

**SATELLITE NAVIGATION SYSTEM MARKETING**

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**Statement of the problem in General and its relationship with important practical tasks.** Large investment high-tech business projects require thorough, in-depth marketing analysis. Before implementing of such project, it is necessary to evaluate not only the possibility of its technical realization, even if the unique innovative developments, market medium, and long term prospects of the project in the current take place. Of course, this belongs to projects in the aerospace industry. A negative example of the project failure is the closing of the production and transport using the world's only supersonic passenger airliner «Concord», which is so commercial and didn't pay off. That is why the answer to a question: whether it is worth realizing the global innovative project (and in a space industry it is only about such projects), – first of all, it consists in what share of the world market will manage to be taken and whether enough to cover a cost and to get profit.

**The analysis of researches and publications, which is based on the solution of the problem.** In recent decades, the world began to develop new service – satellite navigation. Satellite navigation system (Eng. Global Navigation Satellite Systems (GNSS)) is a system designed to determine the location (geographical coordinates) land, water and air objects. Satellite navigation system can also be used to obtain accurate time. Such systems consist of space equipment and ground segment (control systems). Now only two satellite systems provide a complete and uninterrupted covering of the globe — GPS and GLONASS [3].

**Unexplored the issue to which this article is devoted.**

Satellite navigation system was developed as a defense projects, but in the last ten years, their services began to use commercial firms and individual consumers. Global market of users of satellite navigation systems and manufacturers of navigational equipment have formed.

**Statement of the problem.** The article is devoted European satellite navigation system Galileo market prospects analysis.

**Main material and results.** In 1974, the US army put into orbit the first satellite new at the time of the navigation system NAVSTAR, which was later renamed the Global Positioning System (GPS). In the mid 1980s, GPS technology was allowed to use civilian ships and aircraft, but for a long time they were available less accurate positioning than the military.

In 1982 USSR provided the answer- the GLONASS technology (Global navigation satellite system). The finishing 24th GLONASS satellite orbited in 1995, but small useful life of satellites (three-five years) and insufficient financing of the project almost for 10 years put system out of action. GLONASS was recovered just in 2010. GLONASS – initially Soviet, and now the Russian alternative of GPS [6].

Basic elements of satellite system of navigation:

- orbital group of the satellites radiating special radio signals;
- the land management system and control (a land segment) which includes blocks of measurement of the current provision of satellites and transfer on them the acquired information for adjustment of information on orbits;
- the equipment of the consumer of navigation satellite systems ("satellite navigators"), used for coordinates determination;
- optionally: the land system of radio beacons allowing to increase considerably the accuracy of coordinates determination.
- optionally: information radio system for transfer to users of the amendments allowing to increase considerably the accuracy of coordinates determination [5].

To avoid failures, both GPS, and GLONASS use 31 satellites now: 24 main and 7 reserve. Modern navigation satellites at the height about 20 thousand km fly and per day manage to fly around Earth twice.

This system has both commercial, and defensive appointment. It is obvious that marketing approach is possible only to a consumer commercial component. If to consider the market of satellite navigation, it is possible to characterize it as the market with uniform demand pattern because all consumers impose identical requirements to characteristics and quality of this service. Distinctive feature of the market with uniform demand pattern is that the one who took this market by the first has competitive advantage. Followers are forced to start tough competitive struggle with the leader.

Initially the market of civil satellite navigation created GPS. Completely working group of satellites of the USA allowed to implement GPS worldwide, entering navigation devices into mass production and reducing the value of the made production cost.

Later Russian development of a navigation satellite system of GLONASS purchases gained popularity only in the regional market, by accomplishment of the appropriate target state programs [4]. Now an active commercialization of GLONASS technologies takes place. In particular, according to the order of the Government of the Russian Federation the project of JSC NIS – "ERA-GLONASS" is implemented. However, for successful commercialization and payback of the Russian project of the existing market size it is extremely not enough. Distribution of GLONASS on the markets of the countries of Central Asia and, especially, India can only be a solution.

Recently the competition in this market increases as new global navigation satellite systems are developed. BeiDou (Compass) – the local satellite system of navigation developed by China based on geostationary satellites. As of 2015 the system had 14 working satellites: 5 in geostationary orbits, 5 – on geosynchronous and 4 – on averages near-earth. The program implementation began in 2000. The first satellite orbited in 2007. In May, 2016 the 21st spacecraft was launched.

It is supposed that by 2020 when the number of satellites will be increased to 35, the BeiDou system will be able to work as global.

The Galileo project which is developed by the European Union is of the most great interest to the European market and it shall be started at full capacity till 2020. Initially «Galileo» thought as especially European network, but already declared the countries of the Middle East and South America the desire to participate in its creation. So in the market of global systems of satellite navigation "the third force" can shortly appear. If this system is compatible with existing, and most likely it will be so, consumers will only win.

«Galileo» is the system which at a stage of creation of satellite group. As of November 2016 in an orbit, there are 16 satellites, 9 acting and 7 tested. It is planned to develop completely satellite group by 2020.

Let us analyze market prospects and sales opportunity of the Galileo project. It is the European system therefore can expect the market of the EU, and it is 500 million people. Considering the competitors possibilities it is not enough, despite such impressive market size. Capture of the markets of neighboring countries can become the decision, and it is even more preferable – the market of Latin America. However, it is necessary to be ready to a fierce competition for this market with GPS and GLONASS.

As for an assessment of sales opportunities of the project, it should be noted the following benefits and problems. To the European project will be to increase difficult and costly orbital group of satellites, as Europe has no own reliable and cheap launch vehicles (table 1). Inclusion in the project of Ukraine having the fulfilled technologies of rocket production can be an exit. However, in recent years this industry of the Ukrainian economy is in crisis condition.

**Table 1**

**Start launch vehicle cost analysis (in decreasing order of cost) [8].**

Carrier	Cost, dollars for kg	Cost of start, one million dollars	Load-carrying capacity tons	Note
1	2	3	4	5
Space shuttle (reusable KK) USA	13 000-17000	500	25	Now the project is frozen
"Atlas-5" (disposable carrier rocket) USA		187	9.75 — 29.42 (NOO) 4.95 T- 13 T per GPO	
"Delta-4" (disposable carrier rocket) USA	17 409-13893(NOO) 37 272-28 192(GPO)	164-400	9,42-28,79 (NOO) 4,4-14,22 (GPO)	Cost depending on modification

"Ariane-5" (disposable carrier rocket) European Union	13 330- 15 000 (per GPO)	140-150	10,5 (GPO)	
H-IIA (disposable carrier rocket) Japan	11 440-(NOO) 28 500-(GPO)	114	10-15 (NOO) 4-5,95 (GPO)	
"Falcon Heavy" (reusable carrier rocket) USA	5 474- 2 194(NOO) 16 363- 5 243(GPO)	90-140	16,44-63,8 (NOO) 5,5-26,7 (GPO)	Cost depending on a possibility of return of steps
"Proton" (disposable carrier rocket) Russia	2 830(NOO) 13000(GPO)	65 80 (with the Briz-M block)	23 (NOO) 6,15 (GPO)	Start cost in 2015 was reduced to \$70 million
"Falcon-9" FT (reusable carrier rocket) USA	2 719(NOO) 7 469(GPO)	62	22,8 (NOO) 8,3 (GPO — 1800)	Carrier rocket with the returned first step. The project is at a completion stage
"Union" (disposable carrier rocket) Russia	4 242-11 265	35-78	8,25	Cost of start from Kuru Space Centre — from €40 to 60 million per start
Zenith-2/3SL (disposable carrier rocket) Ukraine-Russia	2 567-3 667	35-50	13,7	
PSLV (disposable carrier rocket) India	4 615-(OO) 10 526(GPO)	15	3,25-3,8 (NOO) 1,2-1,425 (GPO)	
Dnieper (disposable carrier rocket) Ukraine-Russia	2 703	10	3,7	Due to the agreement signature of the START-1, the RS-20 missile system is re-equipped for commercial starts. For start of RN "Dnieper" are used the launcher on the platform 109 of Baikonur Cosmodrome and launchers based on Clear in the Orenburg region. Now the project is frozen

The land management system and control (a land segment) also should be created. A benefit is that Europe has production and technological potential of creation of the equipment for consumers of navigation satellite systems («satellite navigators»).

For an assessment of commercial effectiveness of implementation of the European navigation satellite system, we will carry out SWOT analysis of the project – the analysis of the external environment and internal opportunities. Based on the carried-out analysis we will prove the external and internal potential of success of the project [1].

Implementation of SWOT analysis provides at first identification strong and weaknesses of the project, opportunities and threats of the environment, after that establishment of communications between them which not обходимо to use for successful implementation.

Table 2

The impact of factors on the implementation of the project «Galileo»

	Possibilities	Threat
External environment	1. Considerable financial opportunities of the European Union; 2. The developed general scientific and technical base; 3. Favorable standard and legal conditions; 4. A possibility of expansion of a potential segment of the market due to connection to the project of Latin America; 5. Positive relation to the project of the general public of the European countries; 6. Low interest rates of banks; 7. Rate stability of currency; 8. Possibility of the state support of the project; 9. High performance of work; 10. Level of education of a labor power.	1. Need of large volume of investments for project implementation; 2. Insufficient potential of the domestic market of the European Union for project scales; 3. Presence of the large competitors who already realized similar projects; 4. Threat of appearance of new competitors, having started implementation of similar projects; 5. Political instability; 6. Low rates of economic growth. 7. High prices of many types of resources; 8. Negative attitude from public organizations of an ecological orientation; 9. High salary level of a labor power.
	Advantages	Disadvantages
Internal environment	1. Availability of material and technical resources; 2. High capitalization of the European entities; 3. Effective policy of promotion of projects; 4. Availability of the arranged production of the equipment of the consumer of navigation satellite systems («satellite navigators»), 5. Possibility of connection of the entities of Ukraine to the project.	1. Insufficient development of rocket production in the European Union; 2. Lack of the developed management system and control (a land segment); 3. Design and technological dependence of the entities of Ukraine; 4. Crisis condition of the entities of Ukraine.

The analysis of the environment is the process establishing connection between factors, advantages and disadvantages of the project, and also the opportunities and threats containing in the external environment. We will reduce possibilities of this project in table 3.

Table 3

Assessment of external opportunities for project implementation of «Galileo»

№	Factor name	Probability of Implementation (1-3)	Influence Level (1-3)	Factor assessment (2*3)
1	Considerable financial opportunities of the European Union	3	2	6
2	The developed general scientific and technical base	3	3	9
3	Favorable standard and legal conditions	3	1	3
4	A possibility of expansion of a potential segment of the market due to connection to the project of Latin America	1	3	3
5	Positive relation to the project of the general public of the European countries 2 1 2	2	1	2
6	Low interest rates of banks	2	2	4
7	Rate stability of currency	2	1	2
8	Possibility of the state support of the project	1	2	2
9	High performance of work	2	1	2
10	Level of education of a labor power	2	1	2
	Total			35

The received matrixes create nine fields of opportunities, which have different value for the Galileo project. The opportunities getting on the fields «WS», «WU», «SS» have powerful values for the project, they should be used surely. The opportunities getting on the fields «SM», «WL» and «NM» practically don't deserve attention (table 4).

**Table 4**

**Level of influence and probability of use of opportunities of an external environment for the Galileo project**

Influence Probability	Strong	Moderate	Weak
High	Field WS <b>2</b>	Field WU <b>1</b>	Field WM <b>3</b>
Average	Field SS	Field SU <b>6</b>	Field SM <b>5,7,9,10</b>
Low	Field NS <b>4</b>	Field NU <b>8</b>	Field NM

We will similarly analyze external threats for project implementation «Galileo», their probability and degree of danger (table 5).

**Table 5**

**Assessment of external threats for project implementation of «Galileo»**

№	Factor name	Probability of Implementation (1-3)	Influence Level (1-3)	Factor assessment (2*3)
1	Need of large volume of investments for project implementation	3	2	6
2	Insufficient potential of the domestic market of the European Union for scales of the project	3	3	9
3	Presence of the large competitors who already realized similar projects	3	3	9
4	Threat of appearance of new competitors, having started implementation of similar projects	2	3	6
5	Political instability	1	2	2
6	Low economic growth rates	3	2	6
7	High prices of many types of resources	3	2	6
8	Negative attitude from public organizations of an ecological orientation	2	1	2
9	High salary level of a labor power	3	1	3
	Total			49

The analysis of threats was similarly performed and the matrix of threats was under construction. Consequences to which implementation of threats can lead will be shown in the form of project closure, finishing it to critical condition, heavy damage or easy violations.

Identification in the course of the analysis of factors which are classified as threat of the external dangerous to project implementation and require their urgent elimination. The factors which got on the fields «W», «SK», NR also shall be controlled by management of the project and shall be eliminated as much as possible quickly (table 6).

Table 6

**Level of influence and degree of probability of external threats for project implementation of «Galileo»**

Influence Probability	Destruction	Emergency	Heavy damages	Flicks
High	Field WP <b>2,3</b>	Field WK <b>1,6,7</b>	Field WT <b>9</b>	Field WL
Average	Field SR <b>4</b>	Field SK	Field ST	Field SL <b>8</b>
Low	Field NR	Field NK <b>5</b>	Field ST	Field NL

Advantages of this project are its distinctive features giving the chance to determine and create competitive advantages. Disadvantages of the project are those indicators, which represent competitive vulnerability.

Subject of the analysis is advantages and disadvantages of the project are its internal factors which ranging it is performed according to a technique: 1 - insignificant influence of a factor; 2 – moderate; 3 – considerable influence (Table 7).

Table 7

**Assessment Advantages and disadvantages of the Galileo project**

Advantages	Rank (1-3)	Disadvantages	Rank (1-3)
1.Availability of material and technical resources	3	1.Insufficient development of rocket production in the European Union	3
2.High capitalization of the European entities	2	2.Lack of the developed management system and control (a land segment)	3
3.Effective policy of projects promotion	2	3.Design and technological dependence of the entities of Ukraine	2
4.Availability of the arranged production of the equipment of the consumer of navigation satellite systems	3	4.Crisis condition of Ukrainian enterprises	2
5.Possibility of connection of the entities of Ukraine to the project	2		
Total	12	Total	10

Based on the above-stated tables, the SWOT analysis matrix, which is necessary for group of factors of external and internal environment and determination of strategic prospects of the project, is built.

Table 8

**Matrix of SWOT-project analysis of «Galileo»**

	Возможности (35)	Treat (49)
Advantages (12)	SW (47)	SU (61)
Disadvantages (10)	SLW (45)	SLU (59)

The project is in the field «possibilities and threats», it means that its implementation is risk. However, as systems of satellite navigation have defensive value, the non-market decision – to continue to develop the project can be made.

**Conclusions.** Thus, based on the obtained data, carrying out SWOT-of the analysis, an assessment of external and internal environment, it is possible to draw a conclusion that project implementation of «Galileo» has both benefits, and considerable problems. First, the problem consists in complexity of creation of orbital group of satellites as Europe has no own reliable and cheap launch vehicles. Inclusion in the project of Ukraine having technologies of rocket production can be the solution. But in recent years this industry of the Ukrainian economy is in crisis condition. According to SWOT-to the analysis the project is in the field «strengths and threats», it means that its implementation is risk. However, as systems of satellite navigation have defensive value, the non-market decision – to continue to develop the project can be made.

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його ризикована. Хоча, оскільки системи супутникової навігації мають оборонне значення, може бути прийнято неринкове рішення – продовжувати розвивати проект.

**Ключові слова:** маркетинг; глобальний ринок; інвестиційний проект; супутникові системи навігації; ракетносії; SWOT-аналіз; маркетинг проекту.

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**I. Chyckalo-Kondratska**, D.Sc. (Economics), Professor. **V. Dobryanskaya**, PhD (Technical), Associate Professor. **V. Miroschnichenko**, Senior Lecturer. Poltava National Technical Yurii Kondratyuk University. **Satellite navigation system marketing.** Satellite navigation system was developed as a defense project, but in recent decades, has formed a global market of users of satellite navigation systems, and manufacturers of navigational equipment. The article is devoted to analysis of market prospects by the European satellite navigation system Galileo. Conducted SWOT-analysis, allowed to conclude that the project «Galileo» has advantages and problems.

The main problem is the complexity of creating a satellite constellation, because Europe does not have its own reliable and cheap launch vehicles. The solution may be the inclusion in the draft of Ukraine, who has processed technology of rocketry.

**Keywords:** marketing, the global market, investment project, satellite navigation systems, launch vehicles, SWOT-analysis, marketing of the project.

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**Ирина Борисовна Чичкало-Кондрацкая**, доктор экономических наук, профессор. **Виктория Викторовна Добрянская**, кандидат технических наук, доцент. **Владимир Тарасович Миросниченко**, старший преподаватель. Полтавский национальный технический университет имени Юрия Кондратюка. **Маркетинг систем спутниковой навигации.** Доказано, что спутниковые системы навигации разрабатывались как оборонные проекты, но в последние десятилетия сформировался глобальный рынок пользователей систем спутниковой навигации и производителей навигационного оборудования. Проведен анализ рыночных перспектив разрабатываемой Европейской системы спутниковой навигации «Galileo». На основе SWOT-анализа сделан вывод о том, что реализация проекта «Galileo» имеет преимущества и проблемы. Основная проблема заключается в сложности создания орбитальной группировки спутников, так как Европа не имеет собственных надежных и дешевых ракетносителей. Выходом может быть включение в проект Украины, обладающей отработанными технологиями ракетостроения.

**Ключевые слова:** маркетинг, глобальный рынок, инвестиционный проект, спутниковые системы навигации, ракетносители, SWOT – анализ, маркетинг проекта.