

# Business objective for the life cycle of aircraft

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**Abstract:** *A structural-parametric analysis of the development of the global aviation market has been done and by the example of the development of the domestic helicopter industry, it was shown that the main revenue in the life cycle of aviation technology lies in the area of aviation service. The graphical model of the business objective in the development and operation of helicopters shows the need to maximize the service life of aircraft and reduce downtime. One of the forms that show these features was leasing with the inclusion of services in affiliated centers. At the request of the lessee, the leasing company may also provide additional services for advertising, recruitment, etc. Wet lease is mainly used by companies that manufacture special equipment or are engaged in wholesale activities in the field of aviation, i.e. in fact, they are monopolists. One of the ways to diversify sources of income is the sale of licenses for the production and maintenance of helicopters in the framework of the product lifecycle. Lost sales of helicopters for a holding company must be replenished through monopolization of the service and regulation of prices in this market. In general, the provision of service is a high-tech and profitable business. It requires constant monitoring and quality control of services at all stages of the life cycle of a helicopter. Income growth will be associated with an increase in the term and area of the business goal.*

**Key Words:** *business goal, diversification, license, income, leasing, wet leasing, helicopter, life cycle, provision, monopolist, services.*

## 1. INTRODUCTION

At the end of the 20th century, three aerospace centers with closed chains were formed. This is the United States, united Europe and the USSR. Global shifts in the mega political confrontation of the East and the West in the comprehensive sense of these processes led to the transformation of the aerospace doctrines of the USA and the USSR. Russia, as the successor of the aerospace industry, found itself in a very difficult situation [1], [2], [3], [4], [5], [6], [7], [8].

The cost per unit of production, and even more so the program for creating, for example, an aircraft surpasses the capabilities of a single state. The cost of the bomber is 9, and fighter is 8 orders. These trends necessitate the creation of multifunctional complexes and various highly specialized ones based on a single platform. The established scientific school after the Second World War already underwent a transformation during the Cold War [4], [5], [9], [10]. The end of the Cold War created a prerequisite for the crisis. The number of type of helicopters and airplanes has decreased, and there is no political or economic opportunity for every design bureau to develop an independent base for creating both a line of vehicles and individual planes. What was the objective cause of the crisis?

In parallel, in the West, there was a process of concentration of capital around high-tech production. Modern high technologies in the field of additive technologies, powder metallurgy, production of new structural materials, microelectronics, practical information technologies, radio and optoelectronics required significant investments. The integration process began with enterprises, and continued in the integration efforts of dozens of countries.

For example, in the United States, as a result of integration, practically only two firms remained in the field of aviation: Boeing absorbed Rockwell, McDonnell Douglas and a number of smaller firms, and Lockheed Martin, which merged with Martin-Marietta. and General Dynamics and works in partnership with Northrop, to which joined Grumman and a number of smaller firms. This is an illustration of how it was possible to unite purely American firms into huge groups for the so-called vertical integration in the United States, when it was based on the final product.

For example, the Boeing company not only designed and manufactured mainline aircraft, but also provided after-sales service, technical and flight personnel training and repair. For clearness, purely geometrically, these structures can be represented as vertical pyramids, which are formed according to the principle of a single force framework. Peripheral filling on each technological level provides both the structures included in the vertical, as well as small and medium-sized firms, focused on narrow, but rather high-tech technologies (presence of disintegration elements, free market, etc.). A characteristic sign was the merging of firms working in space, radio electronics, weapons, aircraft and helicopter production. At the same time, there was a process of merging the military and civilian industries. The pyramids, which characterize them in their foundations, have already intersected each other for a long time, and at the beginning of the 21<sup>st</sup> century there was a merging of peaks closed in a single technological chain.

In Europe, the association is made in the practice of international holdings with horizontal integration, which is based on the technological process. The lack of a single vertical is due to a multinational and economic factor. In fact, many of the weaker vertical national pyramids disintegrated vertically are combined into powerful uniform horizontal layers. In the USSR, a solitary centralized system led to a hypertrophied situation. Arranged design verticals still somehow intersected with production [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28]. The vertical of operation was independent from production. Not only aircraft and astronautics went their own ways, but aircraft and helicopter development developed independently. On the whole, having an almost complete range of segments of the aerospace industry, at present Russia has separate technological chains, most of which are in the middle of the last century by the level of technology. The situation in the industry to a certain degree of accuracy is approximated by the situation in education.

CALS technologies provide a unique chance to implement the “world without frontier” principle for the accumulation of advanced achievements in knowledge-intensive businesses.

Today it's not always necessary to catch up with the leaders. Computer engineering has allowed less advanced firms to participate in the division of the engineering services market [1], [4], [6], [8], [10], [15], [29].

*Life cycle business model.* At the end of the twentieth century, the market for helicopters was formed [1], [2], [3], [4], [5], [10], [11], [12], [30]. In this segment, the Russian Helicopters holding received serious competition from the American Sikorsky (part of Lockheed Martin), the European Airbus Helicopters and the Anglo-Italian Agusta Westland. The business model of the life cycle presented in Fig. 1 shows the need to minimize costs and maximize profits. Graphically, the model is presented in the form of a sinusoid. There are two areas. One under the axis is the cost part. The second over the axis is the revenue part.

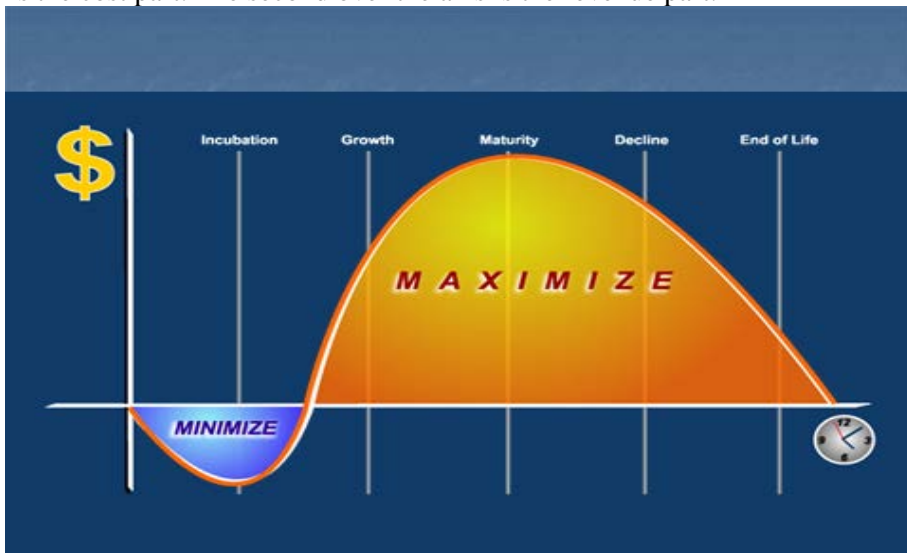


Fig. 1 – Business goal model

A characteristic feature of this minimax optimization is a long service life dominated by the expenditure part in the first quarter and the revenue part in three quarters at the end. A characteristic feature of the aviation business is a long life cycle. So on progressive successful samples, the cycle time has reached 100 years. And this leads to an increase in income derived from exploitation.

## 2. METHODOLOGY

Ways to optimize a business goal during the life cycle are the new trend of doing business. The control action should be directed at minimizing the expenditure side and increasing the revenue side. Graphically, it is necessary to increase the area under the income curve and reduce time and cost.

Possible control actions are shown in Fig. 2. Ways to reduce costs:

- reducing development costs by increasing efficiency;
- reducing costs by reducing the number of late changes;
- quick start of production.

Ways to increase profitability:

- customization;
- better customer satisfaction
- quick response to market demand;

- meeting the requirements for product quality and performance;
- flexibility in new markets;
- after-sales service.

One of the directions of diversification of sources of income is the way to increase the share of income through after-sales service. Such a path is chosen by companies that are confident that the market will be 100% monopolized, otherwise the developer will seek to sell not the product, but the patent and legal component of the technology.

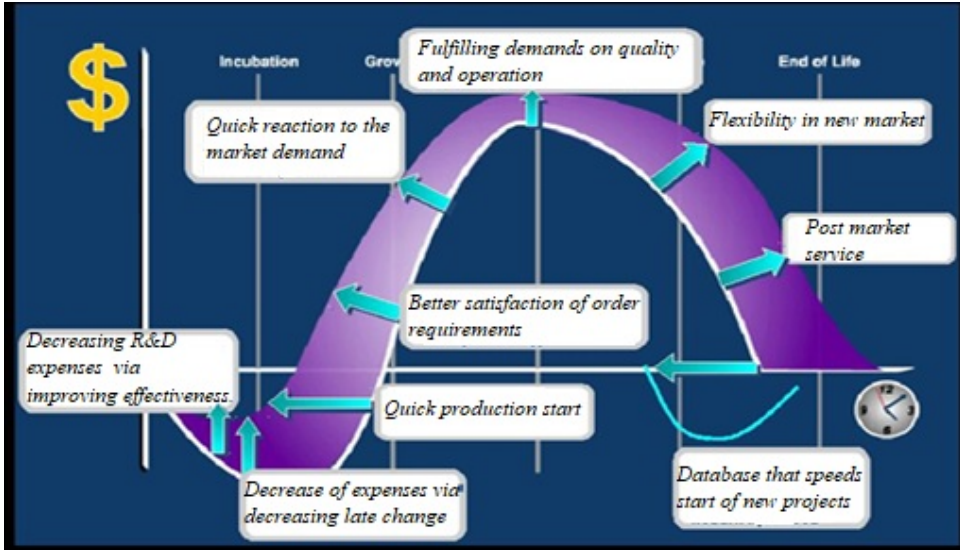


Fig. 2 – Ways to optimize a business goal throughout the life cycle

Service in the “single window” format, with the subsequent transition to life cycle contracts, will reduce the time and material costs for the products, as well as for the repair and modernization of helicopters. Thus, it is possible to sell helicopters below the cost, and the missing part of return according to the “business goal” to get along the product life cycle with the service imposed by the manufacturer.

We see features of this paradigm in the automotive industry with its ups and fatal falls (for example, the US auto industry). Even more evidently the features of this business were manifested in the aircraft industry. Active dumping in the market of main-line aircraft, which was conducted by Boeing, and the parallel development of services with the transition from MTBF to service units and systems based on condition. As part of the fierce competition in the United States and Europe in the aviation market, companies have moved from selling equipment to selling resources (flight hours) [5].

### 3. RESULTS AND DISCUSSIONS

#### 3.1 Leasing

In aircraft construction, one of the forms of appearance of these features was Leasing with the inclusion of services in affiliated centers. Companies that work in the field of aviation leasing are very large financial organizations, as leasing offers very expensive equipment and property guarantees require a lot of guarantees and long terms.

Also, air transport can be leased by state-owned companies authorized to conduct leasing procedures of this magnitude. There are numerous forms of leasing, but “wet” leasing is

interesting for us. “Wet” leasing is leasing, which includes the supply of raw materials, technical service, repair, insurance, advertising. This is a very useful type of leasing, as the leasing company assumes all costs for fuel, maintenance and repair of the vessel, taxes and fees associated with flights, insurance, etc. Sometimes leasing companies, themselves are engaged in the supply and transportation of goods.

In 1998, a federal law was passed giving the right to conduct leasing transactions relating to aircraft. Mostly wet leasing is provided by Western companies. 80% of all transactions in wet leasing are in the West. This is due to the fact that most air transport is produced abroad. Financial organizations in the West are more advanced and wealthy than the companies in Russia, which allows them to expand the market. Only one fifth of all leasing actions in this area are done by Russian lessors. The most active of them are VTB Leasing (40% share), Ilyushin Finance and VEB Leasing.

In addition to the lease itself, under the terms of a wet lease agreement there must be service and maintenance, insurance and many other services that the lessor must undertake. At the request of the lessee, the leasing company may also provide additional services for publicity, recruitment, etc. “Wet” leasing is mainly used by companies that manufacture special equipment or are engaged in wholesale activity in the field of aviation, i.e. essentially the ones who are monopolists.

The scheme of “wet” leasing consists in obligatory technical service, supply, repair and insurance. In addition to these services, the lessor can prepare qualified personnel, marketing, etc. Financial companies and banking organizations seldom use this type of leasing, because they do not have the necessary technical base. The lease agreement contains elements of the loan agreement, lease and financing.

The subject of a wet lease agreement may be the supply of raw materials, technical service, repairs, as well as complex specialized provisions. Also the subject of an agreement in aviation may be aircraft. “Wet” leasing is now forbidden in Russia and is not yet used. It is provided in Russia only to promote the new aircraft Sukhoj Superjet100, which can be leased by a foreign company. Today, only the IFC company is engaged in the study and implementation of “wet” leasing. This type is very efficient and more convenient for a lessee who cannot serve a whole fleet of aircraft or will be able to test in practice expensive transport before buying a large quantity of it.

### **3.2 Organization on service center**

There is a critical number of helicopters in the region, which allows a company to make a service center. In this segment, the holding has serious competition from the American Sikorsky, the European Airbus Helicopters and the Anglo-Italian Agusta Westland. If the Company has its own aircraft maintenance base and external line stations for maintenance when it is working at home and abroad, then it can conduct service on behalf of the developer. The fact of such a possibility must be verified by the manufacturer or, by an affiliated company, with the issuance of a license and accreditation, personnel certification, etc. For example:

1. Over the years of activity, over 8500 helicopters have been repaired by specialists of UTair-Engineering JSC. Every day, more than 300 units of aviation technology are served in different regions of the planet. With the increase in the fleet of foreign-made helicopters in Russia, the need arose for regular and high-quality maintenance of this aircraft. Having a highly qualified engineering staff and many years of experience in operating helicopters of both Russian and foreign production, and also taking into account close partnership with Eurocopter, it was decided to establish a UTair-Engineering JSC at the production facilities of

the Technical Service Center and repair for foreign-made helicopters. Currently, UTair-Engineering JSC has certificates and performs maintenance on European helicopters of the family Eurocopter AS 350, AS 355 N, BO 105, EC 130 B4, North American helicopter Robinson R 44 and Italian Agusta Westland 139.

Specialists of the Center for Maintenance and Repair of Foreign-made Helicopters of UTair-Engineering JSC will perform all the declared types of operational and periodic maintenance, special checkups, advisory services and other services in a timely manner with high quality. A well-developed logistics system will make it possible to deliver the necessary units and components in the shortest time. Types of MRO center services for foreign-made helicopters.

### ***Agusta Westland 139***

#### ***Operational MRO***

- preflight preparation
- providing parking,
- FMS database update,
- operational check 25H,
- ELT removal,
- ELT installation,
- installation of P-855,
- Spring and summer period (fall and winter period) without regard to the replacement of oils,
- towing,
- preparation for flights after storage,
- checkup.

#### ***Periodic MRO***

- routine maintenance after 50 hours of flight,
- routine maintenance after 12 hours of flight.

#### ***Storage works***

- preparation for storage,
- storage after 3 days,
- storage after 28 days.

### ***Eurocopter AS-350 B3 / AS-355 N / NP***

#### ***Operational MRO***

- operational checks before the first flight (BFF),
- check at short-term parking with engine shutdown (TA),
- check at the end of the flight day (ALF),
- providing parking,
- additional checks after 10, 25, 50 flying hours, 7 days, 1, 2, 3 months.

#### ***Periodic MRO***

- periodic checkups and checks after 100, 110, 200, 300, 400, 600 and 1,200 flight hours,
- periodic checkups and checks after 24 months or 500, 550, 1 000, 2 000.2 500, 3 500 and 5 000 hours of flight on the first reached limit.

### ***Eurocopter EC-130 B4***

#### ***Operational MRO***

- preflight checks,
- providing parking,
- additional operations.

*Periodic MRO*

- checkup after 150 flight hours / 12 months (according to the first reached restriction),
- checkup after 600 flight hours / 24 months (according to the first reached restriction),
- checkup after 1200 flight hours / 48 months (according to the first reached restriction),
- checkup after 144 months,
- checkup at specific intervals.

*Unscheduled MRO*

- unscheduled operations “E”,
- unscheduled technical checkups.

*Works on storage.*

***Eurocopter BO-105****Operational MRO*

- preflight checks,
- providing parking,
- additional operations.

*Periodic MRO*

- checkup after 150 flight hours / 12 months (according to the first reached restriction),
- checkup after 600 flight hours / 24 months (according to the first reached restriction),
- checkup after 1200 flight hours / 48 months (according to the first reached restriction),
- checkup after 144 months,
- checkup at specific intervals.

*Unscheduled MRO*

- unscheduled operations “E”,
- unscheduled technical checkups.

*Works on storage.*

***Robinson R-44****Operational MRO*

- preflight checkup,
- parking.

*Periodic MRO*

- service after the first 29 hours,
- service after 50 hours,
- service after the first 100 hours,
- service after 100, 300, 500 hours,
- service in 4, 12, 24 months, in 3, 4 years.

*Special MRO*

- storage,
- overhaul.

Assembly according to a special instruction after the delivery of Robinson R-44 serial helicopters for export.

2. The second example of the development of the service center is ATB Heliport Istra, which was the first in Russia to start to overhaul Robinson R44 helicopters and gain experience and provide materials for the repair of this model. In the presence of a complete set of necessary equipment for the maintenance of helicopters of popular world brands: Robinson, Airbus Helicopters, Bell, Agusta Westland.

Each helicopter, like any other type of machinery, has a definite date for the necessary maintenance.

For example, the maintenance of the Robinson brand (in particular, Robinson R 44) is every 50 hours of flight; overhaul – from 2200 hours (about 12 years of active service).

Many consider regular maintenance “expensive”, but in fact full maintenance of the helicopter costs not so much money. Considering that on average private owners use a helicopter for no more than 200 hours per year, the amount of annual maintenance of a helicopter will be comparable to the cost of servicing a good car – about 300,000 rubles annually. But the repair of the helicopter, in the event of mechanism failure or wear of parts, will cost much more.

3. The third example is connected with the creation of a situational center for monitoring the technical condition of a helicopter fleet of the Russian Ministry of Defense. This system will ensure prompt collection and processing of information for timely decision-making on the implementation of service work within the framework of the state defense order.

The specialists of the Ulan-Ude Aviation Plant (U-UAZ) of the Russian Helicopters holding company, which is part of Rostec State Corporation, began to support the life cycle of the Mi-8AMTSh helicopters of the Russian Ministry of Defense.

The company's service brigades are simultaneously involved in military units of Chita and Novosibirsk and have already completed routine maintenance on several vehicles, which allowed minimizing the risks of poor-quality and untimely fulfillment of the planned SDO tasks, increasing the technical readiness of the helicopter fleet to perform tasks for the intended purpose.

The life cycle contract of the Mi-8AMTSH helicopters is an integral part of the document signed in December 2016 between the holding and the Russian Ministry of Defense. The contract provides for the maintenance and repair of aircraft during operation in 2016-2020.

In addition to carrying out routine maintenance, U-UAZ will provide for all Mi-8 AMTSH helicopters operating in the Russian Ministry of Defense, the performance of other services.

Among them are the organization of all types of repair of helicopters and components, provision of spare parts and the exchange fund, extension of resources, modernization, technical monitoring, updating of databases and software of electronic equipment installed on helicopters, training of flight and engineering staff.

#### 4. CONCLUSIONS

1. One of the ways to differentiate sources of income is the sale of licenses for the production and maintenance of helicopters in the framework of the LCI. Lost income in sales of helicopters of a holding company must be replenished through monopolization of the service and regulation of prices in this market.
2. In general, the providing of service is a high-tech and profitable business. It requires constant monitoring and quality control of services at all stages of the life cycle of a helicopter.
3. Income growth will be related with an increase in the term and area of the business goal.

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