ROCKET ENGINEERING TERMINOLOGY IN THE ENGLISH SCIENTIFIC AND TECHNICAL DISCOURSE: A TRANSLATION ASPECT

Abstract. The aerospace terminological system does not exist separately from the terminological systems of other industries. The inter-branch connections of these term systems are manifested in the fact that aerospace terminology is constantly replenished with terms from other scientific fields, such as mathematics, biology, ecology, mechanical engineering, aviation, electronics, cybernetics, telecommunications, etc., interaction with which determines the development of the aerospace industry and, accordingly, terminological base as a whole. The relevance of the problem under consideration is connected with the lack of scientific works with a systematic and thorough coverage of the terminology of this field. An advanced study of the specialized astronomical and rocket engineering vocabulary contributes to a more complete disclosure of the leading trends in the development of national terminology, and the study of the peculiarities and difficulties of its translation will allow to determine modern functional and stylistic trends within the given field and predict its future prospects. The purpose of the research is to describe the modern system of astronomical and rocket engineering terminology and to investigate the peculiarities of the translation of the relevant terms into the Ukrainian language. The main method of translating a term is using a lexical equivalent. The following methods of translation of terminological units are also distinguished: descriptive translation, translation using the genitive case, translation using prepositions, literal translation, transcription, transliteration. Multi-component terms cause the greatest difficulty in translation, however, most English terms have a structure that matches the structure of the corresponding terms in the Ukrainian language. The most
common methods of translating terms denoting astronomical objects are literal translation, translation using the genitive case, and translation using prepositions. Difficulties arise mostly when translating terms contain five or more components. Among the terms denoting astronomical phenomena and processes, two-component term compounds prevail, and among the techniques used in the translation of the terms of this terminological subsystem, literal translation and translation using the genitive case prevail. The variety of applied translation techniques depends on the number of components. Among the difficulties of translating terms of this type, it is worth to note the polysemy of individual components of term compounds.

Key words: terminology, translation method, transformation, astronomical and rocket engineering vocabulary, subsystem.

Суїма Ірина Павлівна, кандидат філологічних наук, доцент, доцент кафедри англійської мови для нефілологічних спеціальностей, Дніпровський національний університет імені Олеся Гончара, 49000, м. Дніпро, проспект Гагаріна, 72, тел.: (056)374-98-86, https://orcid.org/0000-0002-2209-8614

TERMINOLOGY RAKETOBUDDUANNA V ANGLOMOVNOMU NAUKOVO-TEHNICHNOMU DISKURSI: PEREKŁADAČČY ASPEKT

Анотація. Аерокосмічна терміносистема не існує окремо від терміносистем інших галузей. Міжгалузеві зв’язки цих терміносистем проявляються в тому, що аерокосмічна термінологія постійно поповнюється термінами з інших галузей науки, таких як математика, біологія, екологія, машинобудування, авіація, електроніка, кібернетика, телекомунікації та ін., взаємодія з якими визначається розвитком аерокосмічної галузі і, відповідно, термінологічної бази в цілому. Актуальність проблеми, що розглядається, пов’язана з відсутністю наукових праць із системним та грунтовним висвітленням термінології цієї галузі. Поглиблене вивчення фахової астрономічної та ракетотехнічної лексики сприяє більш повному розкриттю провідних тенденцій розвитку національної термінології, а вивчення особливостей і труднощів її перекладу дозволить визначити сучасні функціонально-стилістичні напрямки в межах галузі, що досліджується, та спрогнозувати її майбутні перспективи. Мета дослідження – описати сучасну систему астрономічної та ракетотехнічної термінології та дослідити особливості перекладу відповідних термінів українською мовою. Основним способом перекладу є використання лексичного еквівалента. Виділяють також такі способи перекладу термінологічних одиниць: описовий переклад, переклад з використанням родового відмінка, переклад з використанням прийменників, дослідний переклад, транскрипція, транслітерація. Найбільші
труднощі при перекладі викликають багатокомпонентні терміни, однак більшість англійських термінів мають структуру, яка відповідає структурі відповідних термінів української мови. Найпоширенішими способами перекладу термінів, що позначають астрономічні об’єкти, є дослівний переклад, переклад з використанням родового відмінку та переклад за допомогою прийменників. Труднощі виникають переважно тоді, коли термін містить п’ять і більше компонентів. Серед термінів, що позначають астрономічні явища та процеси, переважають двокомпонентні терміносполучення, а серед прийомів перекладу термінів цієї термінологічної підсистеми переважають дослівний переклад та переклад з використанням родового відмінку. Різноманітність застосовуваних прийомів перекладу залежить від кількості компонентів. Серед труднощів перекладу термінів такого типу варто відзначити полісемію окремих компонентів терміносполучень.

Ключові слова: термінологія, спосіб перекладу, трансформація, лексика астрономії та ракетобудування, підсистема.

The relevance of the problem. The functioning and development of any scientific and technical field is accompanied by the emergence and gradual enrichment of its terminology. Terms from the fields of physics, chemistry, biology, aviation, mechanical engineering are included in the quite dynamic terminology system of astronomy and rocket engineering. They became the basis for the formation of authentic term units, which undergo further modifications due to the emergence of new branch concepts and the need for their nomination. The factor of rapid development of the field of astronomy and rocket engineering, as well as its terminology, often poses new challenges not only to terminologists and lexicographers, but also to translators.

Terminology is part of a special vocabulary. It represents the most dynamic lexical system of the language, since the process of emergence of new concepts and terms is permanent. Researches in this area most often show how terminology arises, develops and changes depending on the development of relevant sciences and the general style of thinking, and most often the term contains not only information about a specific object or phenomenon that it denotes, but also bears the imprint of historical era, technical and cultural level of the country within whose language this term exists, as well as the personality of the founder of the term [4, p.197; 5, p. 312].

The aerospace terminological system does not exist separately from the terminological systems of other industries. The inter-branch connections of these term systems are manifested in the fact that aerospace terminology is constantly replenished with terms from other scientific fields, such as mathematics, biology, ecology, mechanical engineering, aviation, electronics, cybernetics, telecommunications, etc., interaction with which determines the development of the aerospace industry and, accordingly, terminological base as a whole.
The relevance of the problem under consideration is connected with the lack of scientific works with a systematic and thorough coverage of the terminology of this field. An advanced study of the specialized astronomical and rocket engineering vocabulary will contribute to a more complete disclosure of the leading trends in the development of national terminology, and the study of the peculiarities and difficulties of its translation will allow to determine modern functional and stylistic trends within the given field and predict its future.

**Analysis of last researches and publications.** At a time of rapid scientific and technical development, the state of research into the stylistic features of scientific presentation is one of the urgent and priority issues of linguistics, as it determines and directly affects the development of scientific thought in the country, the adaptability of the language under study to the accurate presentation of scientific and technical knowledge, the intellectual and verbal level authors of scientific texts.

Scientific and technical texts belong to the scientific style, the field of use of which is scientific activity, technical progress of society, education, training. The main purpose of this style is systematization of knowledge, reporting of research results, proof of theories, substantiation of hypotheses, classifications, explanation of phenomena, presentation of material, presentation of scientific data to society [1, p. 126].

Characteristic features of the scientific and technical style: informativeness, logic, accuracy and objectivity, as well as clarity and comprehensibility. In addition, such features as objectivity, generalization, unambiguity, brevity, evidentiality, persuasiveness, etc. are distinguished [2, p. 81]. Abstract vocabulary, symbols, a large number of terms, schemes, tables, graphs, sample symbols, foreign words, scientific phraseology belong to the main language tools.

Among the linguistic characteristics that distinguish scientific and technical texts from other types of text, most authors name the following: complexity of syntactic constructions, lexical, syntactic and compositional stereotyping; subordination of aesthetic properties to the pragmatic attitudes and intentions of the author; the regulated nature of the use of emotional capabilities; use of syntactic and lexical stamps; the predominance of objectivity in the presentation, the combination of the subjectless way of presentation with the expression of the subjective opinion of the author, the wide use of symbols, formulas, tables, etc. [7, p. 124].

According to the functional and stylistic coloring, the vocabulary of scientific texts is divided into commonly used, terminological and general scientific one. The first category of vocabulary is represented in the texts in the largest number, but the terminological and general scientific vocabulary characterizes the scientific text. The terminological vocabulary has a fairly clear definition. A term is a word that is a definition of a concept, phenomenon, subject, used in a certain field of knowledge and included in the term system [8, p. 36].
When translating a scientific and technical text, one has to solve a whole complex of various tasks at the same time. This type of activity requires not only impeccable command of the language, certain industry knowledge, but also maximum efforts on the part of the translator. Since when translating scientific and technical literature, there is usually no need to look for any hidden meaning in the text, one should strive for special terminological accuracy. At the same time, it should be borne in mind that technical terms do not always coincide in scope in different languages [3, p. 67].

The quality of the translation of scientific and technical texts largely depends, firstly, on the peculiarities of this type of literature, and secondly, on the level of language and general technical and scientific training of the person engaged in translation. Quite often it happens that the translation is edited by a specialist in the relevant field [6].

To ensure the adequacy of the translation, the translator must have:
1) thorough knowledge of the subject, which is the main topic of the original text;
2) a sufficient level of knowledge of the translation language, and therefore of its lexical and grammatical features compared to the native language;
3) a clear idea of the nature of the scientific and technical functional style, both in the original language and in the native language;
4) knowledge of the basics of translation theory, as well as perception of technical translations and the ability to use them;
5) familiarity with accepted conventional signs, abbreviations (abbreviations), systems of measures and weights in the original language and in the native language.

Good command of the native language, as well as the appropriate use of terminology [9, p. 25].

**The purpose of the research** is to describe the modern system of astronomical and rocket engineering terminology and to investigate the peculiarities of the translation of the relevant terms into the Ukrainian language.

**Presentation of main material of the research.**
Aerospace terminology, like the terminology of any professional terminological system, has its own characteristics, in particular the English-speaking one, because English-speaking countries are among the leaders in the world in the direction of aviation and space development. The Ukrainian and English languages, of course, differ in their structure, so when translating, it is often necessary to use grammatical and lexical-semantic transformations, including in cases when there are no equivalent concepts in the translated language, denoting little-known latest developments, so translators resort to borrowing.

Depending on the degree of specialization, the terms are divided into three groups:
1. General scientific terms that are used in almost all branch terminology, for example: system, tendency, concept, theory, analysis, synthesis, etc. It should be noted that such terms can specify their meaning within certain terminology. This category also includes general technical terminology: machine, appliance, aggregate.

2. Interdisciplinary terms are terms that are used in several related or distant fields (economic science has a common terminology with other social and natural sciences), for example: amortization, ecological taxation, sanitation, technopolis, reflection, real time.

3. Highly specialized terms are words or phrases that denote concepts that reflect the peculiarities of a specific field, in particular aerospace, for example: upper atmosphere research satellite, meteor, lunar module.

Like any other terminology, the terminology of the aerospace industry is characterized by systematicity and thematic grouping and is a complex entity, the structure of which contains separate subsystems. The systematicity of the vocabulary of the space professional language is reflected in the systematicity of the conceptual field, which consists in the fact that the meaning of lexical units does not exist in isolation, but in a certain relationship with the meaning of other units of a defined semantic field [4].

One of the most important features that distinguish a term from a commonly used word is its belonging to a certain terminological field. The terminological field is defined as an artificially defined area of existence of a term, within which it possesses all its characteristic features.

The use of semantic fields to describe terminological vocabulary is associated with the division of terminological units into certain lexical-semantic groups, which are separate microsystems within the framework of the aerospace terminology system. Modern English aerospace terminology is very diverse in terms of its lexical and semantic content.

The main semantic groups combine terms to denote general concepts of processes, actions, objects, spacecraft details, properties, equipment used for space exploration, etc. The most typical among them are the following groups of terms:

- to designate machines, mechanisms, devices: simulator – симулятор; gimbals – амортизація; aircraft carrier – транспортний корабель; transmitter – трансмітер; engine bell – сопло-двигун; USS – авіаносець; coil – редуктор; Ascent vehicle – борт орбітального апарату; MDV – пусковий механізм;

- to indicate the details of the spacecraft's equipment and systems: helmet restraint ring – кільце для шолома; communication umbilical – системи зв'язку та вентиляції; booster – прискорювач; fuel pumps – паливні насоси; tower – заглушка; trim – обшивка; cooling system – система охолодження; overboard dump – бортова каналізація;
- to indicate the properties of aerospace engineering: supersonic velocity – надзвукова швидкість; nominal system – система, що працює в нормальному режимі; trajectory – траекторія; relative speed – відносна швидкість; rate of turn – швидкість розвороту; high – висока; translation – показники; pitch rate - рівень підйому;

- to indicate actions, technical processes: pre-launch test – передполітній тест; capsule ingress – вхід в капсулу; to embark – вирушати, запускати; landing – висадка; to penetrate – заходити; to abort – відмовитися, повернутись назад; docking – стикування; splashdown – приземлення;

- to designate space flight control units, positions, specialties: flight controllers – керівники польотом; RETRO (Retrofire Officer) – Пілотований модуль; FIDO (Flight Dynamics Officer) – ФІДО; Guidance – Наведення; Surgeon – бортовий лікар; EECOM (Command Service Module Electrical and Environmental Engineer) – Компресори;

- for designation of premises of special purpose buildings, their parts: flight – центр керування; launch pad – майданчик запуску корабля; Mission Control – центр керування польотом; launch control – управління запуском; pad leader – стартовий майданчик; prime recovery zone – зона приземлення; mission site – космічна база; relay probe – станція зв’язку;

- to indicate special units of measurement, standards: atom – атом; amp – ампер; sol – день; molecule – молекула;

- for designation of substances, materials: rocket fuel – ракетне паливо; lithium hydroxide – гідроксид літію; diesel – дизель;

- names of methods and programs of space exploration: manned space program – космічний політ із людьми на борту; interstellar travel – подорож до зірок; final expedition – остання експедиція; debrief – політ із поверненням до відправної точки;

- names of space objects: star field – зіркове поле; wormhole – червоточина у просторі; black hole – чорна діра; neutron star – нейтронна зірка; collapsed star – колапсар; Solar system – Сонячна система;

- to indicate problems, breakdowns in aerospace systems: short – коротке замикання; liquid propulsion - течія; cabin pressure – розгерметизація кабіни; master alarm – тривога номер один;

- designation of physical and physiological phenomena: Moon’s gravity – гравітаційне поле; hibernation – анабіоз; upper atmosphere – верхні шари атмосфери; gravitational pull – гравітаційне поле; time slippage – часовий зсув.

The semantic method of term creation is the main method of creation because a commonly used lexical unit acquires the status of a term as a result of certain semantic changes in the use of this unit in the language. In general, there are two options for creating terms from commonly used words.
Words that are part of the terminological system in their basic meaning and are both well-known and special at the same time. The lexical meaning of a commonly used word "merges" with the general terminological meaning without special semantic shifts. The definition of such a term differs from the definition of a word in general literary language, for example: entry – 1) вход (у загальнозвичайному значенні), 2) вход в атмосферу (у галузі аерокосмонавтики); gap – 1) проміжок, 2) люфт.

Metaphorization of the meanings of commonly used words is based on the external or functional similarity of the named objects, for example: branch – 1) гілка (дерева), 2) патрубок; guide – 1) провідник, 2) навігаційна конструкція; tail – 1) хвіст, 2) хвостова частина (космічного корабля); nose airlock – носовий повітряний шлюз.

In the process of formation of the aerospace terminological vocabulary, metonymic transfer is also used, which is carried out on the basis of the contiguity of two things, their combination in space or time. New meanings of words appear based on the contiguity of their signs [5]. The metonymic method of transfer is not based on similarity (as in the metaphorical one), but on the contiguity of concepts, in other words, a word that is the name of one object or phenomenon is used to designate another object or phenomenon that is in relationship with the first. Therefore, the metaphor is primarily a semantic shift in meaning, and metonymy is a semantic shift in reference. Although both processes are symbolic transfers, metonymy identifies the object of its designation, and metaphor characterizes it.

Examples of metonymic transfer in the process of creating aerospace terms are: layout – побудова, cover – покриття, excursion – коливання атмосфери, pass point – допоміжна точка на аерознімку, orbit relaxation – релаксація орбіти, strength – міцність (покриття).

The main method of translating a term is using a lexical equivalent. An equivalent is defined as a constant lexical counterpart whose meaning exactly matches the meaning of the original word.

The most difficulties in translation are caused by compound terms or multi-component terms, because it is sometimes quite difficult to find the most optimal equivalent with the most accurate and appropriate meaning.

When translating terms from English into Ukrainian, the following basic techniques are usually used:

1) descriptive translation – transfer of a term unit with the help of an extended explanation of the meaning of the English term, to which are used in the absence of a corresponding meaning of such a unit in the Ukrainian language (atomic oscillation – коливання атомів у кристалічній решітці, X-irradiation – опромінення рентгенівськими променями);
2) rearrangement (stellar collision – зіткнення зірок, multi-messenger astronomy – астрономія багатьох джерел);
3) addition – increasing the number of lexical components during translation (hydrostatic galaxy halo – галактичне гало у гідростатичній рівновазі);

4) omission – reducing the number of lexical components in the translation process (liquid-propellant rocket engines – рідинні ракетні двигуни, cylindrical waffle-grid shell – циліндрична вафельна оболонка);

5) loan translation – translation of an English term or a terminological expression by means of its exact transmission using the Ukrainian language (neutron star – нейтрона зірка, gas giant – газовий гігант);

6) transcoding – transmission of the sound and/or graphic form of an English term by means of the Ukrainian alphabet, which has two varieties:
   a. transcription – transferring the pronunciation of an English term using letters of the Ukrainian alphabet, that is, transferring its phonetic form, which is often used when translating proper names (jet – джет, sceptron – скептрон);
   b. transliteration – the transfer of the spelling of an English term by letters of the Ukrainian alphabet, regardless of its pronunciation (stringer – стрингер, fitting – фітинг);
   c. adaptive transcoding – translation with some adaptation of the form of the English term to phonetic and/or grammatical structures of the Ukrainian language (counterjet – контрджет, thermostating – термостатування).

Most of the English terms have a structure that coincides with the structure of the corresponding terms of the Ukrainian language. Such terms do not cause difficulties in translation. Example: strength margin of structure – запас міцності конструкції, payload interfacing with rocket – ув'язування корисного навантаження з ракетою.

The main terms used to denote astronomical objects have equivalents in the Ukrainian language, so it is quite simple to translate them adequately, especially if they are single-component: star – зірка, planet – планета, galaxy – галактика. However, the translation of multi-component terms of this type requires more competence.

It is worth to note that in the English language, term compounds of this type are usually attributive phrases of the "adjective + noun" or "noun + noun" type. A large proportion of such terms are translated using loan translation, for example: circumplanetary disk – навколопланетний диск, rocky planets – скелясті планети, brown dwarf – коричневий карлик, binary system – подвійна система.

Astronomical phenomena and processes are often denoted by three-component terms: brown dwarf collision – зіткнення коричневих карликів, white dwarf collision – зіткнення білих карликів, neutron star collision – зіткнення нейтронних зірок, black hole collision – зіткнення чорних дір.

Four-component term compounds make up a relatively small proportion of terms that denote phenomena and processes in the field of rocket engineering. When
translating them, permutation is widely used: space launch systems marketing – маркетинг ракетно–космічних комплексів, pre–launch processing and launching – підготовування та проведення запуску.

For single–component terms denoting phenomena and processes in the field of rocket engineering, the application of loan translation is typical. Instead, multicomponent terms of this type are often translated by permutation. In some cases, term compounds can be translated by loan translation or adding prepositions. There is an equivalent translation of term compounds or their components. The main difficulties in translating terms of this type are related to the synonymy of term units, as well as the use of appropriate Ukrainian equivalents and prepositions.

So, the most common methods of translating terms denoting astronomical objects are loan translation, permutation, and addition of prepositions. Difficulties arise mostly when translating phrases containing five or more components, because the translator must not only correctly define the main word (if it is a noun phrase) and translate the adjectives in the phrase in the correct order, but also provide the most accurate version of the translation that matches the context. Also, when translating such word combinations, it is important to choose the right prepositions to combine their components or to avoid using prepositions altogether.

Among the terms denoting astronomical phenomena and processes, two–component term compounds prevail, and among the techniques used in the translation of the terms of this terminological subsystem, tracing and permutation prevail. However, taking into account the rapid development of astronomy as a science and the fact that the number of discoveries and, therefore, new concepts in this field is constantly increasing, the translator must be ready to face the term compounds containing four or more components. In order to perform an adequate translation of such term combinations, the translator must possess not only sufficient linguistic competence, but also thorough knowledge of astronomy and rocket engineering.

Conclusions and prospects of the research. So, a term is a word or phrase that denotes a clearly defined concept of a certain field of knowledge or human activity. Each term is characterized by the presence of such features as: belonging to a certain terminological system; existence of a definition; ambiguity within one term system; precision; stylistic neutrality; lack of synonyms and homonyms within the same term system; lack of expressiveness, imagery, subjective–evaluative shades.

Each term, as a lexical unit, performs a number of functions: representative, significant, communicative, pragmatic.

Rocket engineering terminology is part of the English language system as one of its subsystems, subject to general language trends. Semantic–structural analysis makes it possible to understand the trends in the formation and development of terminological units, to find out the origin and connections between them. The
translation of industry terminology is a complex process in which the interaction of the term with the context is essential.

The main method of translating a term is using a lexical equivalent. The following methods of translation of term units are also distinguished: descriptive translation, translation using the genitive case, translation using prepositions, literal translation, transcription, transliteration.

Multi–component terms cause the greatest difficulty in translation, however, most English terms have a structure that matches the structure of the corresponding terms in the Ukrainian language.

The most common methods of translating terms denoting astronomical objects are literal translation, translation using the genitive case, and translation using prepositions. Difficulties arise mostly when translating terms containing five or more components, and consist in determining the main word in the term and the appropriate use of prepositions.

Among the terms denoting astronomical phenomena and processes, two–component term compounds prevail, and among the techniques used in the translation of the terms of this terminological subsystem, literal translation and translation using the genitive case prevail.

The variety of applied translation techniques depends on the number of components. Among the difficulties of translating terms of this type, it is worth to note the polysemy of individual components of term compounds.

Single–component terms denoting phenomena and processes in the field of rocket engineering are usually translated literally. Instead, when translating multi–component term compounds of this type, the genitive case is very often used. The main difficulties in translating such terms are related to the synonymy of term units and the use of appropriate Ukrainian equivalents and prepositions.

Different types of translation transformations are used for the translation of rocket engineering terms, among which one can highlight the search for an equivalent or a relative equivalent, the use of transcoding, in particular adaptive, loan translation, descriptive translation, inversion, concretization, generalization, addition, omission, and various types of grammatical substitutions.

Thus, it can be concluded that the study of aerospace terminology in multimodal texts is effective from the point of view of the presence of a connection between the term itself and objective reality, awareness of its place and role in the system of other mechanisms, formation of an idea of how and for what it functions the physical device or phenomenon that this term refers to, that is, in a multimodal environment, the most tangible connection with the denotation, sign and its meaning (concept). At the same time, from the point of view of translation, aerospace terminology is a prospective direction and a rather difficult task for the translator, because in a multimodal environment, it is necessary to take into account much more
additional factors during translation than in an environment in which information is perceived through only one mode of communication, for example, graphic one. This process requires the translator not only to know the rules and methods of translating terminological units, but also tests his/her flexibility, the ability to adapt to changing conditions, act not according to a standard scheme, but often make creative decisions, which is where the translator's skill is manifested.

For a significant number of terms, it is quite natural to have lexical equivalents in the Ukrainian language, since the mechanical, instrument and rocket engineering industries have been actively developing in Ukraine, and a significant contribution was made to the development of the aerospace industry in the world as a whole. At the same time, as cross-linguistic and cross-cultural contacts in the field of aerospace continue to actively develop, and new terms for the latest technological developments appear more and more in the English language, there is often a need for linguistic borrowing, which is realized, in particular, through transcoding, complete or adaptive, loan translation, often combined with inversion.

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