

NATIONAL UNIVERSITY OF PUBLIC SERVICE
TECHNICAL MILITARY PHD COUNCIL

THESES OF DOCTORAL (PHD) DISSERTATION

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**Technical reliability of military electronics
reconnaissance systems**

Author's summary and official reviews of PhD dissertation titled

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SCIENTIFIC PROBLEM

The main characteristic of setting up national intelligence teams (cells or groups) is that the technical equipment for any special tasks should be national by its origin. Despite that it is obligatory to take into considerations any circumstances, parameters highly different in any area (or country) of operations. It is also very important the variety of the technical equipment used by participant countries in the peacekeeping operations. We have to evaluate that the different national intelligence teams should have some technical synchronization, and wheatear our equipment is capable of it.

We have to research and determine those scientific principals and methods which are usable for upgrading our technical equipment already working and which are important for creating new technologies to enhance the capability of the Hungarian national intelligence teams to act quickly, effectively and to better adapt to any circumstances.

It is very important scientific problem that the commissioning organization could give accurate scientific terms of reference for developing, deploying and maintaining the new technical equipment from military (operating) and civilian (producing) point of view in the field of electronic devices for the strategic and tactical reconnaissance of the Hungarian Armed Forces.

RESEARCH OBJECTIVES

Research the scientific links of the technical reliability of the electronic surveillance systems used in the peacekeeping operation and the possibilities of applying them in the planning, developing and producing.

Research and create such a mathematical model which is suitable for making calculations of the reliability of a full reconnaissance system and its subsystems. During the research the mathematical model should be adapted to use for simple and also difficult systems.

Study and research of the malfunctions of the electronic reconnaissance systems used in extreme foreign areas. Research the reasons of malfunctions and the possibility of avoiding it or repairing it.

Demonstrate the adaptability of the results of this study to those organizations (units) of the Military National Security Service and Hungarian Armed Forces which play main role

in planning, developing, producing and using reconnaissance systems. Provide valid and proved information for the decision makers.

RESEARCH METHODS

The complexity of the problem and the wide area of hypothesizes required many different research methods. During this work classical scientific methods and new methods were also used.

My primary target and job was to study the corresponding domestic and foreign works, deep analyses of their contents, detailed work with some variations, and to compare the results of it with the targeted goal and proving their usability.

Methods used during my research.

Research the civilian and military standards and literature and understanding the theoretical and practical basics of quality and reliability. Adapt the general principles to the targeted goal. Combine the theories and practices for the use in the military reconnaissance devices.

Using modern mathematical methods I would like to analyze those procedures which prove my statement in the point No 2 of my hypothesizes and analyzing the alternatives I need to choose the best solution.

My deliberated theoretical preparations were enriched with the opportunity to be acquainted with the different foreign areas of the peacekeeping operations and I could study the differences between these areas. Deliberately collecting and systematizing these circumstances I could evaluate the states of disorder so I have had enough information to be able to make relevant conclusions relating to operating our own systems.

I plan my research methods using the experiences gathered during my visits to the domestic and foreign conferences and exhibitions. I managed to get up to date information about the recently used and developed military electrical reconnaissance systems and I publish them in my study.

During my work on military and civilian electrical systems I often confronted with sensitive information. I tried to avoid to use such information so my study does not have any confidential or above content.

BRIEF DESCRIPTION OF THE TESTS PERFORMED BY CHAPTER

In the preamble I wrote about the reason of choosing my topic, and I gave detailed ma research goals and methods.

In CHAPTER ONE I reviewed the term of quality and quality assurance then I analyzed them using the domestic and foreign standards. After reviewing the civilian standards of the quality assurance I explained the specialties of the military – first of all the ones laid down by NATO – quality assurance. I emphasized the differences between the military and civilian standards and introduced the composite principles of quality assurance originated by the special requirements of the military reconnaissance.

In CHAPTER TWO I collected the mathematical methods usable for determining the reliability of military systems and I demonstrated the usability of these methods with different examples. I would like to name two mathematical methods. The first one is the Markov-modeling for reliability with Graph theory which I made the algorithm to, so it can be compiled to any computer program language for gaining quick results. The second one is the Fuzzy reliability model, which is considered to be one of the most modern model.

In CHAPTER THREE I reviewed one of the methods of the study of failure-free work which is the principle of determining the state of failures. Determining the sources of failures is the one of the most important part in planning a system which in case of military equipment – deployed in special circumstances – can be completely different from civilian parameters. I introduced the term of failure potential and its mathematical model which highly influences the work of our system, and I examined the impact of electromagnetic compatibility of military reconnaissance systems.

In CHAPTER FOUR I collected the effects of electromagnetic impulses of lightning and the prevention methods against these effects and I specified them particularly for the military electrical reconnaissance systems. I reviewed the protection of informatics (information and communication) systems and also studied the leveled protection of objects deployed in operational theatres.

The SUMMARY consists of the main statements derived from the above chapters and the result of my researches as synthesis of them.

RESEARCH PERFORMED AND SUMMARY CONCLUSIONS

In my paper I made a scientific study of a subject topic which consists one and relevant branch of the wide areas of the technological reliability of military electronic reconnaissance systems deployed abroad. Within this subject I narrowed the set of equipment down to the systems used in peacekeeping operations for the support of collection of information by human intelligence.

During my work on my dissertation chapter by chapter I demonstrated the detailed results of my scientific researches and the fulfillment of my hypothesis and goals.

I presented the specialties (nature) of the military and civilian principles of quality assurance, and furthermore I clearly made differences between the requirements of the deployable military reconnaissance systems and similar systems used in general technical areas which should be taking into strict consideration even in the phase of planning, developing and manufacturing.

I made a conclusion that for the increase of cost-effectiveness depending on the variety of tasks it is highly possible to use civilian equipment instead of special military systems if we consider the results and parameters of technical reliability as determining factor during the selection process.

I collected methods for analyzing reliability which are usable for the military reconnaissance systems demonstrating with practical examples and mathematical calculations and I worked out a mathematical model (concept) suitable for examining simple and more sophisticated reconnaissance systems. I created a procedure – with algorithm and stuctograms – which makes easier the computerized analysis and calculations of the technical reliability using signal flow graph model since this algorithm can be used with a simple computer program language. It can produce quick and accurate calculations. I also presented that the fuzzy-logic (method) is the most modern technology for analyzing the reliability and by now the informatics hardware structures are capable to provide valuable results within a reasonable timeframe.

I concluded that the knowledge of the state of failures is crucial for designing high quality systems. The difficulty is that the military reconnaissance systems are mainly deployed abroad in some peacekeeping operations. Sometimes the domestic information

about the local states of failures is not enough since the standards applied by other countries may be different for both civilian and military systems.

Besides the state of failures I systematized the sources of failures which are highly dependent on the extreme local (theater of operations) circumstances.

To present the method of examining the sources of failures I used the effects of the electromagnetic impulses of lightning and I analyzed and evaluated the methods of prevention. During our foreign missions it is highly possible that we have to connect our systems to the systems of the coalition forces or NATO countries. I also examined such complex systems and introduced methods for graded protection against outer sources of failures, and I showed the priorities and parameters which should be taken into consideration connecting such systems.

The scientific results I created – extended with the special requirements for the military reconnaissance systems – can be used to examine the technical reliability of electronic systems deployed in connection with all the foreign missions of the Hungarian Armed Forces depending on the characteristic of tasks.

NEW SCIENTIFIC RESULTS (THESES)

I consider as new scientific results:

1. Based on the principals of civilian and military quality assurance I revealed the requirements for the military reconnaissance systems used mainly for supporting the information gathering by human intelligence. (Chapter One)

2. I worked out a computer algorithm for applying Markov-model which makes it possible to create quick and accurate calculations of signal flow graphs. (Chapter Two)

3. I worked out and made calculations in a given example which analyzed the technical reliability of the high voltage electronic supply system of HUNNIC forces deployed in abroad. (Chapter Two)

4. During the analization of the states of failures of the military reconnaissance systems I outlined the characteristics and effects of the states of failures and sources of failures related to the electronic systems planned to deploy in foreign countries. (Chapter Three and Chapter Four)

PRACTICAL APPLICATION OF RESEARCH RESULTS, SUGGESTIONS

The general principles and methods adapted to different circumstances given in my study can be used to make development cost-effective, to improve the human resource management, to create development concepts at the Military National Security Service.

It is possibility to replace the systems (electrical) needed for the domestic and foreign missions of the Hungarian Armed Forces with civilian systems which have high reliability in the theatre of operations different from home circumstances.

Most results of this study can be adapted for future curriculum in the B.Sc. and M.Sc. program at the National University of Public Services.

RECOMMENDATION

I recommend these results mainly for those civilian and military (designer) engineers, who are planning and developing systems not for domestic use but for countries with unique circumstances.

In my study I tried to collect all information and mathematical methods related to technical reliability so I consider my study suitable for special study program at the National University of Public Services.

The results of my study can be continued into the following directions:

Research the electrical systems used in the peacekeeping operations of the Hungarian Armed Forces whether my hypothesis and axioms are true in that case or not?

Analyze the reliability of the military systems with the fuzzy logic method.

Collect information about the states of failures and sources of failures in the future possible crises areas where the Hungarian Armed Forces may be deployed.

THE LIST OF PUBLICATIONS

Bárkányi Pál: Pocitacom podporovane urcenie MTTFF- Az MTTFF vizsgálata számítógépes módszerrel (SVOC 1998, Vojenská Akadémia v Liptovskom Mikulási Fakulta Zabezpečenia Velenia, 1998.,ISBN 80-8040-079-2)

Dr. Zsigmond Gyula - Dr. Kárpáti Attila - Bárkányi Pál: Reliability Analysis of Automatic Systems (INES 2001. pp.255-258.,2001., ISBN 952-15-0689-X)

Utassy Sándor - Bárkányi Pál: IP alapú kommunikáció az elektronikus vagyonvédelmi rendszerekben (Bolyai Szemle 2006/2,ZMNE , Budapest, pp. 64-77., 2006., ISSN 1416-1443)

Bárkányi Pál: Vezeték nélküli számítógépes hálózatok biztonsága (Bolyai Szemle 2007/2, ZMNE , Budapest,pp. 115-131., 2007., ISSN 1416-1443)

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Bárkányi Pál: Komplex katonai felderítő rendszerek műszaki megbízhatóságának vizsgálati módszerei (Bolyai Szemle 2009/1, ZMNE , Budapest, pp.85-90., 2009., ISSN 1416-1443)

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Bárkányi Pál: A minőség és megbízhatóság fogalmai a civil és NATO szabványokban (Felderítő Szemle 2012/2, KNBSZ, Budapest, 2012., ISSN 1588-242X, public appearance)

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Bárkányi Pál: Műszaki megbízhatóság elemzés Fuzzy módszerrel (2012. május.

http://www.honvedelem.hu/cikk/32072/barkanyi_pal_Fuzzy)

Bárkányi Pál: A Windows rendszerleíró adatbázisa: a felhasználói anonimitás buktatói (Felderítő Szemle 2009/2, MKKFKH, Budapest, 2008.,pp. 109-125., ISSN 1588-242X)

Bárkányi Pál: A Windows rejtett énje: Tudom mit tettél tavaly nyáron! (Felderítő Szemle 2009/2, MKKFKH, Budapest, 2008.,pp. 55-67., ISSN 1588-242X)

Certificates

Az MTTF vizsgálatára számítógépes módszerrel (BJKMF 1998.)

A BJKMF kommunikációs hálózatának kábelezési tervezése (KKMF 1999.)

Dinamikus vezérelt SQL adatbázis-kezelés Wireless Application Protocol (WAP) segítségével (BME 2001.)

Conference

1997. Bárkányi Pál: Pocitacom podporovane urcenie MTTF- Az MTTF vizsgálatára számítógépes módszerrel (SVOC 1998., Vojenská Akadémia v Liptovskom Mikulási Fakulta Zabezpečenia Velenia)

1997. híradónap Nemzetközi TDK tapasztalatai (BJKMF)

2001. híradónap WAP (Wireless Application Protocol) (BJKMF)

2008. MK KFH konferencia Cyber-terrorizmus (MKKFKH)