DESIGNING A MODERN LABORATORY FOR URBAN COMBAT TRAINING (L4UCT). A PROJECT MANAGEMENT METHODOLOGY BASED APPROACH

Dorel BADEA
Iancu DUMITRU

"Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania

This paper presents the essential coordinates of the project concerning the achievement of feasible versions in terms of their design and functions) of a laboratory for urban operations for cadets, with high potential for implementation in military higher education institutions. Data to identify the optimal correlation (in terms of technical, system and operational views) between game and simulation, applicable in the military field, based on the use of available airsoft weapons and specialized softwares existing on the specialized market for military and / or civilian use are envisaged. Our approach for this project maintains the common areas (resources, rules, actors) in the professional civil literature and the types of simulation defined in military documents: real simulation (it implies real people operating real systems), virtual simulation (it implies real people operating simulated systems) and constructive simulation (models and simulations which imply simulated people operating simulated systems, with real people setting the premises but not determining in any way the outcome of the simulation).

Key words: *simulation, urban combat, project methodology.*

1. BUSINESS CASE

1.1. Project general framework

In the education of fighters for Land Forces, the Military Operations in Urban Terrain (MOUT) should be seen as a high training priority demonstrated by recent theaters of war operations (e.g. Afghanistan/ **Figure1**). Given the fact that the terms Smart Defense and Intelligence are common in contemporary society, this kind of solutions implemented in the educational system support the neo-function of knowledge.

The first step in the process of training may be studying the current regulations (for example FM 3-06 Urban Operations) in a theoretic classroom, creating a scenario that can be enacted in a virtual environment, provided very efficiently by the Virtual Battlespace 2 program, and analysing the results in order to implement the scenario in a laboratory (mini-polygon). This phase complete, the process can move on to the second phase, the "field" phase, where the training is more realistic (**Figure 2**).

Figure 1. Real Urban Combat Operations [1] [2]

Figure 2. Variants of Urban Combat Laboratories and the solution proposed by the project [3] [4]

1.2. Description of the software and technology proposed to be used in the laboratory

The solution approached in a research project proposal sumitted to the Romanian Ministry of National Defense initiated in "Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania revolves around airsoft replicas (**Figure 3**), in the way they are usually accepted and used by a vast majority, as precise copies of real weapons (AK, M4, MP7, Glock, etc.). Historically speaking [5], airsoft has its origins in the 70s, in Japan, where firearms were forbidden and, as a response, the production of an extremely realistic, non-metallic collection of replicas, of military fire-arms began. Afterwards, a system of propulsion resembling the one in target practice was introduced. This was the way non-lethal replicas of real firearms appeared. Afterwards, they became popular in Asian markets under the name of "soft-air" or "air-soft". The gas-propelled replicas evolved, in the late 90s into cheaper electric models (AEG), followed by the development of the systemsproviding for the accuracy and buoyancy of the projectile. The ammunition used by airsoft replicas consists in non-metallic balls generally made from ABS plastic, but as an alternative there are also biodegradable materials, polytetrafluoroethylene, glass, etc. The scenarios of the airsoft games vary a lot, depending on the location, on the number of participants and on the economic capabilities, but generally they go from small "skirmish" games to complex military *be specifically tailored to meet the individual*

Figure 3. Airsoft weapon and bullets used [6]

simulations and historical re-enactments. In these events the participants often associate the airsoft replicas with the real equipment and military tactics with the ones used by the armed forces.

"VBS2 (Virtual Battlespace) offers realistic battlefield simulations and the ability to operate land, sea, and air vehicles. Instructors may create new scenarios and *then engage the simulation from multiple viewpoints. The squad-management system enables participants to issue orders to squad members. VBS2 was designed for federal, state, and local government agencies and can needs of military, law enforcement, homeland defense, loadmaster, and first responder training environments.*

Also, VBS2 may be used to teach doctrine, tactics, techniques, and procedures during squad and platoon offensive, defensive, and patrolling operations. VBS2 (Figure no.4) delivers a synthetic environment for the practical exercise of the leadership and organizational behavior skills required to successfully execute unit missions. This instrument is suitable for training small teams in urban tactics, entire combat teams in combined arms operations or even non-military usage such as emergency response procedures in lethal and non-lethal environments or terrain visualization." [7]

Figure 4. Urban combat training scenarios simulated in the VBS 2.0 program [8]

Also, a useful tool for this project could be ArcGis. *"The ArcGIS Predictive Analysis Tools Add-In is a set of tools used by analysts to build models to predict the location of moving or stationary targets or events. The predictions may be based on doctrine, or they may be derived from a set of observations. The Add-In can be used as part of a workflow to predict future events and activities, such as the likely landing spots for a smuggler's boat, or the probable locations of mobile missile launchers. The ArcGIS Predictive Analysis Tools Add-In lets you build, save, and load queries to share analytical workflows. Included are tools to quickly create simple linear distance from and time from surfaces, which can be useful inputs for predictive analyses. These tools can derive predictive queries from a set of observed points where an event is known to have occurred. There is a speed-model builder that lets you develop sophisticated travel-speed models that account for multiple environmental variables.*

It includes tools for finding shortest paths between locations, given a set of environmental conditions (including point, line, and polygon sources and barriers). The Add-In also includes a time window for showing subsets of, and animating, time-enabled data on the map and in graphs."[9]

It is very well known the fact that these symbols can be used to represent a large variety of GIS features (such as trees or fire hydrants for point features, grass or water for polygon features, and tubes or texture lines for line features). More than that, ArcGIS 3D Analyst supports specialized three-dimensional models, including MultiGen OpenFlight, 3D Studio MAX and SketchUp formats, to allow for a more realistic representation of three-dimensional characteristics (**Figure 5**). [10]

Figure 5. Possibilities to model and simulate urban details using ArcGis software [11] [12]

2. SCOPE MANAGEMENT PLAN

2.1. Scope and objectives

The project aims to increase the effectiveness of training students by developing a modern mini firing range for urban combat, according to the current state of requirements imposed by the beneficiary (MoND), through Land Forces headquarters.

The project follows four major objectives:
- synthesis of game and simulation features (minimum 5), militarily relevant for specific applications;
- conducting research in order to identify the current state of airsoft type applications using different perspectives (one view for civilian use and one for military);
- development of feasible alternatives (in terms of design and and functionality) of laboratory for urban combat in order to transferr the expertise and experience gained by playing and simulation, in the real context of cadets training;
- implementation of the alternative deemed most feasible in the Land Forces Academy of Sibiu (at the end of the project).

2.2. Outcomes

This project ensures the approach of new concepts such as e-leadership in a tactic field the acquirement of training competences for small military structures. It could be also an alternative to obtaining certain extra-budgetary revenues while being, at the same time, a landmark in the promotion of the Land Forces Academy in the civil society.

2.3. Project feasibility

The project is considered as a feasible one and with all qualities and premises necessary for development because:
- it proposes new solutions of training applicable to very many military fields, the proposed technologies having an important impact in terms of resources using performance;
- it responds to the concrete needs of Land Forces education institutions;
- a controlled process of managing activities, a risk management plan, a change management process, laws and regulations to be complied with (Law 295/2004 related to the Weapons and Ammunition, updated, republished in the Official Monitor no. 814/17.11. 2011), quality standards and the basic facilities necessary to complete these activities are already in place;
- the project is mostly realized inside "Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania by a research and development team with people specialized from departments with wide ranging experience and acknowledged performance in military and security scientific research and developing area.

2.4. The work breakdown structure

The work Breakdown Structure (WBS) of this project consists of the following activities:
- technical investigations about current solutions used for urban combat training (identification of NATO requirements for specific training in urban areas; analysis of the role of the Military Operations in Urban Terrain (MOUT) in the education of cadets and fighters for Land Forces);
- elaboration of project plan that will be implemented (this will include: synthesis of a SWOT analysis related to the agreed intention; team formation and the establishment of responsibilities; the final study elaboration; research related to practical and theoretical approaches about game and simulation; study and elaboration of systemic aspects; study and elaboration of technical aspects; study and elaboration of operational aspects);

- realizing the product L4UCT (namely the theoretical room of L4UCT; realizing the minipolygon /practical room of L4UCT);
- testing the product L4UCT (visual inspection; elaboration of the testing plan; the static testing of the product regarding mechanical and physical properties of the structures of the minipolygon, realization of connections between objects; the dynamic testing of the product; developing the testing report using the opinions of trainers and cadets involved);
- dissemination of the results (project web site update; organization of a workshop with representatives of the military educational institution and officials from MoND; editing a brochure for conducting MOUT courses);
- auditing the project (elaborating the financial audit report; elaborating the final report; sending the final report and the financial audit report to the MoND);
- closing the project (archiving the documents; assigning the inventory number).

3. PROJECT RISK MANAGEMENT

In order to build a quantitative analysis of the risks, a 5 x 5 matrix is used, in which the risk level (**Table 2**) is calculated by multiplying the values of emergence probability and the event impact (**Table 1**).

Table 1. Project risk assessment

Likelihood (A)		insignificant 1	minor 2	significant 3	major 4	critical 5
5 very likely		5	10	15	20	25
4 likely		4	8	12	16	20
3 feasible		3	6	9	12	15
2 slight		2	4 B,C,F	6 D, G	8	10
1 very unlikely		1	2 A, E	3	4	5
		1 insignificant	2 minor	3 significant	4 major	5 critical
		IMPACT (B)				

In this case, the significance of the colors used in the matrix is: Green = Low risk, Orange 9 = Medium risk, Amber 10 – 12 high risk, Red = High risk.

Table 2. Risk assessment grid

Likelihood of Occurrence (A)	Severity of Impact (B)
1- Very unlikely (hasn't occurred before)	1 - Insignificant (have no effect)
2 - Slight (rarely occurs)	2 - Minor (little effect)
3 - Feasible (possible, but not common)	3 - Significant (may pose a problem)
4 - Likely (has before, will again)	4 - Major (Will pose a problem)
5 - Very Likely (occurs frequently)	5 - Critical (Immediate action required)

The risks associated to this project and the conditions under which they are likely to appear (**Table 3**) are related to the following areas: host institution executive support; project managers' authority; project team members' motivation; products interoperability level; quality of the purchased products.

4. TIME MANAGEMENT PLAN

The purpose of this plan is to show how the project will be executed and to provide to all stakeholders a tool to monitor project status at any given time. All the project members must agree with work assigned, durations and schedule. The project schedule will be reviewed and updated by the project manager weekly based on the reports and observations provided by the team members. The total estimated duration of the project is 95 working days between 29 April 2014 and 11 September 2014.

The milestones are: the final study elaboration - 05.06.2014; acquisition of VBS 2.0 kit and ArcGis Version 10 - 04.08.2014; the dynamic testing of the product - 12.08.2014; editing a brochure for conducting MOUT courses - 01.09.2014; sending the final report and the financial audit report - 02.09.2014; archiving the documents - 09.09.2014.

The detailed time management plan of the project should be represented by the Gantt chart.

Table 3. Project risk factors and related actions

Risk	Risk description	Likelihood	Impact	Likelihood x Impact [Score]	Actions required
A	Personnel from project team misses	1	2	2	Activities will be reassigned to another project team members
B	The estimated costs for some of the products may be higher than expected Some delays caused by the Romanian	2	2	4	During the planning phase a 5% margin for the acquisition costs was discussed
C	Law of acquisitions (ambiguous in some situations)	2	2	4	Depending on the procedure used in the acquisition processes, the legal duration of the acquisition can be extended in order to have enough time.
D	Differences between the products requested and provided by firms	2	3	6	The contract will mention the required specifications
E	Insufficient knowledge about the integration of technical, operational and systemic approaches of the project	1	2	2	Inhouse training course will be provided, brainstorming meetings will be held
F	Transformation of institution	2	2	4	The benefits of project for the cadets, regardless of the decision making authority, will be emphasized.
G	New equipment is not interoperable with existing one due to different software and hardware connectivity issues	2	3	6	The feasability study will be conducted based on IT standards

5. PROJECT QUALITY MANAGEMENT

The quality approach consists in controlling the deliverables according to existing standards. The entire project team is part of the Land Forces Academy and its activity complies withthe standards applied to the entire institution. "Nicolae Balcescu" Land Forces Academy participated (2012-2013), along with other higher education institutions included in the "B" category - education and research institutions, in the international institutional assessment processes within the project "Performance in Research, Performance in Teaching - Quality, Diversity and Innovation in Romania's Universities". The Institutional Evaluation Programme (IEP) is an independent membership service of the European University Association (EUA) that offers evaluations to support the participating institutions in the continuing development of their strategic management and internal quality culture. The IEP is a full member of the European Association for Quality Assurance in Higher Education (ENQA) and is listed in the European Quality Assurance Register for Higher Education (EQAR). The Management is committed to the Quality endeavor by providing all the necessary resources in terms of manpower, skills, tools etc. In corroboration with the Quality goals, Land Forces Academy has a well structured Quality Management System (QMS) having a strong process focus and comprising of Procedures, Guidelines, Standards and Templates. Stakeholders decide on the quality of the cadets based on the performance of the command officers building up process, according to the assumed institutional task, a process that is presented in the next figure.

Figure 6. Pilars of quality assurance in cadets education [13]

Also, in 2010 "Nicolae Balcescu" Land Forces Academy Sibiu was subject to an external institutional evaluation conducted by the Romanian Agency for Quality Assurance in Higher Education, which accredited all bachelor and master study programmes and rated LFA Sibiu as "University of Highest Confidence".

Based on this framework, the scientific results of this project will be submitted to the scientific community in order to have a feed-back on the writings. At the same time this feed-back will serve as a quality measurement. The main key quality concepts and the associated measurements are: functionality (it is necessary to have great flexibility in terms of the different urban combat scenarios that will be practiced with the cadets team/platoon); safe security (it is necessary to comply with work protection measures by wearing specific military equipment and accessories). The success of the project is dependent upon the performance and experience of the managerial team. The project also helps each participant in enhancing the experience in their areas of expertise and to obtain an actual perspective of a subject. As special standards and regulations, AQAP 2110 – NATO quality assurance requirements for design, development and production, and UFC 4-022-01 Security Engineering will be applied.

After the test phase a questionnaire will be given to the cadets to see to what extent the laboratory meets their expectations (**Table 4**).

Table 4. L4UCT product quality evaluation questionnaire-USER'S VOICE

Seq.	Quality criteria	Score (1-5)	Additional comments
1.	Laboratory spaces are adequate from an ergonomic point of view.		
2.	Laboratory helps to improve basic skills in the urban combat training.		
3.	Targets acquisition has an appropriate level of difficulty.		
4.	Degree of targets camouflage is…		
5.	Scenarios practiced by computer can be applied in reality using airsoft weapons.		
What would you improve in this laboratory?			

6. HUMAN RESOURCE MANAGEMENT

The organization of the project team is presented in Figure 7.

The main responsibilities and associated necessary skills are:

- the project manager approves and will be responsible for carrying out of all indicators. He is the one responsible for the relationship with the rector of institution. The Project Manager must have a PhD degree in engineering science and strong knowledge in quality assurance requirements (ISO 9001).

- the financial team will provide financial management and will be responsible for drawing up all financial documents/reports and for acquisitions. They must have very good knowledge and experience in acquisition laws and acquisition procedures.

- the training officers team is responsible for creating training scenarios, generating urban combat requirements for IT experts and implementation of laboratory in the training of cadets. They will be able to provide state of the art military training equipment.

- the R & D team will provide project management activities in different phases and is responsible for integrating the technical, systemic and operational aspects. They have to be specialized in management or related fields.

- the IT team will provide technical software requirements and coordinate implementation ensuring the interoperability of equipment. Previous expertise is needed in the field of military and security IT equipment for decision making processes and troop leadership procedures.

Figure 7. Project organization chart

Rarely does everyone on a team have the same understanding of who is responsible for what. A RACI (R = Responsible, A = Accountable, C = Consulted, I = Informed)

Chart, also known as a RACI Matrix, clarifies roles and responsibilities, making sure that nothing falls through the cracks. RACI charts also eliminate duplicated efforts and confusion by assigning clear ownership for each task or decision. For the present project this tools is applied in the next table for the main activities, considered milestones.

Table 5. RACI matrix

Activities	PM	F	TO	NCO	RD	ITE	ITW
Final study elaboration	A	C	C	I	R	R	I
Acquisition of VBS 2.0 kit and ArcGis Version	C	R	C	I	C	R	C
Installation of all products purchased for laboratory	I	I	R	R	C	R	R
Product dynamic testing	I	I	R	R	C	R	R
Editing a brochure for conducting MOUT courses	A		R		R	C	
Sending the final report and the financial audit report	A	R	C		R	I	
Document archiving	I	R		R	I		

7. COMMUNICATIONS MANAGEMENT PLAN

The stakeholders identified as relevant for this project are: the cadets (K); project team members (PTM); institution's leadership (IL-dean of faculty, rector, vice rectors); Deprtament of Armament from MoND (DA); Romanian Land Forces Staff (RLFS); suppliers (S).

The communications management plan has to fulfill, mainly, the following roles:
- to report to high importance stakeholders the status of the project and the influence on their institutions;
- to brief and debrief all project members on their activity and how their work influences the project.

In order to achieve the performance strategy of the project, we must assure timely and effective communication to all of the stakeholders involved with the project. Our communication will be based on the scope and on the project phases. Communication during the project will be done using the communication facilities provided by the Land Forces Academy (*e.g.* e-mail, phone, fax, regular mail, etc.).

These groups are analyzed based on the support (power/ influence)/ interest criteria provided by Mendelow's Model. According to these, the categories identified as relevant for this project are: High power, interested people (HPIP); High power, less interested people (HPLI); Low power, interested people (LPIP); Low power, less interested people (LPLIP).

The Stakeholders' Matrix is presented in **Figure 8**.

power		level of interest	
		low	high
low		A	B K, IL, PTM, S
high		C	D DA, RLFS

Figure 8. Stakeholders' Matrix for the L4UCT project

The following strategies might be applicable to each quadrant [14]:
- **Box A (minimum effort)**: their lack of interest and power makes them open to influence. They are more likely than others to accept what they are told and follow instructions.
- **Box B (keep informed)**: these stakeholders are interested in the strategy but lack the power to do anything. Management needs to convince opponents to the strategy that the plans are justified; otherwise they will try to gain power by joining with parties in boxes C and D.
- **Box C (keep satisfied):** the key here is to keep these stakeholders satisfied to avoid them gaining interest and moving to box D. This could involve reassuring them of the outcomes of the strategy well in advance.
- **Box D (key players/participation)**: these stakeholders are the major drivers of change and could stop management plans if not satisfied. Management, therefore, needs to communicate plans to them and then discuss implementation issues.

It is compulsory that the project manager will create a database with contact information for all stakeholders directly involved in the project.

8. PROJECT COST MANAGEMENT

The total cost of the project is: $61116.

The main categories of costs refer to the acquisition of VBS and ArcGis software (28000$), audio system (1000$), after action review tools (2000$) and system components of airsoft (2500$). The main assumptions used in this part of the project are: the material and equipment resources required for the laboratory will be subject to acquisitions actions; the project team members will be paid with their monthly salary.

9. PROJECT CLOSEOUT

The project manager will get feed-back from project team members. All the documents related to the project are to be archived electronically and in paper format according to MoND rules. Based on these documentations, the project manager presents to the final report and the plan for the workshop the key stakeholders in order to disseminate project results. Another post project stage could be that of finding links with other research, in this case the results achieved by Romana Oancea [15] representing a useful guideline.

10. CONCLUSIONS

The domain of modelling military actions and its use in cadet instruction combines judiciously the advantages of game and simulation. Moreover when addressed both theoretically and practically and starting from the common points (resources, rules, actors), and moving on to its agreement with the requirements of a demands based knowledge society proves a modern approach. Even if itless exploited at national level, it has a great potential to transform and implicitly to adapt land forces to the demands and challenges of the new security environment. The operational model developed by this project ensures reduction of the budget spent for basic military training and representation of a more complex system that allows experimentation in a direct manner, minimizing physical risks while maximizing awareness of the associated risks with these types of battle procedures.

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