoriju za proveru kontrolne opreme, za pritisak i dužinu, kao i kontrolnu opremu za proveru strukture materijala, hemijskog sastava i mehaničkih karakteristika i laboratoriju za proveru čistoće ulja prema standardima ISO, MIL i DIN.

PROIZVODNI PROGRAM

PPT-Namenska projektuje, konstruiše, proizvodi, ispituje, servisira i remontuje uređaje i sisteme iz oblasti hidraulike, pneumatike, procesne tehnike i servotehnike za potrebe vojske i civilnog tržišta, vrši usluge proizvodnje uređaja i sistema, po zahtevima domaćih i stranih kupaca.

Proizvodni program PPT-Namenska obuhvata proizvode za potrebe vojske, proizvode za procesnu tehniku, proizvode iz oblasti servotehnike i ostale proizvode.

milling, for CNC grinding and drilling, honing, lapping and pairing, for assembling and testing of servo actuators.

Production of hydraulic and pneumatic equipment is not possible without appropriate heat and surface protection treatments. Majority of modern technological processes have been successfully used by PPT-Namenska for many years. Thus used are soft and normalization glowing, improving, salt bath, protective gas and vacuum hardening, induction hardening, gas cementing and carbonating, short and long-term gas nitrating, Tenifer process nitrating and powder boring. The equipment in use meets the strictest domestic and international standards. Galvanic coating processes include chromium, nickel and zinc plating, blueing and phosphating. Quality control is assured with most modern devices, applied during and after completed processes.

Equipment assembly rooms are specially protected for faultless cleanliness. Certain departments where critical units, such as aircraft equipment, are assembled are provided with clean air and air conditioning.

PPT-Namenska possesses test and control equipment for finished products and systems, for homologation in development and control during production run, according to MIL standards, including test benches for functional testing of hydraulic, pneumatic and fuel supply equipment and systems; landing gear test stand (drop, jolt, fatigue, endurance); aircraft brake, wheel and tire testing rig; test benches for jolt, vibration and acceleration testing.

In addition to conventional control equipment PPT-Namenska also employs laser measuring system, 3-coordinate measuring machines, profile projectors, contour graphs and microscopes.

PPT-Namenska owns metrological laboratory for inspection of control equipment in respect of pressure and length, as well as control equipment for structure of materials, chemical composition and mechanical properties, and fuel testing laboratory according to ISO, MIL and DIN specifications.

Proizvodi za potrebe vojske obuhvataju proizvodnju za vazduhoplovstvo, KOV i mornaricu.

Vazduhoplovstvo: Stajni trapovi za avione (nosni i glavni), amortizeri, kočnice hidrauličke brave, pumpe (hidraulične i gorivne), hidromotori, servopokretači za primarne i sekundarne komande leta, razvodnici, ventili, filteri, hidroakumulatori, cilindri, slavine, spojnice, rezervoari, priključci, pneumatski sistemi i instalacije, hidraulički agregati i dizalice itd.; elektropneumatski i elektrohidraulički sistemi za rakete (Grom, REHS).

KOV: Tenkovski program (tenk M-84(T-72); tenk T-55; vozila:BRDM-2; BVP-M80A; BOV): elektrohidraulički sistem za upravljanje vatrom po elevaciji i pravcu, hidraulički sistem za upravljanjem tenkom i podmazivanje transmisije, hidrauličke pumpe menjača, hidraulički sistem za podmazivanje motora, pneumatski sistem sabijenog vazduha, hidraulički amortizer, komponente sistema za hlađenje, komponente za gorivo, cilindri, razvodnici, kočni cilindri, cilindar pomoćnih točkova, odušni ventil, pneumatski servoureda. Tenkovski program obuhvata još proizvodnju delova za protivavionski top (Galileo i Bofors) i to elektrohidraulički sistem za upravljanje vatrom po elevaciji i pravcu, kompletan sistem hidraulike i pneumatike za raketne lansere



„Orkan“ i „Košava“, kao i minobacače MB 60mm; MB 82mm i MB 120mm. Pored toga, PPT-Namenska proizvodi i radi na modernizaciji i razvoju novih minobacača.

Mornarica: PPT Namenska proizvodi elektrohidraulički sistem kormilarenja, elektrohidraulički sistem za lanser raketa (sistem „Krma“), komponente hidrauličkih sistema domaćih i ino podmornica, remont sistema i druge komponente za brodove PN-27, DBM, PČ, VPBR.



MANUFACTURING PROGRAM

PPT-Namenska designs, builds, produces, tests, services and overhauls hydraulic, pneumatic, processing and servo equipment and systems designed for military and general applications, it also offers manufacturing of equipment and systems against specifications of domestic and foreign customers. Manufacturing program of PPT-Namenska comprises products for the military, processing equipment,

power actuated equipment and other products.

Products intended for military applications include production for Air Force, Land Forces and Navy.

Air Force: Aircraft landing gear (both nose and main), shock absorbers, brakes, hydraulic lock brakes, pumps (hydraulic and fuel), hydraulic motors, servo actuators for primary and secondary flight controls, distributors, valves, filters, hydro accumulators, cylinders, cocks, couplings, tanks, connectors, pneumatic systems and installations, hydraulic generators and lifts, etc.; electro-pneumatic and electro hydraulic systems for rockets (Grom, REHS).

Land Forces: Tank program (M-84/T-72 tanks); T-55 tank; armored vehicles (BRDM-2; BVP-M80A; BOV): electro hydraulic fire control system in elevation and azimuth, tank hydraulic steering system and transmission lubrication, gearbox hydraulic pumps, hydraulic engine lubricating system, compressed air pneumatic system, hydraulic shock absorber, engine cooling system components, fuel system components, cylinders, distributors, braking cylinders, compensating wheel cylinder, venting valve, pneumatic servo unit. Tank program also includes production of replacement parts for anti-aircraft guns (Galileo, Bofors), specifically for elevation and azimuth electro-hydraulic systems; complete hydraulic and pneumatic systems for mobile missile launchers «Orkan» and «Košava»; hydraulics for mortars MB 60mm, MB 82mm and MB 120mm. In addition, PPT-Namenska manufactures, upgrades and develops new mortars.

Navy: PPT Namenska produces electro hydraulic rudder systems, electro hydraulic system for rocket launchers („Krma“), hydraulic components for domestic and foreign-built submarines, for overhaul, and makes various components for ships type PN-27, DBM, PČ, and VPBR.

Products for processing industries include the following: machines for production of blown plastic containers, machines for injected plastic products, bottle rinsing machines, filling machines for mineral and cooking oils, beer, mineral water, liquid detergents, etc.; single and multihead closing machines for bottles with screwed caps, machines for bottle labeling, packing and transporting, machines for forming and closing of cardboard boxes, machines for packing in shrinking thermo foil, palletizers, bottle inspection machines and numerous other machines of different capacities, as well as tools for plastics injecting and extruding.

Proizvodi za procesnu tehniku obuhvataju sledeće proizvode: mašine za proizvodnju duvane plastične ambalaže, mašine za brizganje proizvoda od plastike, mašine za ispiranje flaša, punilice za mineralna i jestiva ulja, pivo, kiselu vodu, tečne deterdžente itd., zatim zatvaračice za navojne zatvarače sa jednom i više glava, etiketirke, upakivače, usmerivače boca, mašine za formiranje i zatvaranje kartonskih kutija, mašine za pakovanje u termo skupljajuću foliju, paletizere, mašine za kontrolu ispravnosti boca i druge mašine u više veličina i varijanti, kao i alate za duvanu i brizganu plastiku i ekstrudere.

Proizvodi iz oblasti servotehnike: Razvoj servorazvodnika u PPT-Namenska otpočeo je pre tridesetak godina. Od tada do danas stečeno je značajno iskustvo u ovoj oblasti tehnike zahvaljujući čemu PPT-Namenska proizvodi više tipova i varijanti servorazvodnika, međusobno različitih po gabaritnim i priključnim merama i po statičkim i dinamičkim karakteristikama. U proizvodnom programu nalaze se jednostepeni, dvostepeni i trostepeni servorazvodnici kao, na primer, elektrohidraulički servorazvodnici za regulaciju protoka (serija A, B, B31, D, G, H, E), elektrohidraulički servorazvodnici za regulaciju pritiska (serija PA, PD), trostepeni elektrohidraulički servorazvodnici, hidraulički i elektrohidraulički servopokretači i servosistemi za regulaciju položaja, brzine i sile.

Obzirom na iskustvo stručnjaka PPT-Namenska i na postignut nivo tehnološkog razvoja, vreme potrebno za osvajanje proizvodnje novih tipova servorazvodnika svedeno je na svega nekoliko meseci. Na zahtev kupca za vrlo kratko vreme se mogu osvojiti i specijalni tipovi servorazvodnika kod kojih jedna ili više karakteristika odstupa od standardnih vrednosti.

Između ostalih osvojena je proizvodnja minijaturnog servorazvodnika serije A koji tehnološki predstavlja jedan od najsloženijih proizvoda iz ove oblasti, a koristi se kod primarnih komandi leta borbenih aviona. Gabaritne i priključne mere, kao i dinamičke i statičke karakteristike su u skladu sa standardom SAE ARP 490 E. Njegov kvalitet i pouzdanost u radu već su dokazani prvo kroz homologaciju, a zatim i u realnim uslovima rada.

Napravljeni su i određeni koraci u osvajanju nove generacije servorazvodnika. Radi se o direktno upravljanoj jednostepenom servorazvodniku sa četiri upravljačke ivice motorom (DDV) i direktno upravljanoj jednostepenom servorazvodniku sa osam upravljačkih ivica (DDV).

Ostali proizvodi: U poslednjih desetak godina u PPT-Namenska poklanja se velika pažnja razvoju i proizvodnji vazdušnih sportsko-lovačkih pušaka za strano tržište. Razvijeno je i serijski se proizvodi više tipova i varijanti ovih pušaka raznih karakteris-

Servo technique products: Development of servo distributors was initiated at PPT-Namenska thirty years ago. Since then, valuable experience in this field has been gained so that PPT-Namenska currently produces several types and versions of servo distributors, of different dimensions and connector sizes and of different static and dynamic performance. Manufacturing range includes single-step, two-step and three-step servo distributors such as, for example, electro hydraulic servo distributors for flow regulation (series A, B, B31, D, G, H, E), electro hydraulic servo distributors for pressure regulation (series PA, PD), three-step electro hydraulic servo distributors, hydraulic and electro hydraulic servo starters and position, speed and force regulating servo systems.



With this vast experience of PPT-Namenska engineers and achieved advanced level of technology, time needed to develop and place in production new types of servo distributors has been reduced to several months only. Upon request from customers, it is possible to develop, in very short time, special servo distributors with one or more specification parameters different from standard values.

Among other products, the Company has acquired production of miniature servo distributor series A which is technologically one of the most complex items in the field and which is used in the system of primary flight controls on combat aircraft. Dimensions and connectors, dynamic and static specifications of this product are according to SAE ARP 490 E. The quality and reliability of these products was proven in homologation and in actual service.

Development is under way to acquire the next generation of servo distributors. The product in question is a directly controlled single step servo distributor with four motor-controlled edges (DDV) and directly controlled single-step servo distributor with eight motor-controlled edges (DDV).

Other products: In last decade, PPT-Namenska had directed considerable efforts to develop and manufacture air rifles and sporting rifles for foreign markets.

A number of types and versions of these arms were developed and are in series production, featuring different characteristics and design. In addition to multi-purpose police rifle (XCRG-MSRG) which is in series production, development is under way of new rifle for the same application that should offer improved performance characteristics.

Production run at PPT-Namenska also includes air rifles (S-16; S-16x; AGS, BR1), multi-purpose police rifle MSRG-38 (firing tear gas, rubber bullets and flares), components and sub-assemblies for printing industry (printing of currency bills and newspapers), clamping and accessory tools for machine tools, destined for domestic and foreign markets.



tika i dizajna. Pored višenamenske puške za policiju (XCRG-MSRG) koja se serijski proizvodi, radi se na razvoju nove puške iste namene, ali koja bi trebala da bude boljih karakteristika.

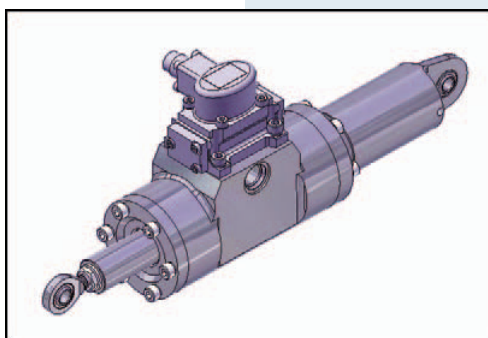
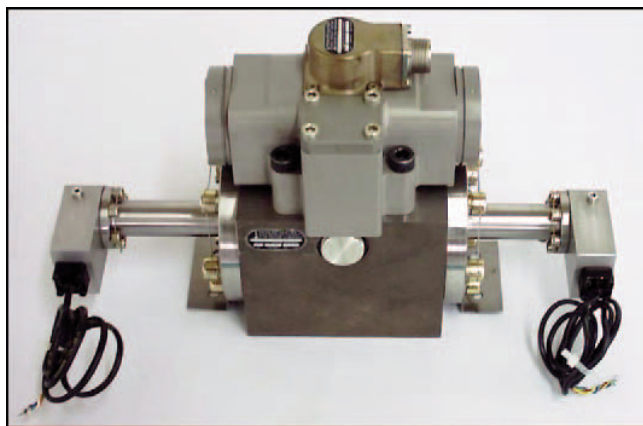
U serijskoj proizvodnji PPT-Namenska su još vazdušne puške (S-16; S-16x; AGS, BR1), puške za policiju, višenamenske MSRГ-38 (za suzavac, gumene metke, svetleće rakete), delovi i podsklopovi za grafičke mašine (za štampaње novca i novinskih publikacija), stezni i pomoćni alati za mašine alatke za domaće i strano tržište.

AKTUELNI PROIZVODI I RAZVOJNI PROJEKTI

Koristeći postojeće tehnološke mogućnosti, potencijale stručnog kadra u oblasti istraživanja i razvoja, a uz saradnju sa stručnim službama kupaca, stalno se razvijaju novi proizvodi i usavršavaju postojeći koji imaju tražnju na domaćem i stranom tržištu.

U periodu 2000 – 2006 PPT Namenska je razvila stajni trap, brave, upornice i komponente hidroinstalacije aviona Lasta 95, homologovala rešenja i proizvela komplete za ugradnju na dve prototipske letelice.

Lasta 95 je avion nove generacije za početnu i osnovnu obuku, razvijen da omogući visok nivo obuke i lak prelaz na naprednu obuku na bilo kom avionu. Stajni trapovi ove letelice su tipa poluge-klackalice sa gasno uljnim amortizerima na nosnoj i glavnoj nozi. Projektovani su u saradnji sa Vojno-tehničkim institutom, Žarkovo, u skladu sa standardima FAR 23, vojnim standardima vojske Srbije i MIL standardima. Prva ispitivanja u letu aviona Lasta 95 planirana su za 2007. godinu.



CURRENT PRODUCTS AND DEVELOPMENT PROJECTS

Utilization of available technological base, of human resources' potential in the field of research and development and cooperation with specialist services of customers result in constant development of new products and upgrading of existing lines that are in demand in the domestic and foreign markets.

In the period 2000 – 2006, PPT-Namenska had developed landing gear, locks, struts and hydraulic installation components for Lasta 95 aircraft, which passed the homologation and sets were manufactured for fitting in two aircraft prototypes.

Lasta 95 is a new generation aircraft for initial and basic training, developed to ensure high level of piloting skills and easy transfer to advanced training on any aircraft in service. Landing gear for this aircraft consists of rocker struts with gas/oil shock absorbers for nose and main wheels. Landing gear was designed in cooperation with Air-Technical Institute, Žarkovo with application of FAR 23 standards, Serbian Military Standards and MIL specs. First flight tests of Lasta 95 are planned for year 2007.

Upon request from a foreign customer, PPT-Namenska had developed and has in series production aircraft hydraulic pumps and hydraulic motors of improved characteristics; a piston-axial pump of higher speed (4000-7000 r.p.m.), specific flow of 2.4 cm³/o and of extremely compact dimensions for its rated pressure of 210 bar; as well as a piston-axial hydraulic motor with minimum stable speed of 0,8±0,3 r.p.m., maximum spinning speed of 8000 r.p.m. and specific flow rare of 6 – 13 cm³/o.

Upon special requests from customers, there were developed several types of electro-hydraulic servo actuators, designed for hydraulics in test benches, aircraft and rockets. These actuators are designed as compact units comprising integrated linear inductive position and/or speed sensor in its piston rod and electro-hydraulic servo distributor of high dynamic performance. These units are characterized by high quality of execution, low friction and precision functioning.

PPT-Namenska enjoys significant, broad cooperation with expert teams of Jugimport-SDPR in the field of modernization and development of new equipment and systems, such as, mortars (cal. 60mm of lightweight construction and extended range, calibers 81mm, 82mm, 120mm), tank M84 AB1 (featuring upgraded hydraulic and pneumatic components and systems, upgraded shock absorbers, camera lifting device, etc.), self-propelled gun-howitzer NORA-B52 cal. 155mm (upgraded breechblock and breach, new barrel, new automatic loader comprising projectile feed and

nim stabilnim brojem obrtaja $0,8 \pm 0,3$ o/min, maksimalnim brojem obrtaja od 8000o/min i specifičnim protokom 6 do 13 cm³/o.

Po specijalnim zahtevima kupca razvijeno je više tipova elektrohidrauličkih servoaktuatora sa primenom u hidrauličkim sistemima probnih stolova, aviona i raketa. Ovi aktuatori su konstruktivno rešeni kao kompaktne jedinice sa integrisanim linearnim induktivnim davačem položaja i/ili brzine u klipnjači i elektrohidrauličkim servorazvodnikom visokih dinamičkih mogućnosti. Odlikuju se visokim kvalitetom izrade, malim trenjem i preciznom funkcionalnošću.

PPT-Namenska ima značajnu i veoma dobru saradnju sa stručnim ekipama Jugimport-SDPR u oblasti modernizacije i razvoja novih uređaja i sistema kao što su, na primer, minobacači (60mm lake konstrukcije, produženog dometa, 81mm, 82mm, 120mm), tenk M84 AB1 (modernizacija hidrauličkih i pneumatskih uređaja i sistema, amortizera, sistema za podizanje kamere i dr.) i NORA-B52 – samohodna top-haubica kalibra 155mm (modernizovan zadnjak i zatvarač, nova cev, sistem za automatsko punjenje sastavljen od donosača projektila i donosača barutnog punjenja, mehanizam za opaljenje i dr.), SH3 – Modernizovana haubica 105mm (izrada modernizacionog seta: zadnjak, zatvarač, cevi, gasna kočnica i ostalih pratećih elemenata). U PPT-Namenskoj proizvode se i razvijaju najsloženiji uređaji i sistemi sa veoma strogim tehničkim zahtevima, što zahteva vrlo kvalitetne materijale i uske tolerancije izrade. Svi proizvodi se detaljno ispituju i homologuju prema zahtevima svetskih standarda (MIL, ARP, GOST i td.) što govori da su proizvodi razvijeni u PPT-Namenska nivoa i kvaliteta poznatih svetskih proizvođača. Ovo se potvrđuje i proizvodima koje PPT-Namenska trenutno realizuje za strane kupce, a koji u svemu odgovaraju navedenim svetskim standardima.

Zahvaljujući dostignutom nivou kvaliteta svojih proizvoda, PPT-Namenska je ostvarila saradnju sa nekoliko vodećih svetskih firmi iz oblasti avioindustrije. PPT-Namenska je dobila sertifikat firme BOEING za proizvodnju i isporuku delova i uređaja za ugradnju u civilne avione prema njihovim zahtevima i standardima.

Pored američke firme BOEING, PPT-Namenska je ostvarila značajnu saradnju sa još nekoliko značajnih vazduhoplovnih firmi i to MOOG (SAD), Aviostar, Motostroitelj, IL (Rusija), SHL – IAI (Izrael), Messier – Hispano i Lucas (Francuska).

Stručni kadar i dobra tehnološka opremljenost PPT Namensku preporučuju kao pouzdanog partnera za saradnju u svim navedenim oblastima.

international standards (MIL, ARP, GOST, etc.) that assure quality standards on par with the most reputed world manufacturers. This is testified by the products, currently manufactured at PPT-Namenska for foreign buyers, which fully meet the above stated world standards.

Owing to the attained level of quality of its products, PPT-Namenska enjoys cooperation with several leading companies of the world aviation industry. PPT-Namenska is certified supplier for Boeing Aircraft Co. for the supply of components and equipment for fitting in civil airliners according to specifications and standards of that manufacturer.

In addition to Boeing, PPT-Namenska has achieved significant cooperation with several other important aviation companies, including MOOG (USA), Aviostar, Motostroitelj, IL (Russia), SHL – IAI (Israel), Messier – Hispano and Lucas (France).

Expertise of its human resources and appropriate level of its technical outfitting recommend PPT-Namenska for reliable partners in cooperation in all above described areas.



TEHNIČKI REMONTNI ZAVOD

THE TECHNICAL REPAIR FACILITY Kragujevac

Pišu
**Marketing Tehničkog
Remontnog Zavoda**

By
**Marketing of the Technical
Repair Facility**

Tehnički Remontni Zavod Kragujevac (TRZK) je specijalizovana, savremeno opremljena vojna ustanova u sastavu Ministarstva odbrane Republike Srbije, sa visoko razvijenom tehnologijom i iskustvom od 56.godina rada na generalnom i tehničkom održavanju ubojnih sredstava (UbS) za potrebe oružanih snaga. TRZK jedini na teritoriji Srbije, a nekada i SFRJ, ima zaokružen sistem održavanja UbS. Kroz kontrolna ispitivanja i ispitivanja hemijske stabilnosti baruta vrši se nadzor kvaliteta uskladištenih UbS, od municije za lično naoružanje preko artiljerijske municije svih kalibara, mina svih vrsta, do nevođenih raketa za višecevne lansere, a na osnovu dobijenih rezultata predlaže i realizuje njihovo održavanje.

Osnova poslovne politike nalazi u Deklaraciji o politici kvaliteta u kojoj se kaže sledeće: Tehnički Remontni Zavod će, u saglasnosti sa poslovnim politikom Zavoda, usmeravati svoje aktivnosti ka obezbeđenju i stalnom unapređenju kvaliteta radi ispunjavanja zahteva kupaca i korisnika usluga i poboljšanja performansi organizacije. Kvalitet proizvoda i usluga, uz povećanu efikasnost i ekonomičnost poslovanja, predstavlja najznačajniji prioritet Zavoda.

Smatramo da je način da se u tome uspe osvojiti proces poslovne izvrsnosti i to je suština naše strategije. Želimo da nas i dalje znaju po pouzdanosti i kvalitetu naših tradicionalnih proizvoda i usluga, ali i da se nametnemo tržištu novim i još boljim. Standard kvaliteta JUS ISO 9001:2001 i SNO 9010:2005 uveden je 2005. godine i sertifikovan sistem menadžmenta kvalitetom (QMS) od strane akreditovanog sertifikacionog tela Ministarstva Odbrane Sektora za materijalne resurse Uprave za odbrambene tehnologije. Stalan



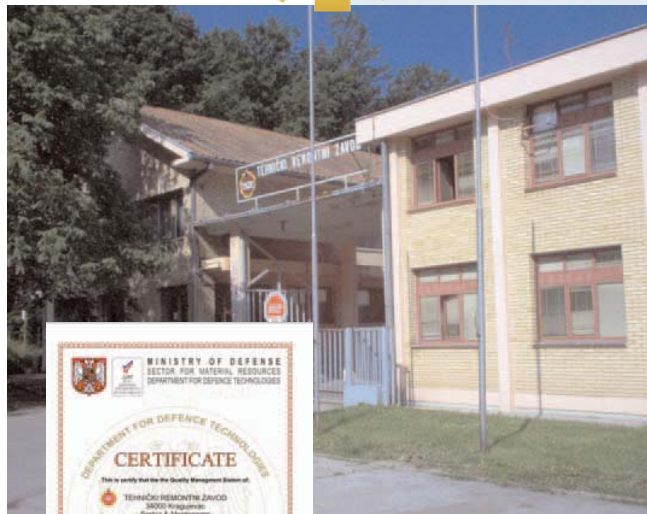
The Technical Repair Facility Kragujevac (TRFK) is a specialized military facility with up-to-date equipment and machinery within the complement of the Ministry of Defense of the Republic of Serbia, with highly developed technology and 56 years of experience in operations on general repair and technical maintenance of live ordnance (LO) for the requirements of armed forces. TRFK is unique in the territory of Serbia, as was once in the territory of the former SFRY, and has an integrated system of LO maintenance.

Through control tests and testing of chemical stability of powder, the quality of stored LO is monitored, ranging from the ammunition for small arms through artillery ammunition of all calibers, mines/grenades of all kinds, to unguided rockets for multiple rocket launchers and, on the basis of the results obtained, their maintenance is proposed and realized.

The rationale of our business policy is contained in the Declaration on the Quality Policy, which stipulates the following: the Technical Repair Facility shall, in line

with the business policy of the Facility, streamline its activities to ensure and continuously improve the quality for the purpose of meeting the requirements of the clients and users of services and upgrading of the performances of the organization. The quality of products and services, with increased cost-effectiveness and business efficiency, represents the first priority of the Facility.

We deem that the method to succeed in this it to master the process of business excellence and that is the core of our strategy. We want to continue to be renowned for reliability and quality of our traditional products and services, but also to impose ourselves upon the market with new and even better ones. The quality standards JUS ISO 9001:2001 and SNO 9010:2005 were introduced in 2005 and the Quality Management System (QMS) was certified by the accredited certification body of the Ministry of Defense, the Material Resources Sector (MRS) of the Defense Technologies



napor menadžmenta usmeren je ka tome da se Poslovnik o kvalitetu i Deklaracija o politici kvaliteta shvate kao neophodna suština poslovnog ponašanja svih zaposlenih.

VOJNI program: Vremenom UbS gube svoje početne karakteristike usled hemijskih i mehaničkih oštećenja, ili zastarevanju usled pojave i uvođenja savremenijih UbS.

TRZK realizuje aktivnosti iz domena održavanja UbS, praćenja stanja, laboratorijska ispitivanja hemijske stabilnosti baruta i raketnih goriva, poligonskih balističkih ispitivanja, tehničkog održavanja (Tehnički pregled UbS, čišćenje i zaštita, kompletiranje i prepakivanje, delaboracija, uništavanje UbS i njihovih elemenata, obuka za tehničko održavanje...), generalno održavanje UbS.

Takođe, TRZK izrađuje UbS pomoćne namene: vežbovna, manevarska, školska, opitna. Ova UbS su namenjena za vežbanje, obuku i izvođenje pojedinih vrsta ispitivanja UbS ili njegovih elemenata, oružja, oruđa, lansera i drugih sistema.

Održavanje UbS na lokaciji naručioca: Opremljeni smo specijalnim prenosnim alatima i pokretnom radionicom za remont municije. Po zahtevu, naše specijalizovane ekipe izvršice tehnički pregled, analizirati, obraditi podatke o stanju UbS i otkloniti neispravnosti.

Remont UbS instaliranjem pokretnih radionica: Radionica pokretna RK-M85 predstavlja savremeno rešenje sistema za kvalitetno održavanje klasičnih UbS na terenu i poljskim uslovima. Zbog svoje fleksibilnosti i vrlo velike mogućnosti prilagođavanja, od najjednostavnijih do najsloženijih zahteva remonta UbS, radionica omogućava ekonomičnije održavanje UbS.

Sanacija mesta masovnih eksplozija: U slučaju nesreća i masovnih eksplozija u skladištima UbS kada, po pravilu, dolazi do ozbiljnije kontaminacije neeksplozivnim UbS, nudimo uslugu potpune sanacije zemljišnog prostora. Posedujemo veliko dugogodišnje iskustvo u obavljanju ovih krajnje složenih i rizičnih operacija.

Izrada elemenata UbS i alata i uređaja za održavanje UbS: U saradnji sa VTI osvojili smo izradu niza elemenata UbS od kojih ističemo: generator gasa za metak 130 mm i 155 mm, izradu elemenata bombe ručne, detonatorske pojačnike za mine 82 mm i 120 mm (od TNT i flegmatizovanog heksogena), izradu ambalaže za mikro pakovanja (upaljač, bomba detonator). Ističemo da su skoro svi alati i uređaji koji se koriste u procesu održavanja UbS naš proizvod.

Inženjering u delatnosti održavanja UbS. Za potrebe naručioca vršimo projektovanje i izradu alata i uređaja za održavanje UbS, kompletnih tehnoloških linija, kao i prenos tehnologije, stručnu pomoć i nadzor.



Department. Permanent efforts of the management are concentrated on having the Quality Rulebook and the Declaration on the Quality Policy understood as the indispensable essence of the business conduct of all the employees.

DEFENSE program: In time, LO loses the initial characteristics due to the chemical and mechanical damages, or becomes obsolete due to emergence and launching of more advanced LO.

TRFK is engaged in the activities from the area of LO maintenance, monitoring of the state, laboratory testing of chemical stability of powder and rocket fuels, range ballistic tests (Technical inspection of LO, cleaning and conservation, reassembly, and repacking, deactivation, destruction of LO and their elements, training in technical maintenance, etc.), general overhaul of LO.

Additionally, TRFK manufactures LO for secondary purposes: drill, blank, practice, test ammunition. These types of LO are intended for exercises, training, and carrying out of certain types of tests of LO or elements thereof, weapons, artillery pieces, launchers, and other systems.

LO Maintenance at the client's site/installation: We are equipped with special portable tools and with a mobile workshop for overhaul of ammunition. At request, our specialized teams will perform technical inspection, analyze, process the data on the state of LO and eliminate the deficiencies.

Overhaul of LO by setting up mobile workshops: The mobile workshop RK-M85 represents an advanced solution of the system for quality maintenance of conventional LO on the site and in field conditions. Due to its flexibility and particularly large adaptability to the requirements of LO repair, from the simplest to the most complex ones, the workshop enables us to maintain LO cost-effectively.

Clearing of places of mass explosions: In case of accidents and large-scale explosions in LO stores which, as a rule, cause serious contamination with UXO, we offer the services of complete clearing of the land. We have a large long-term experience in carrying out such extremely complex and risky operations.

Manufacture of LO elements and tools and equipment for LO maintenance: In cooperation with the Military Technical Institute, we have mastered the manufacture of a series of LO elements of which we would point to: gas generators for 130 mm and 155 mm rounds, manufacture of the elements of hand bomb, detonator boosters for 82 mm and 120 mm grenades (of TNT and phlegmatized hexogen), manufacture of packaging for micro packing (fuse, bomb, detonator). We point out that almost all the tools and equipment used in the process of LO maintenance are our own products.

Engineering in the activity of LO maintenance. For the requirements of the customer, we design and manufacture tools and equipment for LO maintenance, complete production lines, as well as transfer the technology, provide technical assistance and supervision.



Veliko iskustvo koje TRZK ima u realizaciji svih nivoa održavanja UbS, kao i razvijeni kapaciteti za projektovanje i izradu alata i uređaja koji su namenjeni za ove specifične tehnološke procese, omogućili su da možemo ponuditi kvalitetan inženjering u ovoj stručnoj oblasti.

Projektovanje i izrada alata, uređaja i mašina za održavanje UbS: Kadrovski smo potpuno osposobljeni za projektovanje i izradu alata, uređaja i mašina za održavanje UbS.

Prenos tehnologije, stručna pomoć i nadzor: Tehničko održavanje UbS realizuje se primenom odgovarajućih tehnologija koja se mogu dobiti uz alate, uređaje i tehnološke linije. U sklopu prenosa tehnologije vršimo izradu i montiranje opreme, izradu tehnološke i druge literature i obuku stručnog kadra naručioca u TRZK, kao i na lokaciji naručioca. U daljem radu nudimo saradnju i usluge stručne pomoći i nadzora.

DOPUNSKI program: Uticaj globalnih promena na makro političkom i ekonomskom planu, smanjenje obima posla za potrebe Vojske Republike Srbije, prouzrokovao je i usmeravanje ka dole navedenim dopunskim proizvodnim programima.

Projektovanje i konstrukcija podrazumeva izradu konstruktivno-tehnološke dokumentacije prilagođene raspoloživim resursima, a prema zahtevu potencijalnog naručioca; inženjering u oblasti prerade metala, inženjering u oblasti prerade drveta i proizvoda od drveta, inženjering iz oblasti prerade-brizganja plastomera.

Program obrade metala obuhvata izradu alata, uređaja i opreme potrebnih za odvijanje tehnoloških procesa, kao i izradu proizvoda u serijskoj i pojedinačnoj proizvodnji struganjem glodanjem, brušenjem, koordinatnim bušenjem, izradu alata za štancovanje i savijanje lima do 2 mm debljine, izradu alata za brizganje plastomera (termoplasta), izradu ukrasnih i dekorativnih predmeta od mesinga ("Radijus").

Program "Radijus" obuhvata izradu mesinganih svećnjaka, satova raznih oblika i veličina, ukrasnih vaza, pepeljara, kutija za nakit, stalaka za kišobrane, čeličnih gimnastičkih ručnih tegova i drugih predmeta.

Program obrade drveta: na visoko produktivnim stolarskim mašinama vršimo izradu drvene ambalaže svih oblika i dimenzija, palete svih oblika i dimenzija (proizvođački broj JZP 016-01), kancelarijski nameštaj i enterijer, košnice "DB", "LR", "AŽ" prema sopstvenoj tehničkoj dokumentaciji, meteorološke zaklone, kućice za pse i druge proizvode.

The large experience TRFK has in carrying out all levels of LO maintenance, as well as the developed capacities for design and manufacture of tools and equipment intended for these specific engineering processes, have enabled us to be in a position to offer high-quality engineering in this area of expertise.

Design and manufacture of tools, equipment, and machines for LO maintenance: We have all the skilled personnel needed for design and manufacture of tools, equipment, and machines for LO maintenance.

Technology transfer, technical assistance and supervision: Technical maintenance of LO is carried out by applying relevant technologies that can be provided with the tools, equipment, and production lines. Within the technology transfer, we manufacture and install the equipment, elaborate the engineering and other documentation, and train the skilled personnel of the customer within TRFK, as well as at the customer's site. In further operations, we offer cooperation and services of technical assistance and supervision.

SUPPLEMENTARY program: The effects of global changes on political and macro economic level, the decrease of the volume of workload for the requirements of the Armed Forces of the Republic of Serbia, has also caused our orientation towards the below specified supplementary production programs.

Design and construction includes elaboration of the design and engineering documentation adapted to the available resources, in accordance with the requirements of the potential customer; engineering in the area of metal working, engineering in the area of woodworking and production of wooden products, engineering in the field of processing-jet molding of plastomer.

The program of metal working includes the manufacture of tools, units, and equipment required for the technological processes, as well as for the manufacture of products in series and individually by turning, milling, grinding, jig drilling, manufacture of the tools for pressing and bending of sheet metal up to 2 mm thick, manufacture of the tools for plastomer jet molding (thermoplast), manufacture of ornamental and decorative objects of brass ("Radijus").

"Radijus" program includes the manufacture of brass candlesticks, clocks of various forms and sizes, decorative vases, ashtrays, jewel boxes, umbrella stands, steel gym grip hand weights, and other objects.

Program of woodworking: on the highly efficient woodworking machines, we manufacture wooden packaging of all forms and dimensions, palettes of all forms and dimensions (manufacturer No. JZP 016-01), office furniture and interior decoration, bee-houses "DB", "LR", "AŽ" according to our own technical documentation, shelters from the elements, kennels, and other products.

Surface protection includes protection of metal products applying the procedures of mechanical and chemical removal of the products of corrosion from metal surfaces, protection of metal surfaces by applying the procedures of passivation, phosphatizing, galvanization, and lacquering including lacquer baking. We also apply surface protection of wooden surfaces using agents for protection against worms (Pentolat), as well as surface coating of wooden and metal products with all kinds of paints.

Površinska zaštita obuhvata zaštitu metalnih proizvoda postupcima mehaničkog i hemijskog odstranjivanja produkata korozije sa metalnih površina, zaštitu metalnih površina postupcima pasivizacije, fosfatiranja, cinkovanja, lakovanja sa pečenjem laka. Takođe vršimo površinsku zaštitu drvenih površina sredstvima za zaštitu od napada štetočina (Pentolat), kao i površinsku zaštitu drvenih i metalnih proizvoda svim vrstama boja.

Skladištenje i prevoz: raspoložemo sa skladišnim prostorom namenski izgrađenim za čuvanje eksplozivnih materijala u skladu sa zakonskim propisima i isti možemo ponuditi potencijalnim zakupcima. U sklopu skladištenja moguće je angažovanje vozila za prevoz eksplozivnih materijala.

VIZIJA TRZK koncipirana je u saglasnosti sa našim analizama i zahtevima MO SMR Uprave za odbrambene tehnologije i pretpostavljenih potreba tržišta uz maksimalno iskorišćenje vlastitih resursa. Prioritet je transformacija prema potrebama Vojske Srbije uz uvažavanja i potreba tržišta, iskorišćenje svih raspoloživih kapaciteta, osvajanje novih tržišta uključujući i inostrana, prestrukturiranje dela kapaciteta iz vojnog u civilni program, zaštitita interesa zaposlenih, osvajanje nove tehnologije remonta. Ovakav koncept vizije sadrži našu višedecenijsku tradiciju, poslovni ugled i glavne pravce razvoja.

Prilikom donošenja poslovnih odluka rukovodstvo TRZK ima u vidu postignut nivo bezbednosti života i zdravlja zaposlenih i zaštitu životne sredine u skladu sa zakonom i ostalim pravnim aktima koji regulišu ovu oblast, SNO i JUS koji se odnose na rad sa eksplozivom i drugim opasnim materijama i naređenja iz MO SMR Uprave za odbrambene tehnologije, kao i zahteve kupca i raspoloživost potrebnih materijalno tehničkih sredstava.

Analize tržišta već su uslovile promene u poslovnoj politici, uključivanje u tržišnu utakmicu sa tradicionalnim vojnim programom, ali i sa ponudom novih, za tržište interesantnih civilnih programa, uključujući i osvajanje inostranog tržišta. Jedan od naših ciljeva jeste da postanemo glavni regionalni centar za demilitarizaciju rashodovanih, neperspektivnih ili zabranjenih UbS i minsko-eksplozivnih sredstava. Analize naših eksperata, takođe i MO SMR UOT, pokazuju da u naoružanju okolnih armija ima mnogo više UbS nego što predviđa strategija evro-atlantske bezbednosti. Takođe, međudržavne konvencije obavezuju na uništenje pojedinih vrsta minsko-eksplozivnih sredstava (npr. protiv-pešadijske mine), a značajna je i količina zastarelih, rashodovanih i za čuvanje vrlo opasnih UbS.

Vrlo je inspirativna i realna ideja da se umesto uništavanja eksplozivima, spaljivanjem ili potapanjem u more, deo UbS, posle delaboracije, vrati privredi u vidu sekundarnih sirovina (mesing, aluminijum, čelik, plastika, eksploziv...) za izradu novih proizvoda, a istovremeno i zaštiti životna sredina. Ova ideja je postala stvarnost. TRZK je angažovan da za NATO agenciju "NAMSA" demilitarizuje protivpešadijske mine. Posao je dobijen zbog najboljih uslova koje smo ponudili u odnosu na međunarodno tržište. Milionita delaboracija, proslavljena uz visoke državne i strane goste, bila je prilika da se zbog ukupne satisfakcije zainteresovanih strana najavi i buduća saradnja.

Storage and transport: we have a storage facility specifically constructed for storage of explosive materials in compliance with the statutory regulations and we offer the same to the potential leasees. Along with the leasing the storage space, it is possible to rent vehicles for transport of explosive materials.

TRFK VISION has been conceived in accordance with our analyses and the requirements of the MOD MRS Defense Technologies Department and the assumed market requirements with maximum utilization of our own resources. The priority is the transformation in line with the requirements of the Armed Forces of Serbia while taking into account the market needs, utilization of all available capacities, winning new markets including foreign ones, restructuring of a part of the military production capacities by converting the military program into a civilian one, protection of the interest of the employees, mastery of a new technology of overhaul. Such a concept of our vision incorporates our decades-long history, business reputation, and the main trends of development.

When bringing business decisions, the management of TRFK bears in mind the achieved level of safety of the life and health of the employees and the environment protection in compliance with the law and other legal documents governing this area, SNO and JUS related to the operations with explosives and other hazardous matters, and orders from the MOD MRS Defense Technologies Department (DTD), as well as the requirements of the customers and availability of the required material and technical assets.

Market analyses have already given rise to the changes in our business policy, joining in the market competition with the traditional defense program, but also with the offer of new, civilian programs interesting for the market, including winning of foreign markets. One of our objectives is to become the main regional center for demilitarization of written-off, obsolete or prohibited LO and mines and explosive devices. The analyses of our experts, as well as those of MOD MRD DTT, indicate that, in the arsenals the neighboring armies, there are much larger quantities of LO than it is envisaged by the Euro-Atlantic security strategy. Additionally, the government-to-government conventions impose the obligation to destroy certain types of mines and explosive devices (e.g. anti-personnel mines), and the quantity of obsolete, written-off and very-hazardous-to-keep LO is also considerable.

A very realistic and inspirational is the idea, instead of destructing by blasting, burning or sinking in the sea, to return a part of LO, after deactivation, to the industries in the form of secondary materials (brass, aluminum, steel, plastics, explosive, etc.) for the manufacture of new products and, at the same time, to protect the environment. This idea has become reality. TRFK has been engaged to, for NATO NAMSA Agency, demilitarize the anti-personnel mines. The contract was awarded to us because of the best terms and conditions we had offered compared to the international market. The millionth deactivation, celebrated with the high-ranking government and foreign guests, was the opportunity to announce future cooperation as well because of the overall satisfaction of the interested parties.



“Linda Bird, kontraadmiral američke vojske i direktor NATO agencije „NAMSA“, 14. 09. 2006.god., na svečanosti u TRZK povodom milionite demilitarizacije protivpešačkih mina je izjavila: „Milion mina je 110 tona eksploziva koji može biti iskorišćen u komercijalne svrhe. Dobijeno je 750 tona otpadnog gvožđa za različitu industrijsku proizvodnju. Takođe, preko 60 tona plastike od kojih se mogu napraviti kanalizacione cevi, a više od 100 tona drugih nusproizvoda može biti iskorišćeno za različite civilne proizvode. Time što su izbegnute detonacije na otvorenom, stotine miliona litara štetnih gasova nije ispušteno u okolinu, što je značajno za očuvanje prirodne sredine“. Navodimo i izjavu direktora Odeljenja za kontrolu naoružanja glavnog štaba NATO, Majkla di Migensa, datu sredstvima javnog informisanja prilikom uništenja milionite protivpešačke mine: „Za samo godinu dana uništeno je milion protivpešačkih mina, ili 73 posto od ukupne količine. To je veliki posao i vi ste ga obavili odlično. Ovo je do sada najveće projekat NATO u Srbiji. Njime se unapređuju naši odnosi, a krajnji cilj je da se postigne veća bezbednost, kako u vašoj zemlji tako i na prostoru čitavog Balkana. Očekujem da ovim putem i nastavimo.“

Sekretar Ministarstva Odbrane Srbije Zvonko Obradović istom prilikom izjavio je sledeće: „Od 1975. godine protivpešačke mine su ubile milione nedužnih ljudi i mnogo dece. Zato je ovaj projekat izuzetno značajan. Otavsku konvenciju je potpisala 151 država, a Srbija je hrabro preuzela obavezu da sa njima podeli odgovornost u rešavanju problema svetskih razmera. Istovremeno, ovo je način da se uspostavi bolja bezbednost u celom regionu. Srbija ovim putem pokazuje da je spremna za evro-atlantske integracije, a kragujevački Tehnički remontni zavod je više nego dobro obavio povereni mu posao. Cilj Ministarstva odbrane je da ovu ustanovu sada promovise i na međunarodnom planu“.

S obzirom na specifičnu delatnost TRZK i činjenicu da je u svim ključnim procesima prisutan visok stepen opasnosti po život i zdravlje radnika, selekciji, izboru i usmerenju kadrova u TRZK pridaje se posebna važnost i značaj. Striktno se insistira na stručnosti i osposobljenosti radnika za obavljanje određenih poslova, njihovom psiho-fizičkom zdravlju i usklađenosti njihovih ličnih karateristika sa zahtevima posla i uslovima u kojima se posao obavlja. Selekcija kadra je stalni proces koji se odvija pri prijemu, obučavanju, praktičnoj



Linda Bird, Rear Admiral of US Navy and the Director of NATO NAMSA Agency, on September 14, 2006, at the ceremony in TRFK on the occasion of the millionth demilitarization of anti-personnel mines stated: A million mines represents 110 tons of explosive that may be used for commercial purposes. 750 tons of waste iron have been obtained for various industrial productions. Moreover, over 60 tons of plastics, which can be used to manufacture of sewer pipes and over 100 tons of other byproducts can be used for various civilian products. By having avoided outdoor detonations, hundreds of millions of liters of noxious gases have not been discharged into the environment, which is important for preservation of the environment.“

We also quote the statement of the Director of the Armaments Control Department of the NATO Headquarters, Michale de Migens, given to mass media on the occasion of destruction of the millionth anti-personnel mine: „In only one year, a million of anti-personnel mines were destroyed, or 73 percent of the total quantity. That is a big job and you have done it excellently. This is the biggest NATO project in Serbia up to now. With it, our relations improve, and the ultimate goal is to achieve higher security, both in your country and in the territory of the entire Balkans. I expect us to proceed along the same lines.“

The Secretary of the Ministry of Defense of Serbia Zvonko Obradović, on the same occasion, stated the following: „Since 1975, anti-personnel mines have killed millions of innocent people and many children. That is why this project is particularly important. The Ottawa Convention has been signed by 151 states, and Serbia has courageously undertaken the obligation to share with them the responsibility in resolving of this problem on international scale. At the same time, this is a way to establish improved security in the entire region. In this way, Serbia is demonstrating that it is ready for Euro-Atlantic integrations, and the Technical Repair Facility from Kragujevac did the job entrusted to them more than well. The objective of the Ministry of Defense is to now promote this facility in the international market as well“.

In view of the specific activity of TRFK and the fact that, in all the key processes, the life and health of employees are exposed to a high degree of hazard, in TRFK, special attention and importance is attributed to the recruitment, selection, and specialized training of the manpower. We strictly insist on the professional skills and training of workers in

proveri osposobljenosti, raspoređivanju, pa sve do upućivanja na školovanje i posleddiplomsko usavršavanje. Unapređenje kvaliteta kadrova podržava se stalnom obukom i obrazovanjem, čime se postiže da svi zaposleni svoje zadatke obavljaju kvalitetno i na najbolji način.

Većina poslova u TRZ ima karakter timskog rada jer su radne operacije sledljive, a konačni proizvod - usluga je rezultat zatvorenog ciklusa većeg broja uzajamno povezanih operacija, odnosno direktnog učešća većeg broja izvršilaca. Iako se timskim radom ostvaruje kolektivni učinak, doprinos svakog pojedinca u timu je merljiv i vrednovan u skladu sa utvrđenim kriterijumima čime se postiže usklađivanje individualnih i timskih ambicija sa ciljevima TRZK kao organizacije. Zavisno od postavljenog cilja za ostvarivanje poslovne politike organizovan je i timski rad u formi odbora, radnih grupa, timova, komisija i ekipa u koje su uključeni zaposleni različitog profila zanimanja iz različitih organizacionih celina.

TRZK shvata da je za uspeh na mikro ili makro planu neophodan komplementaran tim ljudi koji se u isto vreme razlikuju i međusobno dopunjuju. Zaposleni koji su pojedinačno dobro funkcionisali uče veštine efikasnog timskog rada kao metoda rešavanja. Moderno poslovanje nalaže da budemo različiti, drugačiji od konkurencije, da stalno razvijamo novi i kvalitetniji proizvod ili uslugu.

S obzirom na podvučenu ulogu tržišta u novoj koncepciji poslovne politike, a i da bi se najpovoljnije odgovorilo dugoročnim i kratkoročnim zahtevima i izazovima zainteresovanih strana, rukovodstvo TRZK je kao strategiju preduzeća usvojilo osvajanje procesa poslovne izvrsnosti kroz primenu politike kvaliteta čiji je osnovni sadržaj uspostavljeni sistem menadžmenta kvalitetom (QMS).

Kao element ukupne poslovne politike proistekle iz potrebe i očekivanja kupaca i drugih zainteresovanih strana, TRZK na čelu sa direktorom utvrdio je politiku kvaliteta kojom su definisani osnovni ciljevi u vezi sa kvalitetom proizvoda i usluga, kao i obaveze svih zaposlenih u njihovom ostvarivanju i stalnom unapređenju. U postupku preispitivanja QMS istovremeno se preispituje i Politika kvaliteta radi postizanja njene adekvatnosti i da bi služila kao stalni okvir za utvrđivanje i preispitivanje ciljeva kvaliteta.

Napominjemo da je 9. novembra 2006. godine, u Privrednoj komori Srbije u Beogradu Tehnički Remontni Zavod Kragujevac dobio Oskar Kvaliteta u kategoriji velikih organizacija za oblast Politika i strategija i Ljudski resursi, na konkursu za Nacionalnu nagradu za poslovnu izvrsnost Srbije od Fonda za kulturu kvaliteta i izvrsnost (FQCE) Beograd. TRZK je prvi i za sada jedini od ustanova Vojske Srbije ili preduzeća namenske proizvodnje sa prestižnom nagradom FQCE.



carrying out certain operations, their psychological and physical health and matching of their individual characteristics with the requirements of the job and the conditions in which a job is carried out. Manpower selection is a continuous process, which takes place when recruiting, training, hands-on qualification testing, deployment, all the way to their referral to schools and postgraduate studies. Upgrading of the quality of the personnel is supported by continuous training and education, whereby it is achieved that all the employees carry out their assignments properly and in the best way.

TRFK is aware that, for the success on micro or macro level, it is indispensable to have a complementary team of people who, at the same time, differ from one another and complement one another. The employees, who have individually functioned well, learn the skills of efficient team work as a method of problem solving. Modern business operations force us to be specific, different from our competition, to continuously develop new and better-quality products or services.

In view of the stressed role of the market in the new concept of our business policy and, also, in order to best respond to the long-term and short-term demands and challenges of the interested parties, the management of TRFK has adopted, as the strategy of the enterprise, mastering of the processes of business excellence through implementation of the quality policy the basic content of which is the established quality management system (QMS).

As an element of the overall business policy resulting from the needs and expectations of the customers and other interested parties, TRFK, headed by its director, has established the quality policy, which defines the basic objectives related to the quality of products and services, as well as the obligations of all the employees in their performance and continuous improvement. In the process of QMS review, the Quality Policy is simultaneously reviewed for the purpose of achieving its adequacy and in order to use it as a permanent framework for setting and reviewing the quality objectives.

We hereby stress that, on November 9, 2006, in the Chamber of Commerce of Serbia in Belgrade, the Technical Repair Facility Kragujevac was awarded the Quality Oscar in the category of big organizations for the area of Policy and Strategy and Human Resources, at the competition for the National Award for Business Excellence of Serbia from the Fund for Quality Culture and Excellence (FQCE) Belgrade. TRFK is the first and, for the time being, the only institution of the Armed Forces of Serbia or defense industry enterprises with the prestigious FQCE award.

NAUKA U SLUŽBI PRAKTIČNIH DOSTIGNUĆA

FAKULTET TEHNIČKIH NAUKA UNIVERZITETA U
NOVOM SADU

Piše
Nikola Teslić

Razvoj tehnologija doveo je do raznovrsnih izazova u svim zemljama sveta. Ti izazovi su naročito oštri u malim i siromašnim zemljama kao što je Srbija. Nivo tehnologije pruža veliku šansu takvim zemljama sa stanovišta mogućnosti realizacije složenih sistema kako u industriji tako i u Vojsci. To s druge strane znači da je moguće ostvariti izvestan stepen tehnološke nezavisnosti u malim zemljama. Ali za to je neophodna čvrsta povezanost visokog školstva sa industrijom. Taj problem je prisutan i u najrazvijenijim, ali je dominantan u malim zemljama. Sledeći takvu potrebu na Univerzitetu u Novom Sadu, na njegovom Fakultetu tehničkih nauka, razvijana je delatnost transfera znanja u privredu, koja pored obrazovnog procesa i procesa istraživaškog rada čini celinu delatnosti ovog Fakulteta. Rezultati koji su iz toga proistekli su impresivni.

Fakultet tehničkih nauka (www.ftn.ns.ac.yu) osnovan je 18. maja. 1960. godine kao Mašinski fakultet u Novom Sadu u sastavu Univerziteta u Beogradu. Zajedno sa još šest fakulteta sa područja Vojvodine, Fakultet ulazi u sastav Univerziteta u Novom Sadu, 28. juna 1960. godine.

Otpočinjanje studija elektro i građevinske struke, 1971. godine, uslovilo je izmenu naziva Fakulteta u FAKULTET TEHNIČKIH NAUKA (FTN), 22. aprila 1974. godine. Danas se na Fakultetu organizuju studije iz devet struka sa 69 obrazovnih profila. Ovakva fizionomija svrstava Fakultet tehničkih nauka u Novom Sadu među najrazvijenije visokoškolske institucije u zemlji i regionu.

Fakultet tehničkih nauka je naučno-obrazovna institucija sastavljena od 13 departmana, šest stručnih službi, devet naučno-stručnih centara i devet malih preduzeća. Lociran je u sedam zgrada na 30.000m², sa 703 zaposlena i preko 9.000 studenata. Do danas je na Fakultetu tehničkih nauka diplomiralo oko 9.200 studenata, magistriralo 520, a doktorsku disertaciju odbranilo 223 kandidata.

SCIENCE IN SERVICE OF PRACTICAL ACCOMPLISHMENTS

THE FACULTY OF TECHNICAL SCIENCES
– IRAM – RT d.o.o.

By
Nikola Teslić

Development of technology has brought variety of challenges world-wide. These challenges are especially severe in small and underdeveloped countries such as Serbia. Increase in technological level gives big chance to such countries to develop complex systems for industrial and military applications. On the other hand, it means that it is possible to make some degree of technological independence in small countries. To do this, tight connection between high education and industry is essential. This problem is immanent in developed countries but it is prevailing in under developed countries. Following this need, on the Faculty of Technical Sciences at the University of Novi Sad activities are developed to foster the transfer of



knowledge into the industry. These activities together with educational process and research work are three main principles of the Faculties organization and function. Accomplished results through described processes are impressive.

The Faculty of Technical Sciences was established on May 18, 1960, as the Faculty of Mechanical Engineering in Novi Sad, and as the part of the University of Belgrade. Together with six other faculties from territory the Autonomous Province of Vojvodina on June 28, 1960., it became an integral part of the University of Novi Sad.

Since 1971, the Faculty established the studies in electrical engineering and civil engineering. Therefore from April 22, 1974, the Faculty of Mechanical Engineering grew into the Faculty of Technical Sciences. Today, the Faculty performs studies in 9 fields with 69 educational profiles. This brings the Faculty of Technical Science side by side with most developed higher educational institution in Serbia and region of South East Europe.

Delatnost Fakulteta je orijentisana u tri područja: obrazovna, naučnoistraživački rad i razvoj i primena istraživanja u praksi.

Obrazovanje se ostvaruje kroz trostepeni ciklus školovanja: prvi nivo čine osnovne akademske studije koje (u zavisnosti od struke) traju 3, 3,5 i 4 godine (180 – 240 ESPB bodova); drugi nivo su diplomske akademske studije – master, koje zajedno sa osnovnim akademskim studijama traju pet godina na svim departmanima (300 ESPB). Treći nivo čine doktorske studije koje traju tri godine (180 ESPB).

Uz ove studije organizuju se specijalističke studije i, u saradnji sa renomiranim evropskim univerzitetima, međunarodne MBA (Master of Business Administration).

Fakultet tehničkih nauka na osnovnim studijama izvodi nastavu iz sledećih oblasti visokog obrazovanja:

- **MAŠINSTVO:** Proizvodno mašinstvo, Mehanizacija i konstrukciono mašinstvo, Energetika i procesna tehnika, Tehnička mehanika
- **ELEKTROTEHNIKA I RAČUNARSTVO:** Energetika, elektronika i telekomunikacije, Računarstvo i automatika
- **INDUSTRIJSKO INŽENJERSTVO I MENADŽMENT:** Industrijsko inženjerstvo, Inženjerski menadžment
- **GRAĐEVINARSTVO**
- **SAOBRAĆAJ**
- **ARHITEKTURA**
- **GRAFIČKO INŽENJERSTVO I DIZAJN**
- **INŽENJERSTVO ZAŠTITE ŽIVOTNE SREDINE**
- **MEHATRONIKA**

Naučnoistraživačka delatnost Fakulteta tehničkih nauka je usmerena na realizaciju naučnoistraživačkih projekata odnosno podprojekata iz područja osnovnih istraživanja, inovacionih projekata, projekata tehnološkog razvoja, projekata programa energetske efikasnosti kao i istraživačkih projekata po zahtevu privrednih preduzeća.

Fakultet nudi svoje usluge u rešavanju aktuelnih problema privrede u područjima koja pokriva. Profesori fakulteta drže predavanja, po pozivu, na mnogim Univerzitetima u najrazvijenijim zemljama sveta. Značajni rezultati su ostvareni u međunarodnoj saradnji o čemu svedoči veliki broj realizovanih međunarodnih projekata.

Biblioteka Fakulteta raspolaže fondom od preko 160.000 bibliotečkih jedinica. Za potrebe svojih korisnika biblioteka koristi veoma razvijenu službu međubibliotečke razmene sa drugim bibliotekama u zemlji i inostranstvu.

Veliki broj studentskih organizacija brine o interesima studenata ne samo iz domena studija već i o kulturnom i zabavnom životu. Razmene studenata i stručne prakse organizuju brojne međunarodne studentske organizacije koje postoje na Fakultetu.

Fakultet je sertifikovao sistem kvaliteta po međunarodnim standardima EN ISO 9001:2001 kod Saveznog zavoda za standardizaciju i međunarodne sertifikacione organizacije RWTÜV iz Esena. Fakultet, odnosno njegovi departmani organizuju sedam stalnih konferencija u zemlji i inostranstvu i izdaju tri međunarodna časopisa na Engleskom jeziku.

Specifičnost Fakulteta su devet malih i srednjih firmi koje funkcionišu u okviru Naučno-tehnološkog parka, jedinstvenog na našim prostorima.

Ideja o saradnji sa industrijom je u okviru FTN jedna od tri potpuno ravnopravne komponente pored naučnog i obrazovnog rada. Devedesetih godina prošlog veka u okviru FTN

The Faculty of Technical Studies is the educational and scientific institution comprising 13 institutes – departments, 6 scientific centers, 6 administration offices and 9 small companies. The Faculty is located in 7 buildings on the area of 30.000m², with 703 employees and more than 9,000 students. Until now, approximately 9.200 students graduated from the Faculty, 520 obtained MSc degree and 223 candidates obtained PhD degree.

Activity on the Faculty is focused in three fields: educational, scientific-research work and development & appliance research in practice.

Education on the Faculty is organized in three level cycle: 1st level is base academic studies which (in dependence from occupation) take 3, 3.5 or 4 years (180 – 240 ESPB points); 2nd level is master academic studies, which together with base academic studies takes five years on all department (300 ESPB). 3rd level is Doctoral studies that take three years (180 ESPB).

The Faculty also offers programs for a specialist studies in cooperation with reputable European University's of the international MBA (Master of Business Administration).

The Faculty of Technical Science organizes studies at the undergraduate level from following fields:

- **MECHANICAL ENGINEERING AND PRODUCTION ENGINEERING:** Production Engineering, Mechanization and Construction Engineering, Energy and Process Engineering, Technical Mechanics
- **ELECTRICAL AND COMPUTER ENGINEERING:** Power, Electronics and Telecommunications Engineering, Computing and Automatics
- **INDUSTRIAL ENGINEERING AND MANAGEMENT:** Industrial Engineering, Engineering Management
- **CIVIL ENGINEERING DEPARTMENT**
- **TRAFFIC ENGINEERING DEPARTMENT**
- **ARCHITECTURE**
- **GRAPHICAL ENGINEERING AND DESIGN**
- **ENVIRONMENTAL ENGINEERING**
- **MECHATRONICS**

Research activities of The Faculty of Technical Sciences is aimed at realization of scientific research projects as to realization of subprojects in field of basic research, invention projects, projects of technological development, projects of energy efficiency program as research projects demanded by industry.

The Faculty offers its services in solving actual problems in industry in fields that treats.

Faculty's professors lecture on many universities in different countries.

Significant results are achieved in international cooperation that is seen in large number of realized international projects.

Library of the Faculty disposes with fund of over 160.000 units. For its users needing library uses very developed service of interchange with other libraries in country and abroad.

High number of student's organizations cares on student's interests as in domain of studies as in domain of cultural life and entertainment. Student's exchange and practical work are organized by number of student's organizations on the Faculty.

su počela da se otvaraju preduzeća koja su proistekla sa Fakulteta a blisko vezana sa naučnoistraživačkim radom. Napravljeni okvir je kasnije pretočen u okvir naučno-tehnogloškog parka Univerziteta u Novom Sadu. Naučno Tehnološki park Univerziteta u Novom Sadu (<http://www.nosic.ns.ac.yu>) je okvir za pretakanje visoke tehnologije i rezultata naučno istraživačkih aktivnosti u preduzeća.

Jedno od prvih preduzeća osnovanih u okviru Fakulteta Tehničkih Nauka pre 15 godina bilo je FTN-IRAM-RT d.o.o., preduzeće proisteklo sa katedre za Računarsku tehniku i Računarske komunikacije, a koje je jednako zanačajan doprinos kako saradnje sa industrijom tako i sa Vojskom.

FTN-IRAM-RT se od osnivanja bavi delatnostima koje se izučavaju na samoj katedri, a to je projektovanje hardvera, softvera u realnom vremenu i računarskih komunikacija ili ono što se u savremenoj nauci naziva Sistemi zasnovani na računaru. Početkom devedesitih godina preduzeće je ušestvovalo i bilo nosilac u nizu projekata koje su rezultovale automatizacijom gasovodne mreže Vojvodine, a ostavreni su i zavidni rezultati u automatizaciji linija za proizvodnju podnih obloga SINTELON iz Bačke Palanke. FTN-IRAM-RT je pronašao svoje mesto i u oblasti projektovanja hardvera i softvera za telekomunikacije. Primera radi, razvijene su biblioteke softvera za sledeće signalizacije: SSNo7, DSS1, V5.1, V5.2, X.25. Ovi softverski moduli su ugrađeni u proizvode domaće industrije: DKTS, IRITEL, DŽITI, a u inostranstvu: STROM-Češka, LONIS-Rusija, Nemačka i sl.

Fokus preduzeća FTN-IRAM-RT danas su razvoj i projektovanje uređaja iz oblasti računarstva, računarske tehnike i računarskih komunikacija, neke od osnovnih oblasti koje preduzeće pokriva su: (i) projektovanje hardvera, (ii) projektovanje sistema na bazi FPGA, (iii) projektovanje sistema, algoritama i softvera za digitalnu obradu signala, (iv) robotika i (v) proizvodni kapaciteti za namensku proizvodnju.

FTN-IRAM-RT je jedan od deset najvećih potrošača elektronskih komponenti, imajući u vidu da je ovo razvojno-istraživačka firma koja je razvila veliki broj različitih ploča u prethodnom periodu. Tim za projektovanje hardvera osposobljen je za projektovanje najsloženijih uređaja koji treba da zadovolje sve kriterijume elektromagnetne kompatibilnosti, pouzdane masovne proizvodnje i to kako za klase industrijskih uređaja tako i za namenske - vojne uređaje.

Jedna od važnih komponenti je projektovanje sistema na bazi programabilnih sekvencijalnih mreža (FPGA). FTN-IRAM-RT tj. Katedra za Računarsku Tehniku koristi FPGA

The Faculty of Technical Sciences has certificated its quality system according to the international standards ISO 9001:2001 at the Federal Bureau for Standardization and at the International Certificate Organization RWTÜV from Essen, Germany.

Departments of Faculty organize seven conferences in country and abroad, and publish three international magazines in English language.

There are nine small and medium firms acting as a part of Scientific-technological Park, unique in our region.

The idea of cooperation of the Faculty of Technical Sciences with industry is one of three main Faculties activities side by side with educational and scientific work. In the 90's, first companies connected with the Faculty were founded and started to develop. These companies are closely connected to scientific research activities. This model is later used as model within Scientific-technological Park of the

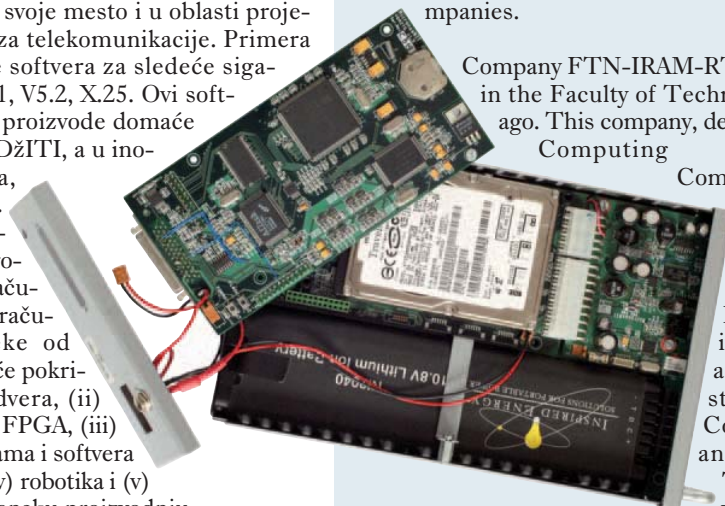
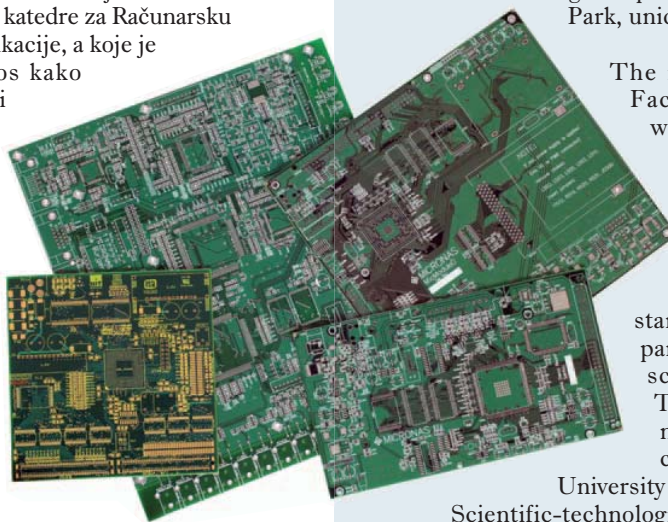
University in Novi Sad

Scientific-technological Park of the University in Novi Sad (Novi Sad Innovation Centre <http://www.nosic.ns.ac.yu>) is frame for streaming high technology and results of scientific research activity to companies.

Company FTN-IRAM-RT d.o.o is founded within the Faculty of Technical Sciences, 15 years ago. This company, derived from the Chair for Computing Engineering and Communications, gives significant contribution in cooperation with industry as well as with the Army.

FTN-IRAM-RT since its foundation in 1991 is active in areas that are studied on the Chair for Computing Engineering and Communications. These areas are hardware, real-time software

or as it is called in modern science, Computer based systems. In the 90's the company participated in series of projects which results are automation service of gas pipeline network. Besides that, some high results are achieved in automation flow line of floor panel's production SINTELON Backa Palanka. FTN-IRAM-RT founded its place in area of projecting hardware and software for telecommunication. For example, software bibliotecas for following types of signaling have been developed: SSNo7, DSS1, V5.1, V5.2, X.25.



integrirana kola za rešavanje niza izuzetno složenih problema digitalne obrade video signala, zaštite signala (kriptovanje), komunikacionih problema, složenih problema u digitalnoj obradi video signala. Isto tako, ova tehnologija i intenzivno obrazovanje kadra u preduzeću stvorili su okruženje stručnjaka i odgovarajuće softverske pakete za projektovanje integriranih kola. Ono što je trend u poslednjih nekoliko godina je verifikacija integriranih kola na FPGA platformama u čemu FTN-IRAM-RT postiže zapažene rezultate.

Digitalna obrada signala je nezamenljiv deo savremenih računarskih sistema, FTN-IRAM-RT je svih 15 godina prisutan u ovoj oblasti i može se pohvaliti rezultatima u oblastima primene ovih tehnologija: Audio obrada signala, Obrada video signala, Obrada govornih signala i Komunikacije.

Audio obrada signala odlikuje se nizom implementiranih audio standarda za kompresiju i dekompresiju, poboljšanje audio signala, kao i višekanalne kodere-dekodere. Neki od pomenutih standarda implementirani su na razne platforme (MP3, AAC, AC3, DPL, Virtulizer, WMA itd.). Pored implementacije algoritma na RISC arhitekture, tim inženjera okupljenih u okviru FTN-IRAM-RT osposobljen je da pruži podršku u atestiranju portovanih rešenja kod sertifikacionih tela.

Obrada video signala je jedna od najzahtevnijih oblasti obrade signala s obzirom na količinu podataka koja treba da se obradi u realnom vremenu. Najčešće se obrada video signala radi uz pomoć FPGA integriranih kola, ali moguće su i određene obrade na namenskim DSP programabilnim platformama. Reference u ovoj oblasti su algoritmi za skaliranje, konverziju brzine ispisa slike, redukciju šuma itd. U saradnji sa Vojnotehničkim institutom Vojske Srbije razvoj FTN-IRAM-RT radi na problemima detekcije pozicije eksplozije i tipa oružja koje ju je izazvalo.

U govornim tehnologijama svi relevantni standardi za kodovanje-dekodovanje govora su implementirani na različite DSP-RISC arhitekture (ITU-T G.726, ITU-T G.728, ITU-T G.729, ITU-T G.723.1). Na osnovu dobijenih rezultata razvijena je namenska tehnologija za kodovanje govora na izuzetno niskim bitskim brzinama 2400 bit/sč. Digitalnu obradu signala u komunikacija karakteriše niz modulacionih tehnologija koje su razvijene za: iznajmljene linije (dvožično/ četvorožično), komutirane linije (PSTN/ISDN) ili HF i UHF/VHF radio vezom. Navedeni modemi su realizovani po standardima ITU-T V.23, ITU-T V.26, ITU-T V.22bis, ITU-T V.32, MIL-STD-188-110B, STANAG 4285, MIL-STD-188-181A.

Jedan od interesantnih pravaca predstavlja istraživanje sopstvenog autonomnog robota koje obuhvata

These software modules are built in domestic industry products: DKTS, IRITEL, GT and abroad: STROM-Check Republic, LONIIS- Russia, Germany etc.

Today, focus of company FTN-IRAM-RT is developing of appliances in area of computing and computer sciences. Some of basic areas are: (i) hardware designing, (ii) designing systems on FPGA bases, (iii) designing systems, algorithms and software for digital signal processing, (iv) robotics and (v) manufacturing capacity for dedicated production.

With its experience and developed net of components suppliers, FTN-IRAM-RT is one of the biggest domestic customers of electronic components. Hardware designing team is trained for projecting the most complicated devices that must fulfill the most rigorous criteria's of electromagnetic compatibility, trustful mass production, all that for industrial devices and dedicated military devices.

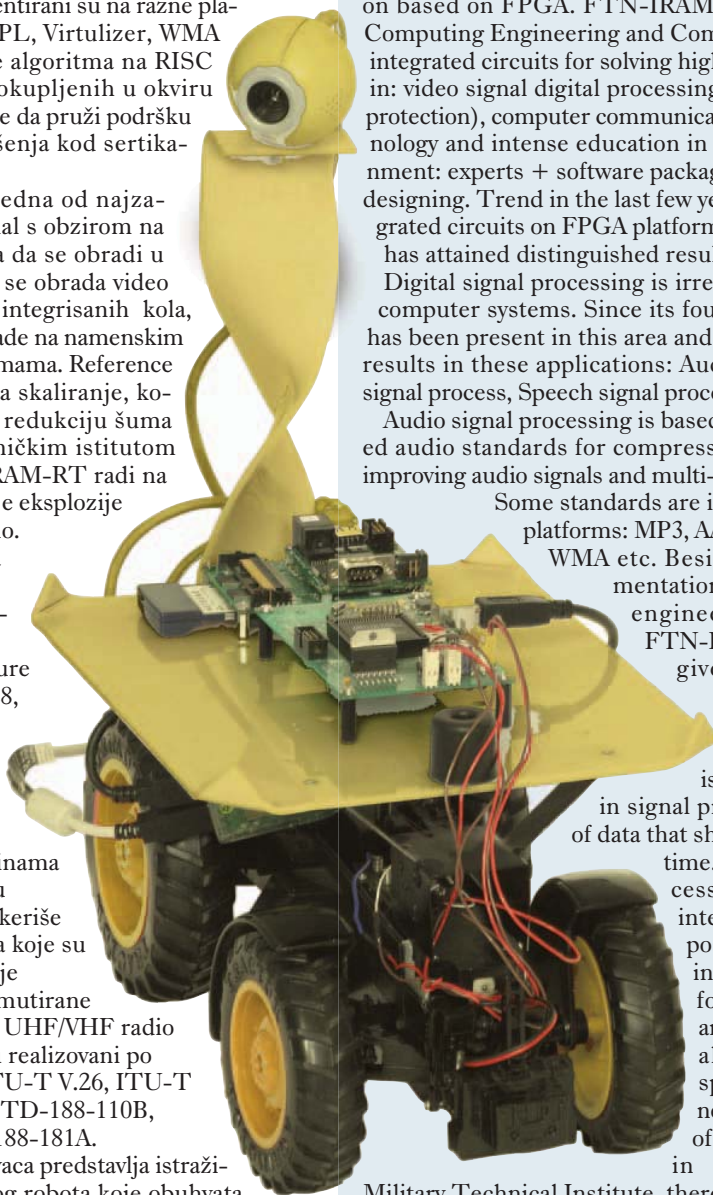
One of the significant components is designing systems on based on FPGA. FTN-IRAM-RT, i.e. The Chair for Computing Engineering and Communications uses FPGA integrated circuits for solving highly complicated problems in: video signal digital processing, signal security (crypto-protection), computer communication problems. This technology and intense education in company created environment: experts + software packages for integrated circuits designing. Trend in the last few years is verification of integrated circuits on FPGA platforms where FTN-IRAM-RT has attained distinguished results.

Digital signal processing is irreplaceable part of modern computer systems. Since its foundation FTN-IRAM-RT has been present in this area and it can be very proud with results in these applications: Audio signal process, Video signal process, Speech signal process and Communications.

Audio signal processing is based on series of implemented audio standards for compression and decompression, improving audio signals and multi-channel coders-decoders.

Some standards are implemented on different platforms: MP3, AAC, AC3, DPL, Virtulizer, WMA etc. Besides of algorithm implementation on RISC architectures, engineer teams assembled in FTN-IRAM-RT are qualified to give costumers support in attest according to certificate organizations.

Video signal processing is the most demanded area in signal processing due to amount of data that should be processed in real time. Mainly, video signal processing is made with FPGA integrated circuits. There is possibility of some processing in dedicated DSP platforms. References in this area are: scaling algorithms, algorithms for picture speed change conversion, noise reduction etc. As part of its own development and in cooperation with the Military Technical Institute, there are results in solving



sve oblasti kojima se bavi FTN-IRAM-RT: hardver, audio obrada signala, video obrada signala i upravljanje. Projektovani roboti obezbeđuju udaljenu kontrolu i upravljanje, kao i poluautomatske režime rada u kojima robot samostalno rešava određene probleme za mikrosredinu, dvosmerni audio-video prenos podataka, sa odedenim poboljšanjima za redukciju ambijetalnog šuma, praćenje govornika (head-tracking system). Razvijena platforma predstavlja polaznu osnovu (skup tehnologija) za razvoj finalnih proizvoda sa elementima koji postoje unutar postojećeg sistema.

FTNI-IRAM-RT se fokusira na proizvodnju malih i srednjih serija, sa osnovnim naglaskom da su u pitanju proizvodi za namenska tržišta sa visokim stepenom izlanog kvaliteta i pouzdanosti. Uredaji koji se proizvode zadovoljavaju stroge klimo-mehaničke zahteve, zahteve za EMC, a u isto vreme su cenom atraktivni na svetском tržištu.



problem of explosion detection and detection of used type of arms.

In speech technologies all relevant standards for speech coding-decoding are implemented on different DSP-RISC architectures. For example: ITU-T G.726, ITU-T G.728, ITU-T G.729, ITU-T G.723.1. Using these results it is developed dedicated technology for speech coding on very low bit rates of 2400 bps.

Digital signal processing and communication characterize series of modulation technologies developed for leased lines (2 wires or 4 wires), switched lines (PSTN/ISDN) or HF and UHF/VHF radio links. Foregoing modems are realized by standards: ITU-T V.23, ITU-T V.26, ITU-T V.22bis, ITU-T V.32, MIL-STD-188-110B, STANAG 4285, MIL-STD-188-181A.

One of the interesting course in research is development of own autonomous robot. This research contains all areas of FTN-IRAM-RT, including in final result: hardware, audio signal process, video signal process, controlling. Projected robots provide remote control and guidance, as semi-automatic work regime in which robot independently solves problems for micro environment, 2 way audio-video data transmit, with some improvements in noise reduction and head-tracking system. Developed platform correspond base – congregation of technologies – for development of final products with elements from existing system.

FTN-IRAM-RT focuses on manufacturing small and medium series, with stress on products for dedicated market with high quality and reliability degree.

Devices which are produced fulfill severe weather-mechanical demands, EMC demands.

These products are also attractive with its price on global market.



Treba napomenuti i dugogodišnju saradnju sa vojnim naučnoistraživačkim institucijama Vojske Srbije: Vojno tehničkim institutom VS (<http://www.vti.mod.gov.yu/>) (u oblasti projektovanja savremenih sredstava komunikacije – modema, obrade zvuka i niza drugih projekata razvoja složenih sistema), Tehničkim opitnim centrom KOVVS (<http://www.toc.vj.yu/>) (u oblasti ispitivanja razvijenih sredstava za domaće i strano tržište), Vazduhoplovni optički centar VS (<http://www.voc.vj.yu/>) (u oblasti modernizacije postojećih merno kontrolnih uređaja).

Cooperation through years with military scientific research institutions of Serbian Armed Forces should be mentioned:

Military Technical Institute (<http://www.vti.mod.gov.yu/>): in area of modern communication systems – modems, sound process and other projects in complex system development.

Technical Test Center (<http://www.toc.vj.yu/>): in area of testing developed appliances for domestic and foreign market. Trimness and teams competence makes possible to service global market.

The Air Force Flight Test Centre (<http://www.voc.vj.yu/>): in area of modernizing meter-controlling devices.

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