OODA DELINEATION FOR INTERNAL AUGMENTATION OF WHEELED MODULAR COMBAT UNIT

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***Abstract*—The aim of the paper is to present through OODA[1] delineation the internal augmentation and modularity of a wheeled modular combat unit. The conclusions are based on legacy knowledge, smart defence propositions, and geopolitical momentum. In parallel, this enables a vision for modelling of unit augmentation as an organically attached component or utilized as a detached independent unit of operational strategic category. By briefly addressing different organizational points through legacy knowledge, the interim organizational bridging between mobility and armour could allow for new near and mid-term organizational and technological solutions that can effectively contain offensively oriented, combined arms in operational manoeuvre.**

***Keywords*—wheeled modular combat unit, internal augmentation, smart defence**

FOREWORD

THROUGHOUT the history of warfare, there has been a consistent attempt to deny adversaries freedom to manoeuvre in the combat theatre. Ancient forms of halting manoeuvre activities included barriers such as walls and other fortifications. The contemporary approach has leaped from radio communication and substantial amounts of equipment in a unit, to a combination of digital information and technology for anti-access/area denial (A2/AD) to close any freedom of action.

As contemporary geopolitical momentum changes from day-to-day, new ways of waging war, and the denial of freedom of action or power projection are sought. Since any technology can only go so far, it means that full solutions lie in the progress of proficiency or the combination of ways and means. Essentially, it means understanding the implications of using combat elements of all branch forces and eliminating any imbalances between sought and possible objectives, as well as understanding the means which are at the disposal to achieve the ends, and ways of implementing them. Only then can we consider the absolute balance between knowledge, method, and means of force.

However, the complexity of a solution constantly materializes out of the inevitable necessity of an objective or a deficiency in the ability to attain it. And when unit (as battalion, brigade, division, corps) is positioned within a context of new strategic geopolitical momentum, the evaluations of employment, structure and capability of a unit are constantly questioned. How such a unit is capable to power project in the complex theatre of strategic environment, and still be a force multiplier, is a question which needs to be answered.

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I. OBSERVATION

Before we begin, it should be noted that a modular combat unit approach is part of an American "30-year process to transform its forces. This transformation includes the modernization of its doctrine, equipment, leadership, organizational structure, facilities, business processes, and virtually every component of its operations."[2]

Nevertheless, at present all contemporary ground armed forces have been considerably influenced by the approach in formation of different modular units (infantry, armoured, wheeled). Nothing has had such an impact on armies during the past decade and a half than wheeled modular combat units centred on brigades as echelon, which attain strategic success in combat operations on the battlefield. This so-called innovation in military combat is sustained through the use of digital technology to offset any inferiority and gain superiority against an adversary. The interim solution, which was instigated out of necessity during active operations (Afghanistan and Iraq), and based on a terminated future combat system (FCS) project, is therefore, after sixteen years of utilization, at a crossroads.

The crossroad for ubiquitous (Stryker) wheeled modular units based around 8x8 armoured vehicles have throughout utilization exhibited desirable and undesirable characteristics. On the one hand, a wheeled vehicle is easy to maintain, fast, and mobile on the open road so the infantry and army can reach further.[3] However, such vehicles have limited off-road capability and are too lightly armoured to be used in heavy armoured confrontation theatre, or to be used as power projection units. This assessments come out of political austerity schemes and military doctrinal views, where an asset such as a tank or until recently tracked armoured vehicles are costly excesses, and unnecessary or obsolete equipment in the contemporary world of new expertise, digital technology, and precision guided weapons.[4] If we take in consideration an interpretation of RAND Review of the Army's Modular Force Structure of TRADOC Pamphlet 525-5 Force XXI and review five identified characteristics for wheeled modular units; doctrinal flexibility, strategic mobility, tailor-ability and modularity, joint and multinational connectivity, versatility to function in war and operations other than war, then we can isolate and draw a picture of the present situation, that permits arguments or foundations for archetypal modelling.[5]

A swift assessment shows that the doctrinal flexibility is deficient at present and requires harmonization to be suitable for new geopolitical momentum changes. Doctrinal flexibility and its continual adaption were assessed and established on the basis of the "[ability] to continually adapt tactics, techniques, procedures, and organizations to meet future requirements,"[6] and then again concurrently tied to strategic

mobility that is locked between capacity and technological capability. Looking a couple of decades back, an example of entirely transportable light infantry division "in 500 single flights of C-141 transport aircraft", with no armour, comes to mind.[7] Technology in one form or the other has played a part and remains an Achilles heel for the military—then it was vehicle technology and design—todays particular weaknesses are the weight and size of combat-ready single vehicle and the weight of whole brigade modular combat units (see figure 1).

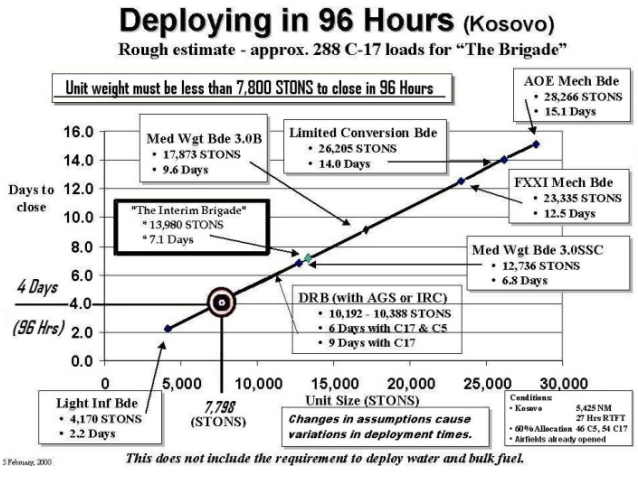


Figure 1: Wheeled modular combat brigade weight and 96 hours deployment estimation[8]

An additional consideration of the subject in table 1 reveals a multi-layered connection to doctrinal flexibility and strategic mobility that directly connects in relation to tailor-ability and modularity. Today's circumstance is that units are modular, and so tailor-ability is deficient in two ways; in the possibility of the permanent existence of limitation in support units or unit types, and the question of a requirement for adaptability in the modular unit to meet all contingencies. And other draws directly on an account of requirements connected to flexibility and strategic mobility. Inter-service cooperation in joint and multinational connectivity, on the other hand, will give underweight and collapse in the middle of versatility to function in a war and operations other than war (OOTW), where "most operations involve nongovernmental organizations (NGOs) and private voluntary organizations (PVOs)."[9] Such action is an endorsement for an adversary to employ a spectrum of anti-access/area denial (A2/AD) versatile operational spectrum of capabilities in OOTW action. Furthermore, one-sided ad-hoc supplementation and prerequisites for tracked vehicles to respond to functioning in substantial confrontational theatre and inability to power project in geopolitical momentum, will have negative consequences on the above said; regarding multinational connectivity, compatibility, and operational ability of wheeled modular combat units to be employed in future conflict with significant effect.

II. ORIENTATION

To orientate ourselves, there are certain essentials from the period of the Cold War to examine and evaluate e.g., "US/NATO's ground posture of 45 divisions […] by the Warsaw Pact's 90 divisions". Consequently, "emphasis was placed on generating massive artillery firepower; divisions were equipped with enough artillery tubes [and] MLRS [stocked] to fire over 1 000 tons of ammunition per day. And moreover, each armoured and mechanized division was equipped with about 275 tanks and 275 IFV."[10] Demonstration and rudimentary assessment of the above and below stated structure of the period, and the capability of divisional artillery firepower, will give us an overview of organizational complexity in the past, and an outlook on the present day deficiency (see figure 2), with added clarification on particular variations.

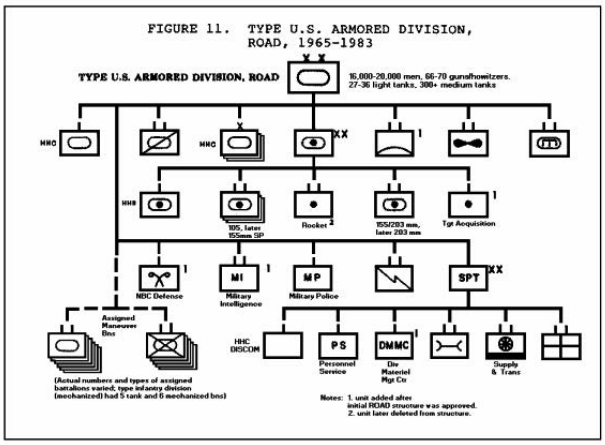


Figure 2: US armoured division, ROAD, 1965-1983[11]

The first variation is linked to ROAD and Division 86 doctrine artillery capability and structure, which "on the surface […] did not look significantly different from the ROAD Division, there were some significant changes made the division extremely lethal on the European battlefield […] counter-battery capabilities were increased with more 8-inch howitzers, and multiple-launch rocket systems."[12] A comparable perspective can be ascertained from a different point of the formational unit; "VII Corps Artillery [was] the largest corps artillery in the free world—204 cannon, an MLRS battalion and three Lance battalions. Our 8-inch howitzer battalions are 3x8, and our two 155-mm battalions will up-gun […] bringing our tube strength to 216."[13]

On that account, we can generalize that the division would be supported by an artillery brigade with 72 artillery pieces, divided into three battalions with 24 tubes each. The estimated concentration (for the Cold War period) would be 3 240 artillery pieces in a ground posture of 45 divisions with 45 artillery brigades, or 135 artillery battalions at the disposal, plus target acquisition and MLRS units.

Correspondingly, we can move on to ammunition expenditure per day by division, generalized to the entire artillery force being 203mm calibre only. The result of this

calculation for an expected 72 artillery pieces brigade not including any other artillery equipment (MLRS or similar) would be 154,32 rounds per artillery pieces per day—taken on an average metric of 203mm rounds weighing 90kg, this presents critical detail from a contemporary perspective of firepower. A contemporary perspective on artillery brigade ability to deliver 1 000 tons of ammunition per day is not in weight of delivered ammunition; but on the quantity of rounds delivered on targeted areas—in this case 11 111 rounds. This density is the contemporary main interest when it comes to upgrading, defending against, transforming and employing future wheeled modular combat units.

Augmentation of wheeled modular combat units is at the intersection of motorized, mechanized, armoured, and field artillery procedures, particularly the precision of high-priority target response that can deliver decisive strikes or allow for a blocking approach in combat theatre. In order to establish detailed foundations, we need to examine Soviet artillery structure and organization of the broader period in combination with motorized rifle battalions and divisions.

Historically, Imperial Russia, the Soviet Union, and contemporary Russia, traditionally bestowed high regard for "artillery officers [that] enjoyed a reputation for intellectual and professional excellence."[14] This traditional regard for artillery units brought in WWII a formation of artillery division units: "by the end of the war 90 artillery divisions and some 140 separate artillery brigades" were created in their own right to accomplish objectives in a combat theatre.[15] The organizational chart of artillery division of the time (see figure 3), and historical understanding allows us the general conclusion that configuration and reconfiguration are adaptations to necessary operational conditions, still interesting and informative for examination from a current perspective. The Soviet artillery in WWII had a central task to overwhelm and destroy the enemy defensive lines, and at the time of the Cold War even led to the development of operational concept in the utilisation of conventional artillery "to accomplish many of the missions previously allocated to nuclear weapons."[16]

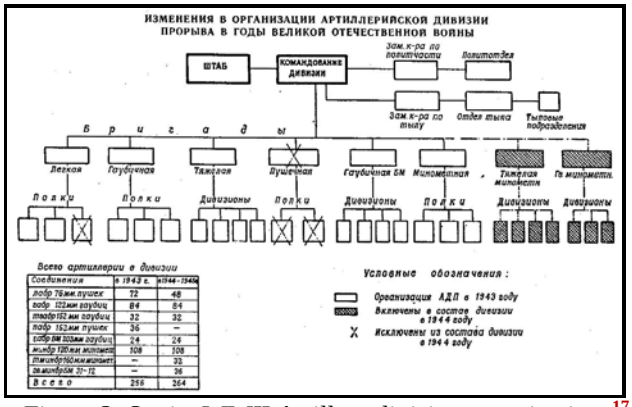


Figure 3: Soviet WWII Artillery division organizations[17]

These informative details can be found amongst both sides of the Cold War—US/NATO corps and division field artillery introduced augmented firepower, and in the same way, the Soviets responded with a reconfiguration to US/NATO artillery reorganization. US Army Soviet Arms Studies Office stated that "allocation of gun tubes in Motorized Rifle Divisions has increased from 168 to 228. The Army Artillery Regiments have likewise grown from 54 to 95 tubes."[18] This concentration in division field artillery was a Soviet planners scientific stand and definitely even today is used by Russian forces, since it "[predicts] outcomes and determines allocations of forces and means to ensures the victory."[19] Similar details are found for the 2S1 artillery howitzer battalion in its employment allocation as an attachment to battalion units for specific tasks—an operational battlefield situation would allow a division commander to allocate forward detachments/battalions, where their mission would be to "[turn] tactical success into operational,"[20] and these forward detachments/battalions would always receive 2SP1 artillery battalions as an attachment, allowing them to be "separated from [the] main force [by] as much as 35 km."[21] An example in figure 4 displays the 2S1 howitzer battalion configuration and figure 5 illustrates the fire plan of the same unit, which combined, allow for contemporary perspectives into new solutions.

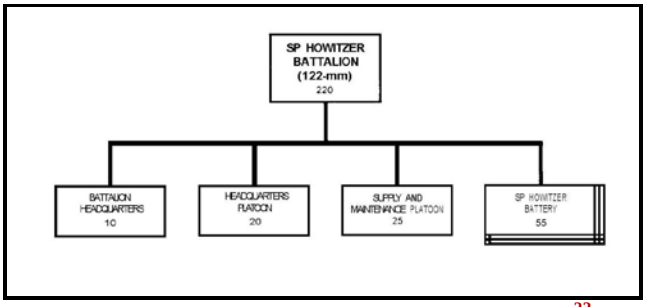
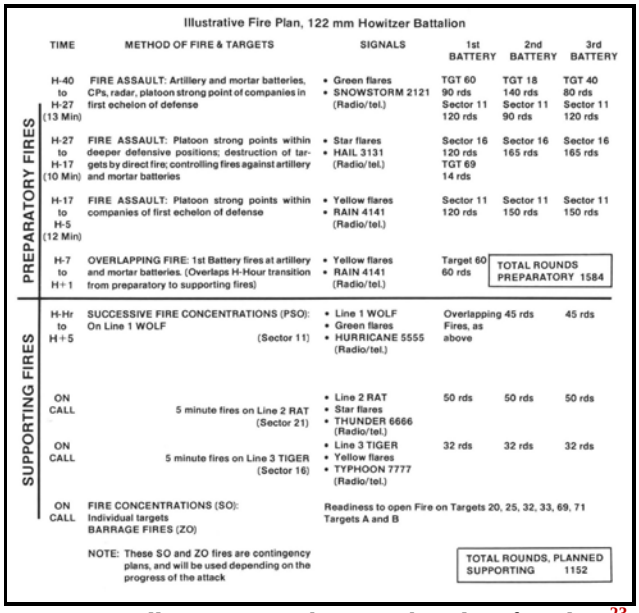


Figure 4: 2S1 howitzer battalion configuration[22]

It is accurate to presume that current wheeled modular battalions can have artillery battalions attached out of brigade artillery configuration of the mobile gun system (MGS) variant, 120mm mortars, and towed 155mm howitzers. Then again, for the purpose of striving for contemporary perspectives and connections to new effective solutions, it is worth mentioning that Soviet forward detachments/battalions general equipment included an amphibious capability of likes BTR 60, 70, 80, BMP, BMD, and 2SP1. This illustratively connects in a contemporary context of smart defence, and operational capability as it reduces engineering requirement in case of smaller units fording rivers in the area of operation of the allocated detachment/battalion, optionally being under divisional field artillery protection, or in the case of contemporary diversity of A2/AD capability, allows for broader response possibilities. In the same way, howitzer battalion fire plan in figure 5, on the other hand, gives perspective of the capability of venerable weapon system and facilitates ability to conceptualize effective solutions in context of organizational, political, technical factors and requirements.



Illustrative Fire Plan, 122 mm Howitzer Battalion

	TIME	METHOD OF FIRE & TARGETS	SIGNALS	1st BATTERY	2nd BATTERY	3rd BATTERY
PREPARATORY FIRES	H-40 to H-27 (13 Min)	FIRE ASSAULT: Artillery and mortar batteries, CPs, radar, platoon strong point of companies in first echelon of defense	• Green flares • SNOWSTORM 2121 (Radio/tel.)	TGT 60 90 rds Sector 11 120 rds	TGT 18 140 rds Sector 11 90 rds	TGT 40 80 rds Sector 11 120 rds
	H-27 to H-17 (10 Min)	FIRE ASSAULT: Platoon strong points within deeper defensive positions; destruction of targets by direct fire; controlling fires against artillery and mortar batteries	• Star flares • HAIL 3131 (Radio/tel.)	Sector 16 120 rds TGT 69 14 rds	Sector 16 165 rds	Sector 16 165 rds
	H-17 to H-5 (12 Min)	FIRE ASSAULT: Platoon strong points within companies of first echelon of defense	• Yellow flares • RAIN 4141 (Radio/tel.)	Sector 11 120 rds	Sector 11 150 rds	Sector 11 150 rds
	H-7 to H+1	OVERLAPPING FIRE: 1st Battery fires at artillery and mortar batteries. (Overlaps H-Hour transition from preparatory to supporting fires)	• Yellow flares • RAIN 4141 (Radio/tel.)	Target 60 60 rds	TOTAL ROUNDS PREPARATORY 1584	
SUPPORTING FIRES	H-Hr to H+5	SUCCESSIVE FIRE CONCENTRATIONS (PSO): On Line 1 WOLF (Sector 11)	• Line 1 WOLF • Green flares • HURRICANE 5555 (Radio/tel.)	Overlapping Fires, as above 45 rds		45 rds
	ON CALL	5 minute fires on Line 2 RAT (Sector 21)	• Line 2 RAT • Star flares • THUNDER 6666 (Radio/tel.)	50 rds	50 rds	50 rds
	ON CALL	5 minute fires on Line 3 TIGER (Sector 16)	• Line 3 TIGER • Yellow flares • TYPHOON 7777 (Radio/tel.)	32 rds	32 rds	32 rds
	ON CALL	FIRE CONCENTRATIONS (SO): Individual targets BARRAGE FIRES (ZO)	Readiness to open Fire on Targets 20, 25, 32, 33, 69, 71 Targets A and B			
		NOTE: These SO and ZO fires are contingency plans, and will be used depending on the progress of the attack		TOTAL ROUNDS, PLANNED SUPPORTING 1152		

Figure 5: Illustrative 2S1 howitzer battalion fire plans[23]

In order to understand, broaden perspective, and connect data, further essentials are required—as a Soviet artillery weapon concentration in battlefield sector (see table 1).

Against a prepared defenses on main axis	100-120 wpns/km
Against hasty defenses on main axis	70-80 wpns/km
On a minor axis	40 wpns/km
In defense	45 wpns/km

Table 1: Soviet artillery concentrations per kilometre[24]

Above accentuated figures are self-evident, when it comes to the assessment of concentrated firepower, which by itself demonstrates the scale of artillery support that could be deployed in the battlefield sector or in separate operation in support of a unit. However, what wheeled combat modular unit needs at present, in time of new developments as A2/AD assets, and diffusion of diverse expertise, is in the presented data. Then again it is obscured by the combination of known solutions of contemporary diversity of developments in ammunition, modernization and available or provided expertise. Effective explanation on the other hand lies in the connection of legacy knowledge and expertise combined with contemporary developments. In this case wheeled combat modular unit need streamlined connectivity in communication, with the ability to engage in high intensity combat with high and low connectivity capability, rapid manoeuvre and fire on high-priority targets, with augmented artillery capability.

This assertion is made on the basis of current capability, established on the doctrinal standard of operational area and communication for wheeled modular combat units, which is 50x50 kilometres, with extension to 100x100 kilometres battle-space,[25] where "[Network Centric Operations (NCO)] capabilities enable conduct of simultaneous, independent operations in non-contiguous areas (see figure 6). [Combined with] concept of operations is predicated on NCO capabilities high quality information and shared awareness."[26]

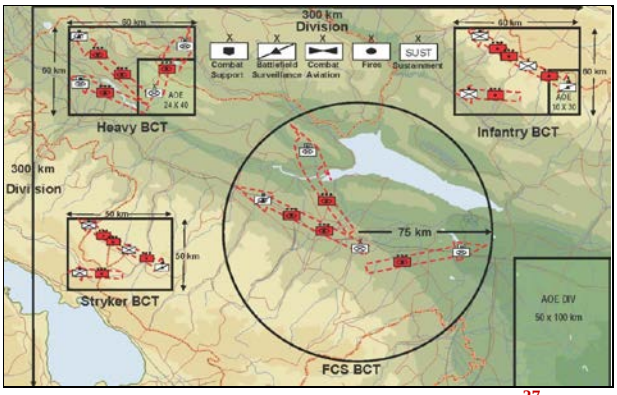


Figure 6: Conceptual areas of operation[27]

The ability of any unit to function in a current high intensity combat theatre, where a variety of known and unknown A2/AD capabilities are implemented, rests in the flexibility of communication and the additional internal tailor-ability of modularization. The internal modularization of a modular unit is in the capability to change arrangement mid-combat operation and stay operational in core concept, with additional ability for strategic effectiveness or response, when a battlefield requirement demands it.

What can be brought about out of standard definitions of modular and connectivity resonate with that stated above: that is, an interconnected system of platforms and applications of components can be separated and recombined to form tactical or strategic units at demand. The context lies between fundamental requirements of concept, the "ends, ways and means, [where] the ways are the method by which the means are applied to accomplish the ends," at present-day inevitabilities: the number of soldiers, and size of the professionalized army.[28]

III. Decision

In spite of inevitable necessity, if there were no concept and changeable geopolitical momentum, there would not be any necessity. Nevertheless, the idea of adaptation is hiding between necessity and an outlined vision of modular concept; "[the] goal is to be able to deploy a combat-capable brigade anywhere in the world within 96 hours after receipt of an order to execute lift-off, a division within 120 hours, and five divisions in 30 days."[29] Literally to attain the presented vision of a wheeled modular combat brigade, there would need to be a profound amalgamation of light infantry units, and vehicles (size-weight) would need to be reengineered as a combination of Swedish SEP 8X8 and ESARCO vehicles. This would result in overall reduction of vehicle weight, dimensions, and with that the combat unit itself. It would even permit the establishment of super-light modular combat units that would be compatible with any theatre of operation, even a complex urban setting.

Then again, the economics of already established wheeled units would be counterproductive. The cost of a like-new Stryker brigade is in excess of 1.5 billion dollars apiece.[30] Alternatively, another option is adding vehicles and at the same time augmenting capability or means with the adaptation of current practices. This vehicle addition, internal modularization inside the modular brigade, enhanced firepower and separation ability, to deliver concurrently tactical and strategic effect, will in overall concept increase weight for 20-25 per cent in context of strategic mobility. Then again by way of concurrent effect in generalized terms of the modularity, the internal separation would provide three divisions that would exercise tenfold limited increase in firepower.

IV. ACTION

As already stated, in the near future, in one form or the other, modifications will be implemented to satisfy and fulfil intended objectives. Since the majority of ground armies have wrapped their security around wheeled modular combat units and the professionalized soldier, in the future any military theatre requirements are going to be dictated by the adversary and your own equipment, with the ability of combined tactical and operational employment of the assets.

Therefore, if modelled correctly, internal augmentation in wheeled modular combat units would create organic combat segments that when necessary, and if the situation allowed, would separate and form light units of strategic effectiveness, working in conjunction with the main unit (see table 2).

Platoon	4	**Company**	6
Company	15	**Battalion**	18
Battalion	45	**Brigade**	54
Regiment	135	**Division**	162
Brigade	405	**Corps**	486
Division	1215	**Army**	1458
Corps	3645	**Army Group**	4374
Army	10935	**Army Theater**	13122

Table 2: Unit, abstract of total vehicles count and artillery configuration[31]

A framework of this particular approach in set modular combat unit is only possible by adding an internally modular organic unit that is operationally adjustable, and at the same time possesses enhanced capability to allow battlefield situation separation to rearrange firepower and allow internally modular echelon to respond decisively to an adversary in the area of operation. In other words, such an approach must constantly contain and maintain initiative, as otherwise a main unit would disengage in overwhelming odds. In short, more combat unit fight as whole, faster manoeuvres. The more it divides, the stronger becomes the slower manoeuvres.

If the augmentation defence question is observed through NATO e.g. smart defence[32] and EDA, pooling and sharing[33] then the proposals, accepted in literal form, could mean that an effective internally modularized force is conceivable:

> a cooperative way of thinking about generating the modern defence capabilities […], in a more cost-efficient, effective and coherent manner […] encouraged to work together to […] support defence cooperation in pooling, sharing […] consideration for nations with similar weapons systems, consolidated munitions procurement […] life-cycle management of the same or similar equipment.[34]

This way of literal understanding, legacy knowledge and capability in smart defence allows for a balanced solution between the economic circumstances and geopolitical momentum, which constructs deterrent defence, between offensive and defensive doctrine with attached (offensive) safety. Allowing one or the other form of internal modularization in the selected modular combat unit concept, would allow them to stay effective in economic circumstances and various geopolitical situations.

V. DISCUSSION AND CONCLUSION

The intention of the paper was not to present a model or concept, but to allow for conceptualisation of new or interim solutions presented through exploration of the contemporary problems of wheeled modular unit and ascertain the possibility of augmentation of wheeled modular unit in austere circumstances, and outline directions of flexible archetypal modelling for internal modularisation of modular or other units.

Modelling of new augmentation is not a question of just adaptability to circumstances, but also management of legacy knowledge and an ability to develop new capabilities without incurring force degradation in a time of economic reductions when new escalations in expenditure are not possible.

In the world of constant change in the geopolitical and economic circumstances, defence is still the responsibility of a nation state. And as much the future is set in decentralized operations and specialized small units, there will always remain a requirement for units of strategic significance that can power project, counteract, contain and sustain initiative.

This ability in the contemporary world of small professionalized armed forces and economic circumstances can only transpire if ways and means are flexible in adjustment to the changing geopolitical state of affairs on the base of legacy knowledge, concurrently organized to form sizable strength that can concentrate for effective and decisive force, under uncertain economic and political conditions.

ENDNOTES

[1]Richards, C. "Boyd's OODA Loop." JV/M, Inc. 21 March 2012. p.1-5. Accessed on 10 March 2017. www.jvminc.com/boydsrealooda_loop.pdf Note: OODA loop, the loop does provide a concise framework for improving competitive power throughout an organization. […] The acronym "OODA" stands for "observe, orient, decide, act [action]," and it is often depicted with the four elements arranged in a simple sequence.

[2]DOA, Final Environmental Impact Statement Permanent Stationing of the 2/25th Stryker Brigade Combat Team. Volume 1, February 2008. U.S. Army Environmental Command Aberdeen Proving Ground, Maryland. p.1-12. https://www.govsupport.us/ Accessed on 23 May 2017. Note: The Army has embarked on a 30-year process to transform its forces. […] As part of its overall transformation effort, the Army has decided to transition to a modular or standardized force structure at all levels of its organization. This process of modular standardization means a transition of the Army from large powerful, fixed organizations constituted at the Division level to an Army designed around smaller, self-contained, logistically supportable BCTs.

[3]Nikolić, N. et al. "Some Problems of Field Maintenance in the Stryker Type Brigades." 5th International Scientific Conference on Defensive Technologies. Belgrade, Serbia 18-19 September2012.p.757.http://www.emp.edu.dz/Manif_Scientifique/OTEH2012/elementi/rad/7-10.pdf. Accessed on 10 May 2017. Note: Quick deployment, respective fire power, high force protection, and mobility, are main characteristics of Stryker brigade. […] Whole this brigade is "on the wheels", and that obtains high tactical mobility in the area of operation. On the other side capability of logistical self-sustaining is small—only 72 hours, after that the Stryker brigade needs external logistical support.

[4]O'Reilly, V. "Stryker Brigades versus the Reality of War." globalsecurity.org. 22 August 2003. https://www.globalsecurity.org/military/library/congress/2003_rpt/stryker_reality_of_war.pdf. Accessed on 30 April 2017.

[5]RAND, "A Review of the Army's Modular Force Structure." Technical report. RAND Corporation, National Defense Research Institute. Santa Monica, CA 2011. p.8. www.dtic.mil/dtic/tr/fulltext/u2/a545348.pdf Accessed on 22 Jun 2017.

[6]TRADOC, "TRADOC Pamphlet 525-5: Force XXI Operations. A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty First Century". Department of the Army. 1 August 1994. p.3-1. www.dtic.mil/dtic/tr/fulltext/u2/a402580.pdf Accessed on 25 February 2015.

[7]Mohr, C. "To Modernize, the Army is Bringing Back Light Infantry". *The New York Times*, 25 November 1984. http://www.nytimes.com/1984/11/25/weekinreview/to-modernize-thearmy-is-bringing-back-light-infantry.html Accessed on 24 June 2017.

[8]Figure, 1. "Wheeled modular combat brigade weight and 96 hours deployment estimation". globalsecurity.org. 5 February 2000. http://www.globalsecurity.org/military/agency/army/images/bde-deploy.gif Accessed on 15 July 2017.

[9]TRADOC, *op. cit.* p.3-2.

[10]Kugler, R. "Case Study in Army Transformation: Creating Modular Forces". Center for Technology and National Security Policy. April 2008. p.6. http://www.dtic.mil/get-trdoc/pdf?AD=ADA480011 Accessed on 22 June 2017.

[11]Figure, 2. "US armoured division, ROAD, 1965-1983". globalsecurity.org. 27 April 2005. http://www.globalsecurity.org/military/library/policy/army/accp/is7032/lsn3.htm Accessed on 15 July 2017.

[12]Kennedy, C. "The U.S. Army Division: The Continuous Evolution to Remain Relevant". United States Army War College. Carlisle Barracks, PA. 2013. p.13-14. www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA589319 Accessed on 18 June 2017

[13]FA, "Silhouettes of Steel: VII Corps Artillery. Reports by Army Corps and Division Artilleries and Marines". *Field Artillery*, December 1988. US Army Field Artillery School, Fort Sill, OK. 1988. p.10. http://sill-www.army.mil/firesbulletin/archives/#1980 Accessed on 10 April 2017.

[14]Grau, L. "Soviet Artillery Planning in the Tactical Defense". dtic.mil. U.S. Army Combined Arms Center. Fort Leavenworth, Kansas. September 1990. p.2. www.dtic.mil/dtic/tr/fulltext/u2/a231788.pdf Accessed on 25 March 2017. Note: Artillery has always held pride of place in Imperial Russian and Soviet Armies. In Imperial Russia, artillery officers enjoyed a reputation for intellectual and professional excellence and received preference over the officers other arms. Today, other nations structure armies around manoeuvre forces. The Soviets, due in part to their unique planning and employment of artillery, appear to have structured their army around artillery.

[15]Gordon, J. "The Evolution of Soviet Fire Support, 1940-1988". *Field Artillery*, Jun 1988. US Army Field Artillery School, Fort Sill, OK. 1988. p.19. http://sillwww.army.mil/firesbulletin/archives/#1980 Accessed on 10 April 2017.

[16]Holcomb, J. Soviet Artillery Utilization. dtic.mil. U.S. Army Combined Arms Center. Fort Leavenworth, Kansas. March 1988. p.1. www.dtic.mil/dtic/tr/fulltext/u2/a216371.pdf Accessed on 23 March 2017. Note: As Soviets perception of future war have changed over time, so have their operational concepts and force structure. With a realization of the possibility (indeed increasing probability) of a conventional phase to any future war, the Soviets have conducted exhaustive study of their own and others military historical experience to determine solutions to the problems such as battlefield might present. A major aspect of this analysis was realization that artillery will have to accomplish many of the missions previously allocated to nuclear weapons, particularly during the initial period of war. As a result, significant emphasis has been placed on developing force structure and concept of employment in last decade. This is apparent from the increased deployment of artillery systems in general and self-propelled systems in particular as well as the substantial attention artillery tactics receives in the Soviet military press.

[17]Figure, 3. "Soviet WWII Artillery division organizations – Изменения в организации артиллерийской дивизии прорыва в годы ВОВ". rkka.ru. 22 November 2011. www.rkka.ru/iorg.htm Accessed on 17 July 2017.

[18]Holcomb, J. *op. cit.* p.1.

[19]Holcomb, J. *op. cit.* p.2.

[20]Holcomb, J. *op. cit.* p.6.

[21]Holcomb, J. *op. cit.* p.6.

[22]Figure 4, "Field Manual 100-2-3 The Soviet Army: Troops, Organization, and Equipment". fas.org. June 1991. p.4-36.https://fas.org/irp/doddir/army/fm100-2-3.pdf Accessed on 15 May 2017.

[23]Figure 5, Daschke, C. "The Artillery Threat". *U.S. Army Aviation Digest.* 25/11. 1979. p.19. http://www.rucker.army.mil/avjournal/1970/ Accessed on 29 June 2017.

[24]Table, 1. *op. cit.* Holcomb, J. p.5.

[25]Witsken, J. "Network-Centric Warfare: Implications for Operational Design". A Monograph. School of Advanced Military Studies. United States Army Command and General Staff College, Fort Leavenworth, Kansas. 2002. p.15. www.dtic.mil/cgibin/ GetTRDoc?AD=ADA403832 Accessed on 28 April 2017. Note: The Army's Force XXI concept was the initial effort to leverage network-centric concepts within its forces, by integrating modern command and control technology with the latest sensors and weapon platforms. The fruit of this initiative is an integrated force, using information dominance to overmatch enemy forces. The Force XXI Organizational and Operational Concept (O&O) envisions leveraging of information to dramatically increase the size of the battlespace assigned to Force XXI division and brigades. The division is expected to dominate a battlespace of 120x240 kilometers. Brigade battlespace is defined as 2700 square kilometers with its organic units, and one-third of the division's battlespace (8000 square kilometers) when augmented. The Interim Force is fundamentally network-centric in its character. The Interim Brigade O&O explicitly incorporates internetted combined arms capabilities. In addition, the Brigade is equipped with large numbers of advanced sensors (on air and ground platforms). The Interim Brigade is intended to execute distributed and dispersed operations over an expanded battlespace, operating over a 50x50 kilometer area (2500 square kilometers). If augmented properly, the Brigade is expected to be capable of operating across a 100x100 kilometer battlespace (10,000 square kilometers). This combination of advanced command and control, extensive sensor suites, and situation awareness enables a new way of warfighting.

[26]RAND, "Network Centric Operations (NCO) Case Study: Stryker Brigade Combat Team". Command & Control Research & Technology Symposium. June 2004. p.6. http://dodccrp.org/events/2004_CCRTS/CD/presentations/269.pdf Accessed on 26 April 2017.

[27]Figure, 6. Brown, K. "Field Artillery Capabilities Update". Capabilities Development and Integration Directorate. NDIA – National Defense Industrial Association 20 June 2008.p.3.https://ndiastorage.blob.core.usgovcloudapi.net/ndia/2008/psa_peo/Brownday2.pdf Accessed on 26 August 2017.

[28]Schmitt, J. "A Practical Guide for Developing and Writing Military Concepts". au.af.mil. Hicks & Associates, Inc. McLean, VA. December 2002.p.3.www.au.af.mil/au/awc/awcgate/writing/dart_paper_writing_mil_concepts.pdf Accessed on 15/03/2017. Note: Viewed as ends, ways and means. Military concepts can be viewed in terms of ends, ways and means, of which the concept corresponds generally to the ways. The means are the military capabilities to be employed in the given situation. They may range from the full arsenal of military forces available at the operational or strategic levels to a particular capability such as a weapon system, vehicle, training system or specific unit at a lower level. The end is the stated objective, ranging from a broad strategic aim to the accomplishment of a particular task. The ways are the method or scheme (that is, the "concept") by which the means are applied to accomplish the ends. The essence of a concept is this description of method. A description of a capability by itself does not constitute a concept; capabilities can be created but not used as envisioned, while identical capabilities employed differently would constitute different concepts. Likewise, the description of a desired objective does not constitute a concept; any number of different approaches or methods, employing various capabilities, could conceivably

accomplish that objective. The end is necessary to provide context, and the means are needed to describe what resources will be applied, but the essence of the concept is the way in which those capabilities are to be employed. In this sense, military concepts are primarily descriptions of how things are done.

[29]Wojtysiak, M. "Another View of the Myths of Gulf War". *Air & Space Power Journal – Air Force, Air Education and Training Command, Air University.* XV/3. Fall 2001. p.57.https://pdfs.semanticscholar.org/ca8e/71674e47134b72e337ad40d39692fd36f5d0.pdf Accessed on 15 May 2017.

[30]Arthur, D. "A CBO Study. Options for Strategic Military Transportation Systems". The Congress of the United States, Congressional Budget Office. September 2005. Washington, DC. p.45. https://www.cbo.gov/publication/17188 Accessed on 10 June 2017. Note: Using Army budget data, CBO estimated that one additional set of equipment—including about 300 Stryker vehicles, various tactical and support vehicles, communications and navigational systems, and other necessary combat equipment and supplies—would cost about $1.5 billion to procure.

[31]Table, 2. Adapted on triangular concept and contemporary unit structure. CSI Report, "Sixty Years of Reorganizing for Combat: A Historical Trend Analysis". usacac.army.mil. December 1999. <usacac.army.mil/cac2/cgsc/carl/download/csipubs/sixty.pdf> Accessed on 28 March 2017. – Smith, S. "Boots in the Air: Moving the New Army Brigade". A Thesis presented to the faculty of the school of advanced airpower studies for completion of graduation requirements. School of Advanced Air Power Studies Air University. 1 June 2000. www.dtic.mil/dtic/tr/fulltext/u2/a391777.pdf Accessed on 10 July 2017. – FMI 3-0.1, "The Modular Force". fas.org. 28 January 2008. https://fas.org/irp/doddir/army/fmi3-0-1.pdf Accessed on 15 January 2017. – Burggrabe, R. "Is the Stryker Brigade Combat Team Still Relevant". A Monograph. School of Advanced Military Studies. United States Army Command and General Staff College, Fort Leavenworth, Kansas. 2016. http://www.dtic.mil/get-trdoc/pdf?AD=AD1021914 Accessed on 10 August 2017. – DOA, *op. cit.* p.2-7.

[32]NATO, "Smart defence – North Atlantic Treaty Organization 2012-2017". nato.int. 2012. http://www.nato.int/cps/en/natolive/topics_84268.htm Accessed on 23 June 2017.

[33]EDA, "EDA's Pooling & Sharing". European Defence Agency. 24 November 2011. http://www.eda.europa.eu/docs/documents/factsheet_-_pooling_sharing_-_301111 Accessed on 12 June 2017.

[34]Bahle, H. "Smart Defense – An innovative approach to security challenges". *Military Review, Third Edition. Center for Defence Analyses. Tirana AL.* June 2012. p.16-22.http://www.mod.gov.al/eng/index.php/publications/military-review Accessed on 20 May 2017.