

**FEASIBILITY STUDY  
INNOVATIVE PROJECT**

**"PROTECTION AND DURABILITY OF ROLLING BEARINGS,  
EXPLOITED IN ALL SECTORS OF THE ECONOMY  
ANY STATE»**

**FERGANA – 2023**

## 1. INTRODUCTION

### INNOVATIVE PROJECT

**"Protection and durability of rolling bearings,  
exploited in all sectors of the economy  
of any state»**

Name of organization: Small enterprise "FAN".

Legal address: Uzbekistan, 150102, Fergana, A. Yassaviy, 40b, 44.

Established: 1992

Main activity: development and implementation of innovative projects.

Number of employees – 5 people

Contact person: Lee Vladimir Petrovich

Position: Director and Project Manager

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## 2. THE ESSENCE OF THE PROJECT

The project is proposed to increase the durability and reliability of rolling bearings operated in all sectors of the economy of any country. This goal is achieved by protecting rolling bearings with the innovative LIZA material.

Practice has established that 1% of anthracite dust in the lubricant causes an increase in the intensity of wear of gearbox parts by 2-3 times, and the presence of 2% sandstone dust by more than 30 times (Tregubov N.M. et al. Repair of mining machines. M., Nedra, 1978, p. 58). To an even greater extent, this statement applies to bearing arrangements.

Thus, equipment that must be operated for **one year** (8760 hours) **fails after 12 days** ( $8760 : 30 = 292$  hours  $\approx 12$  days).

LIZA materials are developments made at the level of inventions and patented in the Republic of Uzbekistan (patents No. 4740, 5967, 2013 and 6044). The patent owner is Lee V.P. and the small enterprise "FAN".

**The World Intellectual Property Organization** (Geneva) conducted an examination of patent No. 5967 and recognized it as a world-class invention, international publication number - WO 97/25544.

On the Russian website: <https://втораяиндустриализация.рф.рф/zashhita-podshipnikov/> LIZA material is included in the directory of domestic (Russian) breakthrough technologies.

This reference includes developments that:

1. Can be implemented everywhere;
2. Do not require significant investments for their implementation;
3. Significantly reduce technological costs;
4. Provide a multiple reduction in the cost of production (10 or more times);
5. Repeatedly increase the service life and reliability of equipment;
6. Achieve multiple increases in labor productivity;
7. Repeatedly reduce losses, useless and harmful costs in the economy.

The LIZA material was included in the collection "Promising Intellectual Property Objects" of the Agency on Intellectual Property of the Republic of Uzbekistan (Tashkent, 2002, p.50).

The development is included in the catalog of the VIII Republican Fair of Innovative Ideas, Technologies and Projects (Tashkent, 2015, p.63).

The LIZA material made it to the semi-finals of the Open Innovations Startup Tour - 2017 in Astrakhan, the largest event of the **Skolkovo IC** to search for the most promising innovative projects in Russia and the CIS.

**Prime Minister Aripov A.N.**, in 2017, at the X Republican Fair of Innovative Ideas, Technologies and Projects, **included this development in the list of the 12 most effective innovative projects** to be implemented as a priority in the economy of Uzbekistan.

In 2020, SE "FAN" received admission and took part in the Russian Forum "OPEN INNOVATIONS STARTUP TOUR 2020" in the sections "Competition" and "Exhibition", <https://2020.startup-tour.ru/exhibitors/91>.

In 2021, this development was presented at the Forum "OPEN INNOVATIONS STARTUP TOUR 2021" in the "Exhibition" section, <https://2021.startup-tour.ru/exhibitors?page=5>.

In 2022, the innovative project of SE "FAN" was again admitted and presented at the Forum "Open Innovations 2022" in the "Exhibition" section, <https://startup-tour.ru/exhibitors?page=2>.

In 2023, this development was admitted to the Russian Forum "Open Innovations 2023" for the fourth time in the "Exhibition" section, <https://startup-tour.ru/exhibitors/13>.

LIZA antifriction materials are designed to protect rolling bearings from any abrasive substances and corrosive media, from the negative influence of various atmospheric factors.

Abrasive substances in the form of dust, sand, sawdust, fibers, various pollution and aggressive environments in the form of solutions of acids, alkalis, salts during operation penetrate into the bearing units of the equipment and cause catastrophic wear, corrosion, which entails a rapid failure of bearings and a stop of the entire production, line, complex, conveyor, etc.

In fact, abrasives are a micro grinder (angle grinder) that has penetrated into the bearing and **does its dirty work extremely quickly.**

LIZA material is an impact-resistant oil-and-gasoline-resistant composition that is long-term resistant to atmospheric factors, various aggressive environments in the form of solutions of acids, alkalis and salts. The temperature range of operation of the LIZA material is in the range from -40 to + 130° C. LIZA material is certified, environmentally friendly, is non-toxic, non-flammable and fire-free, explosion-proof material.

The bearing industry produces standard bearings with shields and seals, unfortunately a limited range of dimensions.

The small enterprise "FAN" has developed a technology for protecting rolling bearings of any size.

LIZA material can protect all single-row deep groove ball bearings (including heavy series), single-row tapered roller bearings, double-row spherical ball and roller bearings, support ball and roller bearings, cassette and roller bearings of axle boxes of railway cars, track rollers of tracked vehicles, which are produced by open-type bearing factories.

When using standard bearings with shields and seals, abrasives, corrosive media still penetrate into the bearing cavity through the gap between the inner ring and the seal, causing wear and failure.

With this design, there is a gap between the bearing and the LIZA material, measured in tens of fractions (0.1÷0.3) of a millimeter. This gap is filled with grease, which also makes it difficult for foreign particles and substances to enter the bearing cavity.

**The essence of this development is the creation of a labyrinth seal in the cavity of a standard rolling bearing. An open bearing with LIZA material is converted into a rolling bearing that is 3.5 ÷ 10 times longer than a standard bearing with a washer or seal.**

Labyrinth seals are considered the most effective of the existing seals for bearing units of equipment.

The bearing cage is an armature for the LIZA material and therefore it rotates with the cage. The rotation of the LIZA material occurs regardless of whether the shaft (i.e. inner ring) or the outer ring of the bearing rotates.

When the LIZA material rotates, **an effective centrifugal force is generated, which instantly discards any particles and media** that tend to penetrate the bearing.

Therefore, the sealing properties of the LIZA material are much more effective than the shields and seals of standard bearings.

The effectiveness of the development is evidenced by the fact that in the 80s the newspaper "Socialist Industry" together with the USSR State Committee for Science and Technology, the State Committee for Inventions, the Central Council of the All-Union Society of Inventors and Innovators and the Exhibition of Economic Achievements of the USSR took patronage over the introduction of eleven promising developments, one of which was the **AFZ-3** antifriction filler for rolling bearings.

**The economic effect** of one bearing with AFZ-3 material **ranged from 3 to 466 rubles (\$)** at a bearing price of **30-39 kopecks (¢)** ("Today, tomorrow and every day" According to the pages of the newspaper "Socialist Industry" 1969-1989, M., 1989, pp. 162-163).

Unfortunately, bearings with AFZ-3 material, due to its fragility (during transportation, installation and operation), did not go into mass production. Also, bearings with this material are designed for low-speed friction units (100÷300 rpm), since they operate in the mode of only dry friction, which is categorically unacceptable for bearing units of any equipment.

The technological process of protecting bearings with AFZ-3 material is laborious: it requires processing of each bearing on a lathe and simultaneous purging with compressed air.

**The effectiveness of the use of impact-resistant material LIZA has been repeatedly confirmed by acts of industrial tests and implementations** at a number of large enterprises in Uzbekistan:

1. Navoi Mining and Metallurgical Combine;
2. Almalyk Mining and Metallurgical Combine;

3. JSC "Ahangaranshifer";
4. Uzbek plant of refractory and heat-resistant metals;
5. JSC "Kuvayacement";
6. Almalyk JSC "Ammophos";
7. Navoi Construction Department;
8. JSC "Akhangarancement".

**The service life of bearings with LIZA material in friction units of various equipment of these enterprises has increased from 1.5 to 7 times.**

The economic effect of the LIZA material on the conveyor line (CPT) of Navoi MMC alone, calculated by the plant on the basis of its own acts of industrial testing of our development, **is 5 billion soums ≈ \$ 2 million.**

The length of this conveyor line is 10 km, the width of the belt is 2000 mm, the conveyor has 30000 rollers, i.e. 60000 310 ([https://youtu.be/v7SvBf5pe\\_A](https://youtu.be/v7SvBf5pe_A)) bearings. The service life of rollers on bearings with LIZA material has increased by 4 times.

Enterprises of the mining, oil and gas, coal industry, enterprises for the extraction of non-metallic materials and other industries use large-sized deep groove spherical double-row roller bearings. These bearings are characterized by high cost.

To protect the bearing **3656 (22356) worth 400 thousand rubles**, 3 kg of LIZA material is needed. If the durability of such bearings with LIZA increases by 1.5 times, then from the investment of **2 thousand** rubles (the cost of bearing protection), the effect will be at least **200 thousand rubles.**

Per Arnold Elgqvist Olsson, a former mechanical engineer from **SKF** (the world leader in the bearing industry), on the website: <http://ru.bearing-news.com/bearing-reliability-tips-part/>, <http://ru.bearing-news.com/bearing-reliability-tips-part-2/> in Postulate No. 8 issues Conclusion: Use **sealed bearings** as often as possible!

Our video on YouTube: <https://youtu.be/B20pc7GDH6U> shows that this statement is outdated and clearly proves that bearings with LIZA material are **ten times longer** than the service life of standard **sealed bearings.**

**In this video, a standard bearing 180305 (with a protective seal) when exposed to pure abrasive sand worked for only 38 seconds!**

The cost of protecting the rolling bearing with LIZA material is an order of magnitude lower than the cost of the bearing itself.

The amount of lubricant in a bearing with LIZA material is an order of magnitude less than the lubricant rate recommended for bearing units of industrial equipment.

A unique feature of this development is the speed of implementation: 10÷15 days, since this innovative technology practically does not require investment and special equipment.

The equipment necessary to protect rolling bearings with LIZA material is not scarce and is used in all ordinary enterprises (drying laboratory cabinet, drilling and lathe).

Two employees who have mastered this technology can meet the need of a single enterprise for such bearings.

The technological process of protecting rolling bearings with LIZA material was developed by a small enterprise "FAN", is its property, includes know-how.

The LIZA material meets the following formulations:

- Energy and resource saving, energy efficiency;
- Protection of bearing units of various vehicles, equipment; machines, mechanisms and devices;
- Technologies and technological processes of mining, mining and processing, oil and gas, coal, chemical industries, extraction of non-metallic materials, building materials industry;
- Underground mining;
- Application and improvement of conveyor lines;
- Reducing the cost of production;
- Saving energy, material resources and environmental protection;
- Use of industrial products with increased durability;
- Reduction of repair, labor costs in the operation of various machinery and equipment;
- This technology can protect bearings of all sizes.

The development can be exported to other countries.

### 3. PROSPECTS AND SCOPE

#### PROJECT IMPLEMENTATION

3.1. The scope of the project is extensive, since rolling bearings are used in all sectors of the economy of any state.

3.2. In the mining, mining and processing, oil and gas, coal industry, enterprises for the extraction of non-metallic materials, the use of bearings with LIZA is promising due to the fact that the equipment of these industries is constantly exposed to the negative influence of abrasive substances of the extracted raw materials, work in atmospheric conditions, as a result of which they have a low service life.

3.3. It is also necessary to take into account that the equipment of these industries is characterized by large dimensions and, of course, bearings of appropriate sizes. LIZA material can be used to protect bearings of all sizes.

3.4. In the construction industry (reinforced concrete plants, house-building plants, building materials plants, mines, sand quarries, mines, open-pit mines) associated with the extraction of sand, gravel, crushed stone, clay, **i.e. abrasives**, the introduction of this invention will also be very effective.

3.5. In the agro-industrial sector, the use of LIZA material in the bearing units of agricultural machinery, which in the process of operation experiences constant exposure to soil, sand, dust, clay, and various contaminants, is also promising.

3.6. In the chemical industry, the use of chemically resistant material LIZA is effective due to the aggressiveness of the substances and media used.

3.7. In the cement industry, the implementation of this invention will also be effective.

3.8. In the railway industry, the development will also be very promising in the axle boxes of various cars.

3.9. In the flour milling industry, the use of this invention, due to dustiness during the processing of products (wheat, rice, various cereals), seems promising.

3.10. In transport, road-building engineering, the implementation of the development also seems to be effective: the bearing units of this equipment, due to their low location, are constantly in contact with sand, dust, dirt, etc.

3.11. However, first of all, the most promising and 100% guaranteed (at least a twofold increase in service life) is the introduction of LIZA material into the bearing units of conveyor and conveyor lines, as well as mine trolleys, into the axle boxes of railway cars, into the track rollers of tracked vehicles.

The cost of the conveyor belt is **50%**, cost of the rollers is **30%** of the cost of the whole conveyor, so the total cost of the belt and rollers is 80% of the total amount.

The cost of replacing a worn belt is **70%** of the cost of operating conveyors, and the cost of repairing and maintaining rollers is 30-40%.

Increasing the service life of the conveyor belt and rollers will have a great effect, given the universal applicability of conveyors in many sectors of the economy.

The wear of the belt and rollers directly depends on the service life of the rolling bearings on which the rollers rotate. When the bearing is jammed, the rollers stop rotating, respectively, catastrophic wear of the belt and rollers begins, which ultimately leads to a shutdown of the entire conveyor line, forced production downtime and large financial losses.

3.12. Conveyor lines are used in all branches of industry and agriculture.

3.13. As noted above, the economic effect of the use of LIZA material on the conveyor alone (CPT) of the Navoi MMC is **5 billion soums ≈ \$2 million**.

3.14. Hence the conclusion: if there are such savings on the conveyor line of the Navoi MMC alone, then on a national scale the economic effect will amount to **hundreds of millions of dollars**.

3.15. All of the above can be attributed to the bearings of track rollers of tracked vehicles (tractors, bulldozers, excavators, pipe layers, military equipment: tanks, infantry fighting vehicles, BMD, air defense systems), which are produced only in open form.

3.16. The specificity of the operation of the bearings of track rollers of tracked vehicles is such that they work "**up to their ears**" in conditions of complete off-road, experiencing constant, continuous exposure to dirt, dust, sand, as a result of which they quickly fail.

3.17. The above is also typical for bearings of axle boxes of various wagon fleets of railway transport.

3.18. In the Russian Federation, the car fleet of Russian Railways has **1,250,000** pcs. Each car is equipped with 8 cassette-type bearings or 16 roller bearings, i.e. 10 million cassette bearings and 20 million roller bearings.

3.19. One cassette bearing costs 27,000 rubles, if after protecting the cassette bearing with LIZA material, its durability increases by 2 times, then the economic effect will be an unthinkable amount - **270 billion rubles** .

Conclusion - the introduction of innovative LIZA material will significantly increase the service life of bearing units of machines, mechanisms, equipment of all sectors of the economy of any state, which will lead to a large multiplier economic effect.

And finally, the turnover of the global bearing market in 2021 amounted to **129.81** billion dollars, in 2028 this figure will increase to **189.41 billion dollars**: <https://www.linkedin.com/pulse/bearing-market->

[2022-show-impressive-growth-2028-supriya-koshti?trk=pulse-article\\_more-articles\\_related-content-card](#), and the average annual growth rate of bearing products during this period will be kept in the region of 6.5-7.5%.

Director of SE «FAN»



V. Lee