

Phd THESES ABSTRACT

„CONTRIBUTIONS TO THE DEVELOPMENT OF OBSCURANT MODULAR PYROTECHNIC SYSTEMS IN THE VISIBLE AND INFRARED SPECTRUM FOR MILITARY VEHICLE PROTECTION”

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The PhD thesis is a milestone in the author's research activity which main purpose is developing of new theoretical and experimental studies regarding the characterization of pyrotechnic smoke compositions especially coverage efficiency in visible and infrared, which establishes the pyrotechnic system performance.

Obscurant systems are one of the countermeasures adapted to the sensors threat used in aerial, terrestrial or marine military actions. Performances of these sensors are reduced mainly due to absorption, attenuation, backscatter (reflection), polarization and scintillation phenomena, which are generated by use of obscurant or stealth systems.

Within the thesis the stages are as follows: a principle sketch of the proposed pyrotechnic obscurant system is presented, a preliminary theory is studied by implementing mathematical models of computation and numerical simulations in order to determine the ballistic system parameters followed by the achievement of a principle laboratory model, to validate its functioning state. The mathematical model is corrected based on experimentally determined values and the final version of the pyrotechnic system model is achieved, by using 3D modeling software - SolidWorks. Finally, proposed tests are undergone, to determine the masking characteristics and an algorithm is implemented to determine theoretical probability of masking the presence of pyrotechnic obscurants based on computing data developed following tests.

To achieve the presented objectives and fulfill the fundamental purpose of the thesis, this paper is organized into seven chapters, structured properly and titled suggestively, to which a number of references and appendices were added. Each chapter ends with a conclusions section, necessary for the better understanding of the thesis. The following are the main elements relevant to each chapter.

The paper begins with Chapter 1: ***“The purpose and objectives of doctoral thesis”***, with a brief introduction and description of the main objectives, which are then individually addressed in detail throughout the other chapters of the paper and ends with the presentation of final conclusions, original contributions and future research prospects.

The author's activity is presented starting with Chapter 2: ***“The current state of research on aerosol masking and development trends of pyrotechnic countermeasures systems in the visible and infrared protection of military vehicles ”*** that presents the theoretical aspects of pyrotechnic obscurant systems in terms of construction and operation state as well as general notions on the principles of masking theory by introducing the notion of obscurant, essential notions in regard to the paper findings.

Theoretical research continues with Chapter 3: ***“The electromagnetic radiation propagation through the atmosphere and interaction with different targets”***, addressing smoke screens operation, by describing portions of the electromagnetic spectrum in which the obscurant systems must operate and also introducing the thermal optoelectronic systems, which are the main threat in the battlefield. The chapter concludes by highlighting the theoretical knowledge acquired, after making experimental tests.

Practical activities and original contributions are presented from Chapter 4: ***“Experimental research to achieve pyrotechnic compositions used in pyrotechnic systems countermeasures”***, in which the pyrotechnic composition blend is established and thermodynamic parameters are determined, through theoretical and experimental studies, followed by validation of the pyrotechnic mixtures load for achieving the proposed goal.

In Chapter 5 of the thesis: ***“Designing and testing of the dispersion of the pyrotechnic load”***, the experimental studies continue with consistent design studies, outlining the final pyrotechnic system capable to achieve the smoke effect, thus conducting a new embodiment of the obscurant system.

Chapter 6: ***“Experimental study on masking capacity of the pyrotechnic compositions based on red phosphorus”***, cumulates results, findings and conclusions of all previous chapters, presents a series of final experimental tests and closes the thesis by implementing a computing mathematical model for the smoke effect of the obscurant system.