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Record documentation of AFTO 781 series in the aspect of safety of operation of F-16 aircraft at Poznan Krzesiny Airport - Analysis of experience in 2010 – 2020

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Abstract

Objectives: The purpose of the article is to present the conclusions and discuss the results of research outcome from the implementation and use of AFTO 781 record documentation in the formation of safety in the process of operation of a multirole aircraft F-16 C/D Block 52+ at Poznan - Krzesiny Airport in 2010 - 2020.

Methods: Surveying and analyzing archival documents for comparison in the context of verifying the reliability of data.

Results: The result of the conducted research is the presentation of research results and conclusions resulting from several years of use of AFTO 781 record documentation in the process of operation of F-16 C/D Block 52+ multirole aircraft at Poznan - Krzesiny Airport in 2010 – 2020.

Conclusions: The main objective of the conducted study was to define the factors determining the functionality of the AFTO 781 series record documentation, in the process of maintaining a certain level of safety in the operation of F-16 aircraft. In addition, the analysis of the results of the study allowed the author to interpret the ability of technical personnel to use the functionality of the AFTO 781 series record documentation in question, as well as to define the following conclusions and proposals for action, in order to minimize the occurrence of potential risks in the operation of aircraft equipment in the future.

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Introduction

Implementation of state-of-the-art technologies for the needs of the Air Force of the Polish Armed Forces, achieving interoperability of aviation and technical personnel in the execution of tasks with NATO aviation, as well as the sanctioning of new organizational structures organization, required intensified efforts at all levels of the Polish Armed Forces to fully utilize and, above all, safely operate the advanced airborne platform, which is the F-16 Block 52 + Advanced aircraft. Implementing the solutions of the U.S. performance record system and adoption of English language technical documentation in the context of effective securing flight training, was preceded by the implementation of training of aviation personnel aviation and technical personnel in the representative offices of the Lockheed Martin Corporation, training centers and air bases located in the United States.

This article presents selected aspects of identifying the scope of impact and functionality in the process of use by technical personnel, AFTO 781 record documentation, on ensuring the level of safety of operation of multi-role aircraft F-16 Block 52+ at Poznan - Krzesiny airport in 2010 - 2020.

In order to make a detailed assessment of the degree of usefulness of the documentation in question, the author characterized the model record documentation AFTO 781, related to the operation of F-16 Block 52+ Advanced aircraft. Then the methodological assumptions were presented in which the subject of the study was detailed, along with the research objectives, divided into an exploratory, as well as explanatory purpose . The research field was indicated along with the subject of the study , and the main research problem and research hypothesis were defined. The analysis and discussion of the results of research in the field of the usefulness of AFTO 781 series record documentation in shaping the safety of F-16 Block 52+ aircraft operation, was prepared based on the selected diagnostic survey method.

1. Legal aspects of using AFTO forms 781

The rules for operating aircraft and aviation equipment are specifically defined according to the types and versions of aircraft in service and military equipment military aviation technology in the Air Force of the Polish Armed Forces. Based on Decision No349/MON of the Minister of Defense dated September 20, 2011 on the Introduction of the "Instruction on the management of technical documentation of the Weapons and Equipment " and the "Instruction on Determining Requirements for Technical Documentation of Weapons and Equipment", technical documentation is divided into:

- production documentation;
- usage documentation;
- support documentation.

"Instruction of aviation engineering and aviation service of the Armed Forces of the Republic of Poland" orders the Commanders of Military Units to develop "Detailed rules for the operation of the SIL of Military Unit", which, in accordance with the guidelines contained

in ISIL - 2017, defines, among other things, a list of documents normalizing the rules of operation of aircraft and aviation equipment operated in a given Military Unit.

"Catalog of Air Force forms" ref. WLOP 474/2012 introduced by Order no. 1154/SG/SP of the Chief of the General Staff of the Air Force dated October 25, 2012, contains a systematized list and basic data on the forms established and put into use in the Armed Forces of the Republic of Poland, in which the following were inventoried and assigned WLOP-inż. signatures to the AFTO 781 series forms, in the following order:

- WLOP-inż./68 – AFTO 781 A – „Maintenance Discrepancy and Work Document”;
- WLOP-inż./69 – AFTO 781 B – „Communication security equipment record”;
- WLOP-inż./72 – AFTO 781 E – „Accessory replacement document”;
- WLOP-inż./73 – AFTO 781 F – „Aerospace vehicle flight report and maintenance”;
- WLOP-inż./74 – AFTO 781 G – „General missions classification – missions symbols”;
- WLOP-inż./75 – AFTO 781 H – „Aerospace vehicle flight status and maintenance document”’
- WLOP-inż./76 – AFTO 781 J –„Aerospace vehicle engine flight”;
- WLOP-inż./77 – AFTO 781 K part I – „Aerospace vehicle inspection, Engine data, Calendar and Hourly inspections”;
- WLOP-inż/77 – AFTO 781 K part II – „Delayed discrepancies document”;
- WLOP-inż./79 – AFTO 781 M – „Status symbols and functional system codes”.

According to an internal document, namely, "Model Forms Layout in a Binder (for F-16 aircraft)," a compilation of forms of the AFTO 781 series, constitutes an aircraft service book named “Binder”. AFTO 781 forms, are documents that record the the performance of all activities affecting the technical status, airworthiness and configuration of the aircraft, as well as the consumption of residual life.

Form WLOP-inż./68 - AFTO 781 A - "Maintenance Discrepancy and Work Document" is a document that records, among other things:

- execution of calendar maintenance, hourly maintenance, periodic maintenance (Phase Inspection) and special maintenance;
- execution of technical bulletins and preventive actions resulting from necessitated by one-time inspections;
- performing activities related to the detection and correction of malfunctions;
- checks related to the performance of other activities (follow-on maintenance);
- erection and installation of gensets and installation and removal of auxiliary equipment aircraft;
- each time an access hatch is opened and closed (door panel);
- each time disconnecting and reconnecting electrical cables and connectors fuel, hydraulic and pneumatic systems;
- loading into and downloading digital data from aircraft systems;
- loading and unloading of combat assets;
- detection of foreign bodies.

Form WLOP-inż./69 - AFTO 781 B - "Communication security equipment record" is a document in which information on the current status of equipment providing classified communications.

Form WLOP-inż./72 - AFTO 781 E - "Accessory replacement document" is a document that contains information related to the status of aggregates installed on the aircraft, which are subject to replacement after a certain period of time due to the consumption of the hourly or calendar resource.

Form WLOP-inż/73 - AFTO 781 F - "Aerospace vehicle flight report and maintenance" used as an identifier and source document, for the purpose of obtaining information on the origin and affiliation of aircraft.

Form WLOP-inż./74 - AFTO 781 G - "General missions classification – missions symbols" contains basic information on classification codes and designation of flight missions performed.

Form WLOP-inż./75 - AFTO 781 H - "Aerospace vehicle flight status and maintenance document" is a document containing data on the airworthiness of the aircraft for flight, recording operational and record parameters and informing about the filling status of the aircraft installations.

Form WLOP-inż./76 - AFTO 781 J - "Aerospace vehicle engine flight" is a document recording the operational and record parameters of engine operation of the aircraft.

Form WLOP-inż./77 - AFTO 781 K part I - "Aerospace vehicle inspection, Engine data, Calendar and Hourly inspections" is a document in which the record is kept of all current calendar and hourly maintenance performed on a given aircraft.

Form WLOP-inż./77 - AFTO 781 K part II - "Delayed discrepancies document" is a document used to record the removal of discrepancies that have been carried over from Form 781A, as well as to record the performance of inspections periodic, overdue scheduled, periodic and other maintenance, and the execution of technical bulletins Technical (TCTO) on the aircraft.

Form WLOP-inż./79 - AFTO 781 M - "Status symbols and functional system codes" contains basic information and functional codes for making entries in AFTO 781 A and AFTO 781 K.

2. Methodological assumptions in the research process

In the discipline of security sciences, in the context of defining the subject of research, we can focus on potential threats to a person, as well as the social group to which they belong, and which are determined by their environment of functioning. Observation of certain aggregated social entities, such as technical personnel, flying personnel or security personnel, functioning in military aviation, when interacting with the environment and reacting in the face of a potential threat, should result in the results of estimating the effects of their activities.

Defining the subject of the study in this work, it should be specified that it will be the following technical personnel, responsible for the implementation of maintenance and repair processes On multi-role aircraft F-16 operated at the airport Poznan – Krzesiny in 2010 - 2020, based on the use of AFTO 781 record documentation, generated in the course of daily service activities in the field of all specialties engineering and aviation service, involved in the process of operation of F-16 aircraft.

The exploratory purpose of the research of the present work, is to try to identify the extent of the of impact and functionality in the process of use by technical personnel of the AFTO 781 record documentation, on ensuring the level of operational safety F-16 aircraft at Poznan - Krzesiny airport in 2010 - 2020.

The explanatory purpose of the research, will be to determine the degree of usefulness and define the results of the study, in terms of the relationship between the process of use by technical personnel technical staff use of AFTO 781 record documentation, and ensuring the desired level of safety of operation of F-16 aircraft at Poznan - Krzesiny airport in the years 2010 - 2020.

On the basis of the above criteria, it was detailed that the basic research problem research in the present work is: "To what extent does the functionality and use of record documentation of the series of AFTO 781 by technical personnel, determines the maintenance of a certain level of safety of operation of F-16 multirole aircraft at the airport Poznan - Krzesiny?"

For the purposes of this paper, the author specified the main hypothesis in the assumption to the presented research problem, as follows: "It is likely that the use and exploitation of the functionality of the documentation AFTO 781 records by technical personnel, in the course of their daily activities service has an impact on ensuring the desired level of safe operation of F-16 multi-role aircraft at Poznan - Krzesiny airport."

To solve the research problem and to verification of the hypothesis set, the method of diagnostic survey was chosen; and research techniques, which is a questionnaire and document survey. In order to implement the above technique, in the present work was used research tool, which is a survey questionnaire in which a consciously thought out and constructed set of conjunctive and disjunctive, covering the core area of the research data.

The study of the documents, consisted of an analysis of existing materials and archived forms of the AFTO 781 series, constituting documentation records, used in the process of operation of multi-role aircraft F-16 Block 52 + Advanced at Poznan - Krzesiny airport in 2010 - 2020. Conducting research due to the choice of the subject of the study and identification of the research problem, located the test area to the Poznan - Krzesiny airport, where in the years 2010 - 2020 32 of the F- 16 Block 52 plus multirole aircraft operated. In addition, the choice of methods, techniques and research tools, found application in conducting the study using a specific group of respondents, being a representative group of technical personnel authorized to operate in the engineering and aviation service, who were authorized to use the record documentation of AFTO 781 forms.

In accordance with the assumptions outlined in the organization of the study, the preparation of the survey questionnaire and the conduct of the survey were completed on February 15, 2022, using access to the survey posted on the website in the form of an electronic version and a paper version of the survey. The link to the survey was posted with the use of the portal www.survio.com and was made available electronically, to members of the engineering and aviation service personnel at the Poznan - Krzesiny Airport, and the paper version of the survey questionnaire was distributed to members of the technical staff, during the duty hours in which the Service Planning and Data Archiving Sections of the Support Squadron were operating.

The survey was completed by 52 members of the engineering and aviation service personnel, using AFTO 781 record documentation in the process of daily service activities.

3. Results

The discussion of the survey results will be based on selected aspects of the use of AFTO 781 forms in the process of operation of F-16 C/D aircraft at Poznan - Krzesiny Airport. One of the main questions was: Were you introduced to the purpose of AFTO 781 forms during the specialist course?

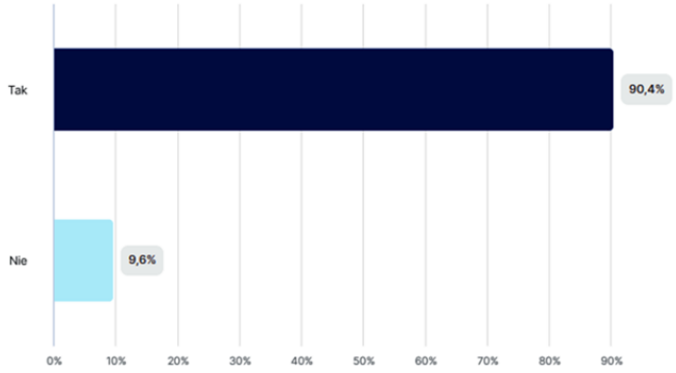

Fig. 1. Number of people introduced to the purpose of AFTO 781 forms
Source: own elaboration

To such a question, as many as 47 respondents, or 90.4% of people, answered positively, while the remaining 5, making 9.6% of the respondents, were not acquainted with the purpose of the AFTO 781 forms. In the next question, respondents who answered affirmatively to that question, were asked to provide the name of the specialized course, and whether they took the course while training in the U.S., or in Poland.

In the case of participation in a specialized course, the responses were as follows:

- 48% (25 respondents) participated in a course held in the US;
- 42% (22 respondents) participated in a course in the country;
- 10% (5 respondents) did not indicate the location of the course.

Another question asked respondents to select up to 3 forms of the AFTO 781 series, which respondents use most often, in the course of their daily business activities. Among the choices of forms presented in the question, respondents assigned the record documentation and the answers given were as follows in percentage terms:

- 30.5% - Form WLOP-inż./68 - AFTO 781 A - "Maintenance Discrepancy and Work Document";
- 19.5% - Form WLOP-inż./77 - AFTO 781 K part I - "Aerospace vehicle inspection, Engine data, Calendar and Hourly inspections";
- 15.9% - Form WLOP-inż./75 - AFTO 781 H - "Aerospace vehicle flight status and maintenance document";
- 13.4% - Form WLOP-inż/77 - AFTO 781 K part II - "Delayed discrepancies document";
- 10.4% - Form WLOP-inż/76 - AFTO 781 J - "Aerospace vehicle engine flight".

The responses given were numerically as follows as shown in the table 1:

Table 1. Number of responses of selected AFTO 781 forms commonly used by respondents

AFTO Form 781 indicated by user	**Number of responses**
AFTO 781 A - Maintenance Discrepancy and Work Document	50
AFTO 781 K part I – Aerospace vehicle inspection, Engine data, Calendar and Hourly inspections	32
AFTO 781 H – Aerospace vehicle flight status and maintenance document	26
AFTO 781 K part II – Delayed discrepancies document	22
AFTO 781 J – Aerospace vehicle engine flight	17
AFTO 781 E – Accessary replacement document	11
AFTO 781 F – Aerospace vehicle flight report and maintenance	3
AFTO 781 M – Status symbols and functional system codes	2
AFTO 781 B – Communication security equipment record	1

Source: own elaboration

Another question included in the survey questionnaire, concerned the classification of potential causal groups, related to the use of the AFTO 781 series forms' functionality, in the context of the impact on the emergence of possible risks to the safety of flight and operation of F-16 aircraft.

The causal groups were categorized as follows:

- lack of qualification;
- communication barriers;
- incapability;
- intentional action.

Among the groups presented, respondents attributed the largest number of responses, 24 which accounted for 46.2% of the total respondents, to the causal group concerning the lack of qualifications on the part of technical personnel, i.e., they pointed to a potential erroneous action resulting from the due to insufficient training, as well as lack of skills or inexperience. Another 20 respondents, or 38.5%, indicated communication barriers, defined as misinterpretation of data, record-keeping or operating parameters, errors in communicating information regarding the task at hand, or misinterpretation of the task received to be performed. The other two causal groups, formulated as incapacity, i.e., the inability to perform certain activities due to mental or physical indisposition, and expressed as intentional action characterized by the deliberate deviation from procedures or the intentional omission of actions prescribed by normative documents and applicable regulations, were indicated by 4 respondents each, giving 7.7% for each causal group.

Respondents identified the importance of the causal groups in the order as in table 2:

Table 2. Number of responses of by respondents

Classification of potential causal groups	Number of responses	Percentage
Lack of qualifications - erroneous action due to insufficient training, lack of skills or lack of experience	24	46,2%
Communication barriers - misinterpretation of transmitted data, recording or operating parameters, errors in the transmission of information regarding the task performed, misinterpretation of the task received for performance	20	38,5%
Incapacity - the inability to perform certain activities due to mental or physical indisposition	4	7,7%
Deliberate action - deliberate deviation from procedures or deliberate failure to act as prescribed by normative documents and applicable regulations	4	7,7%

Source: own elaboration

The answers provided in the next survey question, provided information on the respondents' exposure to potentially occurring errors in the AFTO 781 series forms. In addition, when errors were detected, the respondent was asked to indicate the probable cause of the user's erroneous entry.

For the first part of the question, respondents gave the following answers:

- 92% of respondents answered that they had encountered erroneous entries in the AFTO 781 series forms in the course of official business;
- 8% of the total respondents, had not encountered an incorrect entry in the AFTO 781 record documentation.

In terms of the most common reason for the occurrence of entries that do not comply with the with normative documentation, respondents reasoned as follows:

- 36%, which gave 19 people, pointed to performing duties in a time deficit and inattention and absentmindedness as potential reasons for irregular entries;
- 32%, which gave 17 people responded that the most common cause was human error human error, mistake, as well as failure to verify records of operating parameters and record-keeping records in the record-keeping documentation with the data contained in the Operation Support Information Systems used at 31 Tactical Air Base;
- 24%, or another 12 respondents, answered that such a factor could be deficiencies in the training of technical personnel, in the area of specialized training or language;
- 8%, or 4 respondents, in the course of their daily business activities, never encountered incorrect entries in the record documentation.

The next question, asked for the name and direction of the specialty in which the respondent was trained, and allowed to work in the Maintenance Group in the Engineering and Aviation Service. Respondents, in their answers, defined 20 different specialties in which they were trained and admitted to direct aircraft maintenance.

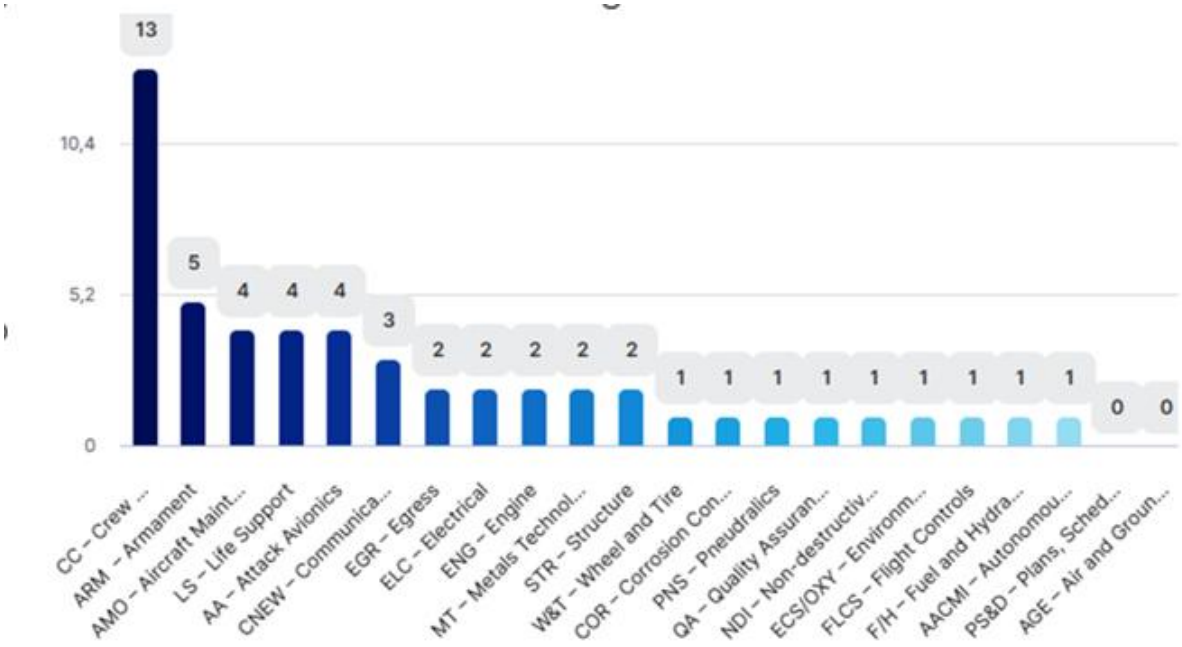

Fig. 2. Number of specialties in which technical personnel were trained
Source: own elaboration

Respondents were also asked about identifying seniority, in direct service of F-16 C/D Block 52 plus Advanced aircraft. Individuals participating in the in the survey, were presented with 3 ranges of time spans, corresponding successively to ranges of 0 to 5 years, 6 to 10 years and 11 to 20 years, in direct operation of multi-role aircraft.

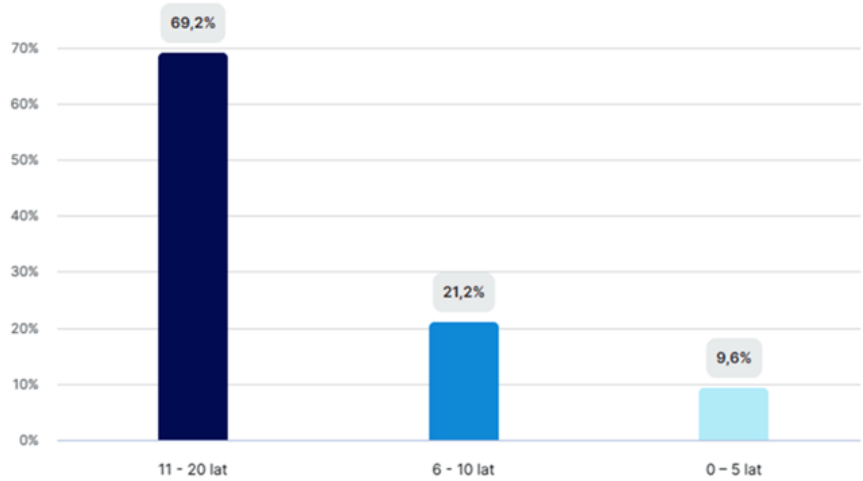

Fig. 3. Length of service in direct service of F-16 C/D by technical personnel
Source: own elaboration

The most frequently selected answer, was a time frame between 11 and 20 years of work in direct aircraft maintenance, and 36 respondents answered in this way, accounting for 69.2% of all responses. The next most frequently indicated time frame, was the answer between 6 and 10 years of work, and this answer was given by 11 respondents, or 21.2% of all respondents. In the case of working in direct service of F-16 multirole aircraft for up to 5 years, such a response was given by 5 people, accounting for 9.6%.

Conclusions

The research problem adopted in this study and the associated scope of the thematic, required research to:

- define the factors that determine the functionality of record documentation AFTO 781 series, in the process of maintaining a certain level of operational safety F-16 aircraft,
- examine the accuracy of records and the authenticity of processed data by defining the processes of their authentication, by technical personnel of the specialty of the Engineering and Aeronautical Service, in the AFTO 781 series record documentation,
- verify the ability to use the functionality of the subject AFTO 781 series record documentation, by technical personnel.

The allowed for a multifaceted analysis of the results of the research work, which allows to positively verify the main hypothesis presented in the work, but also points to areas in which there may be potential hazards that affect the safety of operation of F-16 multi-role aircraft at Poznan - Krzesiny Airport. The results obtained, in terms of the use of record documentation

of the series of AFTO781 by technical personnel as part of their business activities indicate that the most frequently used forms are those that record all processes maintenance, activities prescribed by technical bulletins, containing parameters operational and record-keeping parameters, data evidencing malfunctions, which is the primary source of information on the airworthiness status of the aircraft for flight training and accounted for a total of 79% of the total stock of forms used.

In addition, the indicated forms, represent archival resources from 2010 - 2020, in a total of 116,858 individual cards, which gives per aircraft per calendar year:

- 268 pcs. - Forms WLOP-inż./68 - AFTO 781 A - "Maintenance Discrepancy and Work Document
- 69 pcs. - WLOP forms-inż./75 - AFTO 781 H - "Aerospace vehicle flight status and maintenance document";
- 27 pcs. - WLOP forms-inż./77 - AFTO 781 K part I and II - "Aerospace vehicle inspection, Engine data, Calendar and Hourly inspections" and "Delayed discrepancies document".

Another important factor, in maintaining the assumed safety standards of the F-16 aircraft operation, which was subject to exploration in terms of the assumed problem and research hypothesis, was to examine the probability of uniformity and authenticity of the data generated in the AFTO 781 series record documentation with the operational and record-keeping parameters recorded in the Systems of Information Systems for Supporting the Operation of F-16 Aircraft, both in the Integrated Multi-Level Information System of the Ministry of Defense, as well as in the SI INSPECTIONS of the 31st BLT. 92% of respondents said they had encountered erroneous entries regarding both maintenance activities and as well as record-keeping and operating parameters, and one in three responded that the most common cause was human error, mistake and lack of verification of the concerned records found in the record documentation, with the data found in the in the Operation Support Information Systems used at the 31st BLT. In addition, 38.5% of survey respondents cited as the most common causes of errors and differences in records between the records and the Information Systems Information Technology, unequivocally identified with misinterpretation of the data provided and with errors in the transmission of information regarding the task performed. The summary of the results makes it possible to formulate the conviction that the established goals of the research in the thesis have been achieved, by identifying the scope of of impact and functionality in the course of SIL personnel's use of documentation AFTO781 records, which had a directly influenced the maintenance of the desired level of operational safety F-16 aircraft at Poznan - Krzesiny airport in 2010- 2020. The degree of complexity of recorded activities and processes, multifaceted in terms of purpose and use in the respective specialties of the engineering service and the monitoring of dozens of record-keeping parameters and operational parameters having a direct impact on the aircraft's airworthiness status for flight training, demonstrated in the work in question, justify the relationship between the process of use by technical personnel of AFTO 781 record documentation, and the assurance of the desired level of operational safety of F-16 aircraft at the Poznan - Krzesiny airport in 2010 - 2020.

Analyzing several years of use of F-16 aircraft at the airport Poznan - Krzesiny, it can be concluded that flight safety is determined by many factors that have to do with the aircraft, the process of management and organization of the work, the environment of occurrence and the human factor. The use of documentation AFTO 781 record documentation during the period under review at all levels and the use of its functionality reflects the actual condition of the aircraft, which results in correct assessment of the situation and translates into ensuring the desired level of safety operation of aviation equipment without incidents, incidents and aircraft accidents. To minimize the potential risks described in this work, to continue prevention activities in the field of flight safety, and intensification of the theoretical and practical training for candidates for SIL positions, should pay off with further safe operation of aircraft. The research conducted indicates that the main hypothesis set forth in the study has been verified positively, however, based on the results, it has been indicated areas in which there may be potential threats to the safety of flights.

Analysis of the results of the study make it possible to define the following conclusions and proposals for action, in order to minimize the occurrence of potential risks in the operation of aviation equipment in the future:

- give priority to maintaining a high level of expertise of engineering and aviation service personnel;
- ensure, adhere to and monitor the rules and procedures for proper operation and maintenance of owned aircraft in accordance with the in accordance with the guidelines found in the normative documentation;
- control and monitor the technical condition of aircraft in operation aircraft, taking into account the reliability of recorded data and operational parameters in the record documentation;
- supervise the implementation of activities resulting from the management model Flight Safety Management Model at the 31st Tactical Air Base;
- consistently apply the principles of personnel policy by ensuring a proper path of development within the framework of one's military specialty military specialty in the structures of the engineering and aviation service;
- conduct continuous reviews and updates of the possessed technical documentation of aircraft in operation;

Application and use of the conclusions put forward above, should effectively ensure the proper operation of multi-role aircraft F-16 at Poznan - Krzesiny airport, in accordance with the requirements and standards defined in terms of flight safety.

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Decyzja nr 120/MON Ministra Obrony Narodowej z dnia 19 czerwca 2017 r. w sprawie wprowadzenia do użytku w Siłach Zbrojnych Rzeczypospolitej Polskiej „Instrukcji szkolenia i upoważniania specjalistów służby inżynieryjno-lotniczej do bezpośredniego obsługiwania sprzętu lotniczego w Siłach Zbrojnych Rzeczypospolitej Polskiej".

„Katalog formularzy Sił Powietrznych" wprowadzony Rozkazem nr 1154/SG/SP Szefa Sztabu Generalnego WP, 25.10.2012, Sygn. WLOP 474/2012.

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