

Актуальні питання розвитку Збройних Сил

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CREATING A DATABASE OF EXISTING WEAPON SYSTEM

The operation of complex technical product throughout its life-cycle costs two or more times higher than the actual cost. In addition, the operation of complex technical products such as ships, aircrafts, radars and air defense systems is impossible without the support of the enterprise - the manufacturer or a specialized service representative.

From point of view of Ukraine's integration into the NATO technological, technical and defense structures, it requires a revision of maintenance systems and their adaptation to the standards, which occurs in Western countries.

One of the problems to be solved on the way of Ukrainian Army integration into the Western defense structures is creation of Integrated Weapon System Data Base.

The database, in turn, consists of interactive electronic technical publications created by the developer of the weapon type (contractor) and of the logistics support analysis records, which, as a rule, are created automatically.

It means, that interactive repair and operational documents are, in fact, a canvas, which is filled with data units (technical publications) created by the weapon type manufacturer and corrected by modules of logistic support analysis data, which are formed on the basis of live experience gained in specific operating conditions.

Keywords: *Continuous Acquisition and Life Cycle Support (CALs), integrated logistic support (ILS), logistic support analysis (LSA), integrated weapon system data base (IWSDB).*

Introduction

From point of view of Ukraine's integration into the NATO technological, technical and defense structures, it requires a revision of maintenance systems and their adaptation to the standards, which occurs in Western countries.

Formulation of the problem. As it well known, the operation of complex technical product throughout its life-cycle costs two or more times higher than the actual cost. In addition, the operation of complex technical products such as ships, aircrafts, radars and air defense systems is impossible without the support of the enterprise – the manufacturer or a specialized service representative. The decrease of life cycle cost of high-technology complex products is the aim of NATO members integrated logistic support system (ILS) [1].

ILS system is aimed at:

- projecting the armament item technical condition taking into account external environment;
- supplementing the operating organization of spare parts required for the operation of armament selected group without creating a storage warehouse;
- providing the interactive documentation and operating manuals, repair and training publications [2];
- creating a permanent feedback between the operating organization and the developer, supplier of spare parts and services for specific technical support [3–4].

The concept of ILS is one of the basic invariants of CALS vision and strategy.

Analysis of recent research. The most important activity implemented under the ILS concept that plays a system role is logistic support analysis (LSA). It is a formalized technology of comprehensive study of both the products and the options for its operation&maintenance system, including complex engineering techniques, carried out with the help of specialized computer tools [5].

Weapon systems that are designed and manufactured in Ukraine in recent years are adapted to the modern requirements of design and operation already at the stage of development [6–8].

At the same time, the armaments of Ukrainian Armed Forces include many weapon types made in the years of the Soviet Union, manufacturers of which no longer exist, or economic ties with them are severed, or the price of their goods and services is repeatedly overstated. Those types of weapons require the transition to new, more economical systems of maintenance, in conditions of scarce spare parts and realistic operating and maintenance manuals.

Basic material presentation

One of the problems to be solved on the way of Ukrainian Army integration into the Western defense structures is creation of Integrated Weapon System Data Base (IWSDB). So, the aim of this article is to consider some possibilities for creating a IWSDB.

The result of information technology application is development of IWSDB containing the information objects (data modules (DM)), publication modules (PM), ready-to-use interactive electronic technical publications (IETP), including the ones that were borrowed from other projects, etc.), which allow to generate and provide to the customer a set of operational and maintenance documentation (in the form of a local database).

First and foremost function of IWSDB is to create a set of electronic technical documentation (ETD), including an interactive operational and maintenance documentation (IOMD). The set of such documents is usually produced in the form of a coherent set of interactive electronic technical publications, carried out on the basis of a common database. Such composition of IOMD kit is regulated by the international specification ASD S1000D (International Specification For Technical Publications Utilizing A Common Source Database) [9].

Interactive operating and maintenance documents are usually developed with the aim to provide the operating&maintenance personnel with information on performance of maintenance and repair (M&R) works for weapon type that can be used interactively.

Electronic IOMD is developed, as a rule, by contractor using information technology, which is subject, for example, to requirements of international regulations

[9]. When developing IOMD, one usually uses the design documentation for the product (primarily the electronic, the data from LSA database, including materials for technical support and repair, information pertaining to analogous products, and other data).

One of the most important features of the IOMD set is the capability of diagnostics with forecasting the weapon system technical condition. This means, that the documentation, which is included into the IOMD set, must provide functionality that allows the user to identify the defects of the product, and to predict their appearance.

Diagnosis includes fault identification procedures, as appropriate, followed by corrective action or maintenance procedures. Implementation of diagnostic requires a complex of tools: from the simplest procedures to identify single failure (organoleptically, by appearances, etc.) to integral IOMD with built-in and external means of control and diagnostics. Forecasting involves the capability to anticipate and prevent failure or malfunction of the system based on the analysis of the data entered by the user, the operating data, as well as data received from the built-in and external control systems.

Operation of specific weapon type should be carried out in accordance with the IOMD and the appropriate integrated logistics support (ILS) (Fig. 1).

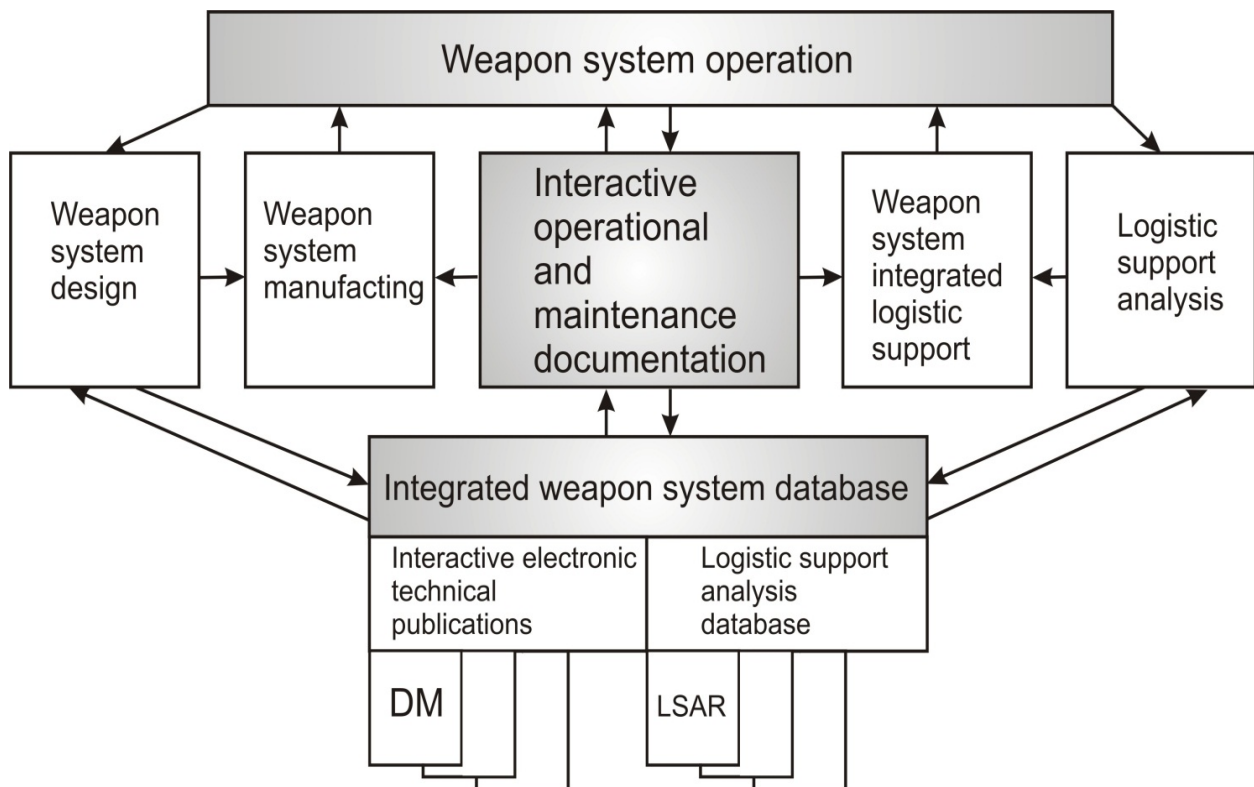


Fig. 1. Role and place of IOMD in the product life-cycle

The basis of the maintenance system is the IWSDB. The database, in turn, consists of interactive electronic technical publications (IETP) created by the

developer of the weapon type (contractor) and of the logistics support analysis records, which, as a rule, are created automatically.

It means, that interactive repair and operational documents are, in fact, a canvas, which is filled with data units (technical publications) created by the weapon type manufacturer and corrected by modules of logistic support analysis data, which are formed on the basis of live experience gained in specific operating conditions (See the lowest stage of picture).

Now, let's separately consider the two components of a database:

Interactive electronic technical publications (IETP) are created by the developer at the stage of weapon type design and are the basis for the design of electronic documents, and interactive operational and repair documentation.

Electronic technical publication may contain: a subset of the data modules (DM) from the information kit, complete set of DM's included into the information set, or a set of DM's included into multiple sets of information.

The data module [10] is an independent information unit containing data for identification and description of the product and / or its components, operating processes, and / or maintenance products and accessories. The data module is typically stored in XML format ((eXtensible Markup Language) – in accordance with a certain pattern (corresponding to the DM type) so that it can be preserved or removed by its code from CSDB (Common Source Database). Data module consists of the identification part (data code of the module) and the content part (text, a table, a diagram or illustration).

Data module code [10] is regulated by the UK standard DEF STAN 00-60, which has international status, it consists of 32 bits and it is used to identify the DM in storage as well as for retrieving it from the CSDB. It contains information about the name of the product, material of manufacture, divisibility into its component parts, and the place, which it occupies in the higher-level system.

Data module has two components: descriptive and informative. Descriptive part contains the DM code, information of access restrictions and applicability. The informative part contains what the user sees as a certain interactive document. It may include:

- description – such as an illustrated catalog;
- procedural part – operation flow charts for certain procedures;
- schemes, photo, video material;
- other elements, as the customer or contractor consider appropriate.

Logistic support analysis database (LSADB) – is the second, no smaller part of the weapon type database, which consists of logistics support analysis records (LSAR).

Logistic support analysis (LSA) is regulated by the UK standard DEF STAN 00-60 (Part 1), which has an international status [10].

LSA is directed on support of a rational correlation between the values of the product life cycle and the availability factor of this product to fulfill the customer's requirements.

LSA encompasses the following basic areas:

- analysis of the product structure in the process of its development aimed at preparing recommendations to ensure maximum product's reliability, maintainability, and operational and repair manufacturability;
- development and analysis of the variants for the product's technical exploitation system (TES) that provide for established requirements to its lifecycle support system;
- analysis of the interaction between the product and its TES, to ensure their rational combination;
- monitoring of the product performance during its intended use, with identification of the key factors that have negative impact on its technical condition.

The sources of LSA data are:

- product's and its components' design documentation at various development stages and phases;
- study results of the product's future conditions of operation;
- statistical data collected in the course of similar products operation, such as its analogues or prototypes;
- Benchmarks and LSA results are stored in a specialized database – the LSA DB.

LSA DB is compiled and kept up to date throughout the entire product lifecycle. Information from this database can be used in all kinds of ILS activities as well as in the processes of development and design of the product and its TES.

In the process of LSA DB forming, the reference books and classifiers are used containing usually constant information that allows to maintain the integrity and consistency of the data included into the database by many experts that perform a variety of LSA tasks, it also provides consistency check of information by an ensemble of products that uses many times the information once included into the database.

Records into the LSA DB (LSAR – logistic support analysis records) are put also in accordance with [9]. These records constitute one of the components of logistic support analysis process (LSA), and represent the reporting material of this analysis. Records of logistics data analysis themselves form relational database, which, if properly filled and developed, becomes a powerful tool in the hands of the operator.

Logistic analysis database is filled with different records of engineering nature. Records may be associated with the works of both preventive and corrective character. They also should indicate the means necessary to do these works. So, the necessary spare parts, tools, accessories (standard and custom) can be specified in the records, as well as requirements to service personnel.

LSA results also show possibility of weapon type repair or conditions of its utilization. LSA results describing the resources necessary for maintenance are usually the basis for the formation of logistics support plan, which in its turn, is a part of IOMD set.

These two components of integrated weapon system database are the basis for the creation of the IOMD set.

During development of the IOMD set the PDM-PLM technology is usually employed [11–12].

More precisely, the IOMD set is, by itself, the PLM-system, based on PDM system, which encircles all the database products, and supplies the necessary infor-

mation at the right time in the right form and in accordance with the access rights given to multiple users.

Conclusion

Integrated weapon system database creation is a complex and multistage task. To fully implement it, it's not only a set of electronic documentation that we need, but there is also a need for creation of an efficient computer network to be used by consumers at different places, where the equipment and weapons are used to be employed.

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СТВОРЕННЯ БАЗИ ДАНИХ ІСНУЮЧОГО ЗРАЗКА ОБТ

В.В. Воїнов, Г.М. Качуровський, А.Ф. Шевченко, О.М. Гурін

Експлуатація складного технічного виробу протягом його життєвого циклу обходиться в два і більше разів дорожче, ніж власне його вартість. Крім цього, експлуатація складних технічних виробів на зразок кораблів, літаків, радіотехнічних та зенітних ракетних комплексів неможливо без технічної підтримки підприємства - виробника або спеціалізованого сервісного підприємства.

Враховуючи прагнення інтеграції України в технологічні, технічні та оборонні структури НАТО, потрібен перегляд систем технічного обслуговування та адаптація їх до стандартів, прийнятих в країнах Заходу.

Одним із завдань, яке необхідно вирішити на шляху інтеграції Збройних Сил України в західні оборонні структури, є створення бази даних зразка озброєння.

База даних зразка озброєння повинна складатися з інтерактивних електронних технічних публікацій, створюваних розробником зразка озброєння (підрядником) і записів аналізу логістичної підтримки, створюваних системою аналізу логістичної підтримки, як правило, автоматично.

Тобто, інтерактивні ремонтні та експлуатаційні документи є, по суті, канвою, яка наповнюється модулями даних (технічними публікаціями), створеними виробником озброєння, і коригуються модулями даних аналізу логістичної підтримки, які формуються на основі досвіду експлуатації того чи іншого виробу в конкретних умовах експлуатації.

Ключові слова: *інтегрована логістична підтримка (ІЛП), аналіз логістичної підтримки (АЛП), інтерактивна експлуатаційна і ремонтна документація (ІЕРД).*

СОЗДАНИЕ БАЗЫ ДАННЫХ СУЩЕСТВУЮЩЕГО ОБРАЗЦА ОБТ

В.В. Воинов, Г.М. Качуровский, А.Ф. Шевченко, А.Н. Гуринов

Эксплуатация сложного технического изделия на протяжении его жизненного цикла обходится в два и более раза дороже, чем собственно его стоимость. Кроме этого, эксплуатация сложных технических изделий наподобие кораблей, самолетов, радиотехнических и зенитных ракетных комплексов невозможно без технической поддержки предприятия – изготовителя либо специализированного сервисного предприятия.

В свете стремления интеграции Украины в технологические, технические и оборонные структуры НАТО, требуется пересмотр систем технического обслуживания и адаптация их к стандартам, принятым в странах Запада.

Одной из задач, которую необходимо решить на пути интеграции Вооруженных Сил Украины в западные оборонные структуры, является создание базы данных образца вооружения.

База данных образца вооружения должна состоять из интерактивных электронных технических публикаций, создаваемых разработчиком образца вооружения (подрядчиком) и записей анализа логистической поддержки, создаваемой системой анализа логистической поддержки, как правило, автоматически.

То есть, интерактивные ремонтные и эксплуатационные документы являются, по сути, канвой, которая наполняется модулями данных (техническими публикациями), созданными производителем вооружения, и корректируются модулями данных анализа логистической поддержки, которые формируются на основе опыта эксплуатации того или иного изделия в конкретных условиях эксплуатации.

Ключевые слова: *интегрированная логистическая поддержка (ИЛП), анализ логистической поддержки (АЛП), интерактивная эксплуатационная и ремонтная документація (ИЭРД).*