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PRACE POGLĄDOWE

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SYSTEM FOR COMBAT AND TRAINING SITUATIONS MODELING WITH DECISION-MAKING SUPPORT FOR TASKS OF NATIONAL AND ALLIED DEFENSE (CLASS SRM2S)[1]

SYSTEM MODELOWANIA SYTUACJI BOJOWYCH I TRENINGOWYCH ZE WSPOMAGANIEM DECYZJI W WYKONYWANIU ZADAŃ NARODOWEJ I SOJUSZNICZEJ OBRONNOŚCI (KLASA SRM2S)[2]

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ABSTRACT: *Challenges posted by the Polish Air Force require immediate activities, especially in the area of training and command in collaboration with the Army and other special operation forces in combined operations. Despite of high operational and tactical requirements with limited material resources, an effective way of obtaining satisfying solutions is reaching into the advanced cooperation with national research and research-development institutions, especially those oriented on the Health Care and Medical Rescue. This cooperation has to provide optimal use of the possessed equipment and systems (hardware*

[1] **SRM2S** (EN) – System od Distributed Modeling and Simulations with Stimulations.
[2] **SRM2S** (PL) – System Rozproszonego Modelowania i Symulacji ze Stymulowaniami.

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and software), associated with an innovative science proposition focused on the identified national and allied defense needs. In progress in emerging technological changes, there appear new possibilities of training and exercises of the Defense Forces. Nowadays, as the high priority seems to be an integration of owned simulation and training systems allowing for integration of training and exercising of the Defense Forces activities not only on tactical but also on an operational level. Giving them new opportunities generated by a fully-integrated smart solution based on LabTSI™ [1] modeling and simulation Platform[3]
KEY WORDS: *depth perception, neuropsychology, cognitive functions, modeling, dynamic processes simulations, decision-making support, computer aided trainings, integration systems, synergy effect*

STRESZCZENIE: *Wyzwania określone przez Polskie Siły Powietrzne wymagają natychmiastowych działań, zwłaszcza w obszarze treningów i dowodzenia we współpracy z armią i innymi siłami specjalnymi we wspólnych operacjach. Poza dużymi wymaganiami operacyjnymi i taktycznymi z ograniczonymi zasobami, efektywną drogą do osiągnięcia zadowalających rezultatów osiąganych w zaawansowanej współpracy z krajowymi instytucjami badawczymi i badawczo-rozwojowymi, zwłaszcza tymi zorientowanymi na Ochronę Zdrowia i Ratownictwo Medyczne. Ta współpraca musi zapewniać optymalne użycie posiadanych urządzeń i systemów (hardware i software). Wraz z innowacyjnymi propozycjami nauki skoncentrowanymi na identyfikacji krajowych i sojuszniczych potrzeb w obszarze obronności. W rozwoju wzmagających się zmian technologicznych pojawiają się nowe możliwości prowadzenia treningów i ćwiczeń sił obronnych. Dzisiaj jako główny priorytet integracji są systemy symulacji i treningu, łączące treningi i ćwiczenia sił obronnych działających nie tylko na poziomie taktycznym, ale też operacyjnym. Dając im nowe możliwości tworzone przez w pełni zintegrowane, inteligentne rozwiązania Platformy modelowania i symulacji LabTSI™* [3] *[1]*
SŁOWA KLUCZOWE: *głęboka percepcja, neuropsychologia, funkcje poznawcze, modelowanie, symulacje procesów dynamicznych, wspomaganie decyzji, komputerowe wspomaganie treningów, integracja systemów, efekt synergii*

Introduction

Experience has shown that the **key problem** is defining strategies of an orientation in an environmental spaces and adequate method of modeling and simulation tools and Implementation of strategies into this Decision Makers under stress

[3] LabTSI™ is a restricted product which has been created in Poland [6].

influences in both stress environment and conditions.

This applies, in particular, to those multi-tasks pilots of the flying platforms used in military operations.

To ensure an effective performance of the maintenance of the pilots to return safely to their bases, requires the most technologically advanced, intelligent solutions.

This is devoted to research and development of the author of strategies of an orientation in environmental space and adequate method of modeling and simulation tools and Implementation of strategies to this Decision Makers under stress influence in both stress environment and conditions.

The result of this work is shown in **the following holistic solution**[4], which is unique and synergy effect-producing contribution of the Author to the state of art of Scientific Information Systems plus Decisions Support Area [4]. It is known the current state of computerization of the Polish Armed Forces has not yet reached the level of the solutions complying with the requirements of the Polish Armed Forces in the light of new challenges for Security [2]. This is the current challenge for science and practice.

Methods

The solutions treats pilot/soldier as the most important part of the Distributed System for Modeling and Simulation of a combat action with the Stimulation of its participants (SRM2S), where the specialized technique and applied technology are necessary extension which supports raising the level of his personal knowledge and abilities in combat action. Offered trainings of the military pilots in the SRM2S™ including psychosomatic health of the pilot/soldier are closest to the real-based conditions of the combat action.

Main aim of the Solution is the well-tested and working prototype of the Distributed System for Modeling and Simulation of a combat action with the Stimulation[5] of its participants (SRM2S).

Range of the Solution includes organizing and creating combat actions modeling system and multi-tasks military aircrafts pilots training system with decision making support in tasks of protection of the battle groups, military bases and important objects including training needs of the Polish Army at the beginning. The solution is based on the system resources of all partners connected with this idea. Aim and assumption of the Solution are consistent with Priority Direction of Research Area of Engineering and Technology Defense for 2009 -2021.Solution introduces technologies developed by the centers of civilian to military applications and vice versa. It involves also the close collaboration with selected industrial centers, mainly in military establishments.

Specific objectives of the Solution are the following:

1. Development of the:

- Methodology for medical research and training soldiers in SRM2S™: to raise the quality of implementation tasks; to ensure the necessary level of air crews security in the air and on land (especially the flight safety);
- Team of psychosomatic measures of soldiers condition;

[4] The term Solution is used in the sense of general problem solving method.
[5] The term Stimulation is used in the sense of BioFeedback [1].

- Procedures for establishing and functioning the Training Command Operations Center;
- Procedures for establishing and functioning the Training Command and Weapon Control Center;
- Procedures for establishing and functioning the Training Simulation Creation of the Battlefield Center;
- Procedures for establishing and functioning the Virtual Center of Research and Evaluation solutions quality;
- Detailed methodology for carrying out medical diagnostic multi-role aircraft pilots, soldiers, battle groups, and leadership team at various levels of their active participation in the hybrid simulation experiments that require an ability to work in critical situations and the ability to make decisions under stress and acute conditions of the time.

2. Creating and organizing the work of:
- Training Command Operations Center in SRM2S™ system for multi-tasks decision makers personnel in a constant communication with the other participants in the hybrid simulation experiments (separate and properly equipped room);
- Training Command and Weapon Control Center, with one of the consortium partners, which allows generation of the current operating environment and simulation of behavior of the Mission participants;
- Training Creation Battlefield Simulation Center;
- Virtual Center of Research and Evaluation of the solutions quality for the obtained solutions and the results of each simulation experiments.

3. Creating an environment to develop a practical methodology of research and training with planning experiments hybrid generator.

Using a set of measures of psychosomatic condition for an adequate methodology for determining the level of preparation of simulation participant to perform tasks at specified combat conditions with multi-tasks decision makers and intelligent soldier/dedicated front-man training functions.

The solution is a part of the priority directions of research in the areas of information and network technology, defense technology, and information systems. It integrates Partners resources in the scope necessary to achieve the Project and increases usefulness of Partners resources in the scope necessary to achieve the Project. It also creates innovative solutions for the specified purpose.

Following are an assumption of the Solution:
- The essence of the approach is measurability and computability of processes, optimization solutions and dynamic decision-making support in the primary cells of SRM2S™ system.
- The objective function and assessment of the system quality are based on a three-factor utility function by A. Janicki.

The specific objectives of the Solution:

1. Effective development of medical research in the assessment of psychosomatic soldiers (pilots and representatives of other duties);(see Fig.1).
2. Effective organization of training centers (see Fig.2).
3. Efficient management of Partners activities.
4. Good identification of Partners needs for personnel proving training.
5. Reliable ICT connections Partners simulators.

6. Adjusted for the effects of the project priority technology needs.
7. Extensible SRM2S structure and useful functions.
8. High-quality virtual conducted evaluation of research.
9. Application of standardized protocols DIS / HLA. (Distributed Interactive Simulation / High Level Architecture).
10. Building of cryptographically secure broadband communication networks.
11. Integration with an access point (PoP) Poland CFBL Net.
12. Planned final effect of the Project (the basic operating functions of the subject project).

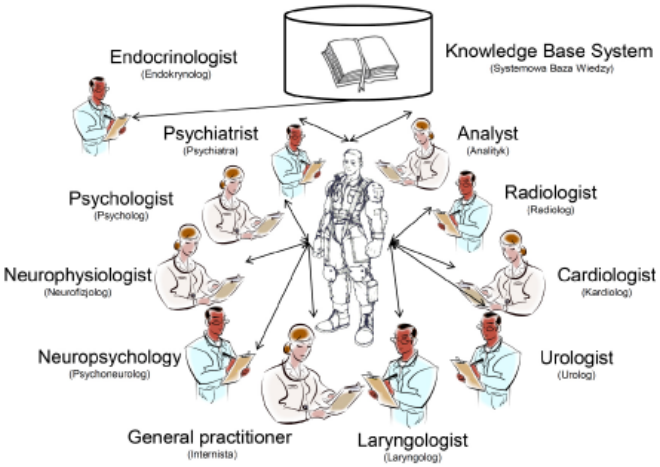

Fig. 1. Medical research in SRM2S^{TM}.
Ryc. 1. Badania medyczne w SRM2S^{TM}.

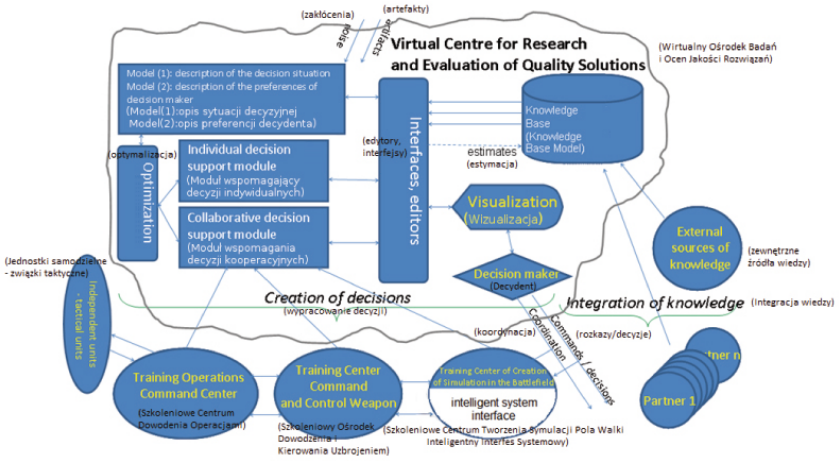

Fig. 2. Distributed system of modeling and simulation operational activities with stimulation of the participants.
Ryc. 2. System rozproszonego modelowania i symulacji działań operacyjnych ze stymulacją ich uczestników - SRM2S^{TM}.

Implementation of the specific objectives[6] meets the needs of well-defined cognitive and training types of forces interacting in the selected theaters with modeling and simulations of pilot combat situations and remotely controlled flying platform (practice, reconnaissance and combat), and independent units of the ground forces equipped with the appropriate platform with a support decision making system in the tasks integrated protection of battle groups, bases and important objects.

It means that the implementation covers:

- Creation of the leading training centers, as well as pilot centers for command and operations support system and / or tactical system of schooling;
- Combination of infrastructure and operating system, a centrifuge operation, and simulator training for pilots of multi-tasking aircraft with iso- and thermobaric chambers in WIML, where ground troops or soldiers of the Navy will be resided, as well as rooms used for leadership team and in the future also with objects other militant and special groups. In this way, will made one, integrated system platform managed by the Training Simulation Creation of the Battlefield Center.

  We are also able to:
- Link research and training tasks assisted selected combat operations and taking the role of the master integrating system, ensuring the implementation of existing or implemented partial solutions;
- Train operators / commanders of the complex military weapons (trainings lasts for a long period of time using the same facilities, involving substantial financial resources and allowing for ongoing assessment power and mental state of an operator / decision maker. This applies also to evaluation his state of health after an injury, the shock of the events, training / battle etc. with a possibility to help in two ways:

  1. An algorithm giving the same procedure.
  2. Decision about external assistance or replacement.
- Continuous evaluation of psychosomatic status individual operators allows „center" to decide to change an operator (Multidisciplinary decision-maker) or leave him as commander;
- Make the selection of the evaluated medical and psychological parameters is important to a psychiatric assessment and formulation of procedures, the current decision, and emergency solutions;
- Successfully solve of research problem and development of appropriate methods and implementation of tools creates new battle values and good proportion of beneficial effects to the cost;
- Dynamic evaluation of these solutions quality, using a three-factor utility function, which will improve the precision and dynamic team train in complex situations.

The result of the above mentioned procedures is also development and establishment of a data communications network. The created network is going to connect to simu-

[6] Let the author at this point count on the readers understanding of the far-reaching brevity text of a saturation deficit of visual figures of developed solutions is caused by intellectual property rights protection requirements. In particular this is related to such objects like the Intelligent System Interface as well as Model of Knowledge Base.
(PL) Niech wolno będzie Autorowi w tym miejscu liczyć na zrozumienie u czytelników, że daleko idąca zwięzłość tekstu z pewnym niedosytem ilustracji opracowanych rozwiązań podyktowane jest zastrzeżeniami związanymi z ochroną praw własności intelektualnych. W szczególności dotyczy to Inteligentnego Interface'su Systemowego i Modelu Bazy Wiedzy.

lators LVC (Live, Virtual, and Constructive) tactical, operational and strategic battlefield systems with the real command and control, electronic intelligence systems for which we provide complete environment required to carry out combined operations.

Effects Achieved

With a private data communications network the solution provides:

- Realistic and potentially unlimited virtual battle space in a realistic visualization of the environment, may be carry out training from tactical to operational to the Military Forces;
- Fasibility of the simulation of real tasks (e.g., supersonic flight, the use of electronic warfare objective of radar interference, etc.) without limitation of the real environment,
- Ability to use the full capabilities of weapons systems in practicing without restrictions relating to environmental protection;
- Complex environment to execute the mission, with the appropriate level of simulated threats;
- An implementation of computer-aided exercise to evaluate the effectiveness of decision making in certain situations, as well as the flexibility of command system to carry out alternative routes of action by selective repetition of the simulation without having to repeat the entire sequence of exercises;
- Computer Assisted Exercises performed on the basis of the simulated environment can be organized in stationary mode, using the currently developed command centers, battlefield simulators, etc., without having cost of the relocation of forces and resources to the place of exercise;
- Possibility of testing and verification of the new doctrines and tactics, before using them in real life - every large-scale exercises are preceded by simulation exercises reflect the real in a real environment;
- Prototype (The Pilot Site: Construction, launching and testing of prototype/ demonstrator of Distributed Modeling System and Simulation of operations with Stimulation of the participants - SRM2S™.

The solution of the key problem achieved exemplify a general framework proposed for advanced applications. Such framework is so plastic that is ready to be used for more specialized tailor-made real-live systems purposes.

The solution provides **the following documentation:**

- Concept of technical solutions, wide area of the distributed simulation;
- Diagram of a data communications network simulation of the extensive distribution of information;
- Configuration of the computer systems of distributed modeling and simulation of operations with stimulation of the participants;
- Software appropriate for the needs of distributed modeling and simulation of operations with stimulation of the participants, particularly domain modules such as a centrifuge High-G training simulators and command and control workstations;
- Configuration of advanced medical equipment to diagnose the participants of the simulation;
- The results of technical studies on the reliability of Simulation, Modeling and

Stimulation operational situation;
- The results of medical tests of pilots, soldiers, and officers proves;
- The results of demo simulation in battlefield.

Conclusions

Obtained status of knowledge and experience gained from the studies of real events in the training course and combat missions, and as a result of partial simulation studies confirm the practical feasibility of this system, both for training and training with the knowledge creation bases parallel with the research results, also called Pilot Sites. Next, one can also talk about the use of the proposed solution in combat operations.

Travel sty statement of 2005 the French Minister for European Affairs to say that their priority is to make the system more competitive solutions in the terms of their usefulness – can be achieved through the development of an ambitious and necessary project, in our case, this behavior requires high skills and interdisciplinary team work.

Following Tindenmans[7] who said that it is not enough that our community of fate is real – has yet to be considered in such a manner.

Final Remark

This research made by the Author has given the background for the formal application of the complex Strategic Project development dedicated for the National Center for Research and Development in Warsaw.

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[7] see Tindenman's report for Member states of UE (1975)