Final Report

« Lightweight gearbox: for which market »

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Introduction

In the beginning of March 2010 our team was formed to work on the EPS project “Lightweight Gearbox” proposed by Dr Lukasz Kaczmarek. We are a group of five students from different nations which accepted to work together. Our aim was to create a commercialization strategy for a product developed in the Institute of Materials Science of Politechnica Lodzka, the lightweight gearbox, a new innovative high-tech product.

To accomplish this task we consider that we are simulating a technology transfer company called TTC whose logo is presented below. Our task was to understand the technology to explore markets and to simulate the creation of a new company for the industrial production of the gearbox. This new company is called “GearExperts” and will be mentioned as such in the rest of the report.

Our task requires a multidisciplinary approach with topics related to mechanics, material sciences, marketing finance and management.
The logo of TTC is as follow:

![Picture 1: logo](image)

The work has been conducted in an autonomous way by our team under the supervision of Dr Kaczmarek. It is part of a greater project connected with technology analysis and conducted with the Innowacja Polska company and Akademia Gorniczo Hutnicza university in Krakow.
The Technology Transfer Company

The scheme below explains the representation of our business plan. The name of our company is TTC MBI. MBI means material science, biotechnology and internet technology. These are our work branches.

Our aim is to create business and new companies. We are always searching for a high-technology in these three branches that we wrote previously. After doing research on the new technology we then make market analysis and business analysis.

One of the businesses that we created is the “Gear Experts”. We have created this company with Technical University of Lodz because after research we know that materials science could be a good way for our business plan. We also know the TU of Lodz is working in development of material branch. For this reason we have proposed them a new business of Lightweight Gearbox.

Scheme 2: Technology transfer company
What is technology transfer?

The team acts as a technology transfer company, therefore it was called TTC. Technology is information that is put to use in order to accomplish some task while transfer is the movement of technology via some communication channel from an organization to another. Technology is the useful application of knowledge and expertise into an operation. Technology transfer usually involves some source of technology, group which possesses specialized technical skills, which transfers the technology to a target group of receptors who does not possess those specialized technical skills, and who therefore cannot create the tool themselves.

The major categories of technology transfer and commercialization involve the transfer of:

- Processes for implementing technology
- Knowledge and skills that provide the basis for technology and process development.
Why transfer technology?

Technology Transfer Company takes place because the organization in which the lightweight gearbox technology is developed is different from the organization that brings the technology to the market. The process of introducing a technology into the marketplace is called technology commercialization. The university has invented the gearbox technology. We develop it into a commercial product or process, and sell it to customers. The university provides know-how and we create the structure to produce and market the products from that technology. This structure is developed with funding from the banks, business angel, loan etc.

Technology transfer companies are important because:

(1) They consist of a body of knowledge and know-how.

(2) They act as a stimulant for healthy competitive international trade.

(3) They have links with other nations' commercial needs.

(4) They create effective plans for management and entrepreneurship from lab to market.

How do we transfer technology?

The step for our organization to transfer technology is finding a suitable recipient for that technology—one that can use the technology and has something of value to offer in return. There are few information activities needed to support technology transfer:

- Technology scouting—searching for light weight gearbox technologies.
- Technology marketing—searching for potential buyers for our light weight gearbox technology, also searching for collaborators, for investors or venture capital to fund a specific technology.
- Technology assessment—evaluating technology, aimed at answering the question "what is this technology worth?" Includes research of any intellectual properties, and market and competitor assessments.

The choice of a mechanism to be used in a particular technology transaction depends on many factors, including the stage of development of that technology, what the company receiving the technology is willing or able to pay, what technology or other assets it might be able to offer instead of money, the likely benefits of establishing a longer-lasting partnership between the organizations instead of a onetime transfer.
For industry, universities offer the best way to acquire basic technological research as those activities are curtailed within firms. Finally, joint industry-university research is viewed as an important recruiting tool in today's competition for scientific talent, since industry-funded projects are often carried out by graduate students who later go to work for their former sponsors.

Technology transfer is a valuable mechanism by which industry can accelerate its innovation activities and gain competitive advantage through cooperation. Technology transfer can also boost overall economic growth and regional economic development.
Product in short

The product we have “discovered” and that we want to commercialize is the lightweight gearbox. It is made of aluminium alloy with specific heat treatment and surface treatment. It allows to build mechanical pieces with hardness as high as low carbon steel, but with a much lower price.

As we said before the Lightweight Gearbox was developed at Politechnika. The design ideas and models have been made. Let us try to locate it on the technology evolution graph below:

Evolution of a technology

I- New ideas are produced by collective brainstorming or through sudden idea of a single person
II- This idea will be developed at laboratories. Models and simulation are made
III- If this product can be constructed, a prototype is built to get practical experience and information
IV- After having a prototype, there should be a research on the market if this product will stand a chance and be successful, considering on its price calculation and therefore its final market price.

V- Launching and growing on the market. After a time the product will decrease its selling numbers.

**Innovation:** New and better product may replace our product and make ours outdated.

**Where we are?**

The gearbox is still in its conception phase (before prototype) but we as a technology transfer company are already devising its commercialization strategy. A prototype shall be needed in the next steps, first to make our business plan more precise, especially the cost calculation, and then as a demonstration tool for promoting our technology.
Team presentation

Before going more into detail let us introduce ourselves in real life. This part shall explain who we are, what we want, how we build our team and how our work was organized in these four months.

Our objectives

1. **To gain knowledge about the technical part**: The team will acquire knowledge about properties of materials, force analysis and how our technology works i.e. the team will have all the necessary information on material engineering of light weight gearbox.

2. **To be acquaintance with marketing**: The team will have the ability to choose a profitable market, have the knowledge of preparing cost estimation for light weight gearbox, a particular product or project and all the needed strategy in business management of our project.

3. **To have an experience in a team working environment**: the members of the team will have the opportunity to know the value of a team and what it takes for a team to work. Although this goal is secondary for our project but it is essential for the progress and outcome of our project which can be utilized by any member of the team in future project.
Who we are?

The Gear Expert composes of five members and each member has a unique quality he contributes for the progress of the project. The fields of the members are utilized during brainstorming and generating ideas. The table below shows the profile of the team members.

<table>
<thead>
<tr>
<th>NAME</th>
<th>NATIONALITY</th>
<th>DEPARTMENT OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minhal Mohsan</td>
<td>Spanish</td>
<td>Mechanical engineering</td>
</tr>
<tr>
<td>Jean Russocki</td>
<td>French</td>
<td>Mechanical engineering</td>
</tr>
<tr>
<td>Garvin Lehwald</td>
<td>German</td>
<td>Mechanical &amp; Business engineering</td>
</tr>
<tr>
<td>Mike Patora</td>
<td>Polish</td>
<td>Science telecommunication</td>
</tr>
<tr>
<td>Babatunde Tijani</td>
<td>Nigerian</td>
<td>Mechanical and applied computer</td>
</tr>
</tbody>
</table>

Table 1: members

The knowledge of mechanics is essential for our project because we have to research and define on our gears. From the above table we can deduce that the members are from different nationalities and 80% of the members have the knowledge of mechanics and only Garvin Lehwald is business oriented from his field of study which is a plus for the team in the aspect of market analyzing and cost estimation.
Team challenges

The team faced different challenges in each stage of the project. On each stage can two common problems occurred, communication of technical vocabulary and organization. When encountering new vocabularies in mechanics of gearboxes or business languages we utilize the dictionary and online translator to change the words to other foreign language for simplification. After well definition of the vocabulary we can do research on the topic and we can decide to apply it to our project.

When the team was formed the first challenge was organization, how to coordinate our team, division of labour and how often the meeting should be held. We decided to contact ourselves via email, SMS, creating a file sharing system online where we can document all our findings and agree when meeting should be held. During the meeting each member’s opinion counts and we compromise when we hit a dead end. Tasks are shared equally among the members to ensure that all members are focused and contribute equally to the project. We appoint a leader of the day to ensure that the meeting goes according to the agenda, also the concentration and participation of all the members during the meetings. The leader of the day also assigns task for the members and he is also responsible for the progress of that meeting either positive or negative. We rotate the position of the leader each day, which means every member has the opportunity to be the leader of the day.

At the beginning, we decided to meet two days per week and four hours each day. We realized that this way was very stressful because every member can’t attend the 4 hour meeting continuously. And we decided to increase the frequency and reduce the length of meeting.

The table on the next page summarizes our challenges and how we overcame it.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organise work efficiently</td>
<td>Choice of a «leader of the day» to share the tasks</td>
</tr>
<tr>
<td>Plan meeting everyone can attend</td>
<td>Increase frequency and reduce length of meetings</td>
</tr>
<tr>
<td>Communication with technical vocabulary</td>
<td>Practice, the rest will follow</td>
</tr>
</tbody>
</table>

Table 2: Team challenges
Work plan

The work plan of the project simply defines which tasks the team wants to achieve at a particular period. There are a few professional tools to create a work plan such as Gantt, pyramid chart, schedule etc. We used both Gantt and pyramid chart for our project. The work plane of our project can be divided into the follow points.

- **GENERAL IDEAS AND KNOWLEDGE OF THE PROJECT:**
  The first step is to do research and acquire all the essential knowledge about lightweight gearbox in the market. This is the most essential knowledge that all the members of the team must possess because all other decisions depend on it: technological choices, choice of market and choice of the properties of aluminium alloy we want to employ in the lightweight gearbox. We acquire knowledge mostly from browsing through the internet, contacts with experts and tips from our supervisor. These three methods have been profitable for the progress of our project.

- **CHOICE OF MARKET:**
  After the team has acquired the necessary knowledge on lightweight gearbox we have chosen two markets that are profitable for the company. We analyse all the potential market by creating a database for the potential markets, by devising criteria of choice: market relevance, size of our market, evolution of the market and prices. These points will be elaborated later in the report.

- **MARKET ANALYSIS:** This is the third step of our work plan which consists of analyzing our selected markets. We have to document the advantages and disadvantage of our markets also the effect on the environment. We also used a professional tool like SWOT to analyze our markets. The two markets chosen are fully analyzed to make the maximum profits.

- **BUSINESS MODEL:** This is a complicated part of the work plan because we serve as a middle company between TU Lodz and the manufacturing company 7. We actually create the business model of that manufacturing company. The team has to make the research on the production process, on sales and marketing, on finance...
• COST ESTIMATION: This is one of the largest part of the project dealing with the aspect of calculating the budget needed to establish the technology for the project, how to maximize profit, how to raise funds and financial documentation of the project. This aspect of cost estimation will be elaborated in the report with the financial statement documented. This part will also determine cost of our lightweight gearbox and how many lightweight gearboxes will be produced.

The above points are the major parts of our work plan and there are also minor parts of the work plan which includes risk analysis, quick look method, force analysis, properties of materials etc. The minor parts of the work plan are also essential to ensure the progress of our project and they help the team to understand and comprehend the major part of the work plan.

Pyramid representation of our work plan

We represented our work plan in the form of pyramid with respect with workload. The work plan elements described above are all included in the pyramid representation where knowledge is at the bottom of the pyramid and business model at the top. We can also see from the diagram below that the work load rises with time. The base of the pyramid is large, as large as all the potential markets. The top of the pyramid, which is our final goal, “a commercialization strategy for the lightweight gearbox” in the beginning was not very precise but after doing research and progressing the target became more precise. From the bottom to the top the workload of the team is also increasing because we are working more in-depth as the scope of our study decrease.
Representation of our work plan.

Scheme 4: Representation of our work plan
Which market?

The main idea is to choose profitable markets where the gearbox can be applied. This part presents the two markets we have chosen, as well as the process of choice of these markets.

To complete this process, it is necessary to look for every industry domain where gearboxes can be found, then look for details about these gearboxes, and then create criteria to select which of these markets are interesting from our point of view.

Let us start with the various potential markets where gearboxes can be applied such as helicopter industries, ships, aircrafts, cars, tanks, RC helicopter, army robot etc.

Potential markets

Scheme 5: market database
We have created a database consists of the tabulation of most of the industrial sector using gearboxes, with types of gears needed in the industries, uses of the gears and materials used for it. Tabulating all this point helps the team to compare all the markets and choose the profitable one. The data base is attached in an Excel file in the CD.

**Definition of criteria of choice**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Irrelevant</th>
<th>Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>Beginning</td>
<td>Mature</td>
</tr>
<tr>
<td>Evolution</td>
<td>Small</td>
<td>Big</td>
</tr>
<tr>
<td>Price vs Cost</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scheme 6: Choice of a market**

In order to choose markets we have defined four criteria of choice:

- **Mechanical relevance**: Knowing the advantages and the drawbacks of our technology, we decide whether it is relevant to use a lightweight gearbox in a market. For instance the decrease of weight is interesting only in mobile devices: it would be useless to use it in a wind turbine.

- **Size of The Market**: The size of the market is a very important factor because of the fact that we are manufacturing a brand new technology on gearbox we have to consider entering a mass production or niche production. The team decided to choose a niche
production to increase profit and eliminating markets such as cars, motorcycles, machine in industries etc. minimizing our choice of market.

- Stage of the market: It can be either infant stage, developing stage or developed stage. The team alighted all the stages and decided to choose a new markets (infant stage) because it’s hardly predictable unlike other stages which have high hindrance of entrance, competitors and other technology are considered has standard.

- Prices: It is necessary to sell at a price lower than current prices and higher than production cost. Therefore we prefer markets which are likely to pay higher for a new modern technology. We discovered that markets such as Formula l and military market will pay higher for new technology on gears while milling industries will not be interested in paying high for new technology.

Considering these criteria the team has decided to choose two markets which are RC helicopters and military robots. Explanation of this choice will be made in the next part.

**Our markets**

Using the process described before the team decided to choose two markets: army robots and military helicopters. In this part of the report will elaborate the impact of our market and simplify the reasons why we choose both markets. The table below will show the reason why we choose RC (Remote Control) helicopter

<table>
<thead>
<tr>
<th>RC helicopter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Why RC helicopters?</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
<th>What we want</th>
<th>What we have</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Criteria</strong></td>
<td>To produce a light weight gearbox</td>
<td>We can apply our light weight gearbox in this market by reducing the weight of the RC helicopter.</td>
</tr>
</tbody>
</table>
## Evolution of market

We need a new market that its consumer will increase in geometric ratio in the nearest future. The RC helicopter is presently used as toys and the application can evolve to other occupation such as policing, filming and spying.

## Size of market

A small market with less competition. There is less competition in the market and profit can be easily made.

## Price

A profitable market. After analyzing the needs of the consumer, the team discovered that it will be a profitable market.

*Table 3: RC helicopters*
The above schematic is a RC helicopter for toys and the materials which are used are not very hard and durable. Our technology offers material with higher hardness. Alloy can be used in some parts which are resistant for friction, wear and fatigue. We can include in these parts gears, rods for transmit power and other metal or polymer materials which can be replaced by aluminium.

The lightweight gears help to reduce weight of our RC helicopter. It can improve agility and time of flight which are very important for RC helicopter. Our technology is not for toys, but its application is much more for professional in a particular field.
Applications of our light weight RC helicopter

There are a lot of applications for our RC helicopter with high mechanical properties and durable construction in our fields of jobs such as media, police, and military, filming etc. We will be discussing only three out of the listed application and how it can improve life of the society.

- **Military application:** The militaries can use the RC helicopter in wars by checking mine fields, observing the battle field which will prevent the loss of soldiers. Our technology enhanced the properties of the RC helicopter by increasing the agility, flight of time also decreasing the weight of the RC helicopter and reducing the fuel consumption. The governments are always interested in technology that will reduce the loss of the soldiers’ life and our technology ensures that and will be profitable in terms of price production for the militaries.

- **Police application:** Police can control the RC helicopter from their district and trail a criminal instead of jeopardizing the life of a policeman. It is easier, the RC helicopter can move faster and very effective. We can easily see how this improved device can improve our life.

- **Media:** The media are willing to have the best relations from events. We can make that possible by giving them our RC helicopter, where we can install wireless camera with very high resolution. We can abstain from hiring cameramen struggling in the centre of crowded event or use real helicopter with a cameraman. We can record event with the perception from our RC helicopter, small fuel consumption and the controller of the RC helicopter controls it from a remote place. Media are always interested in better methods of gaining the information. Our device can be easily applied in bad weather conditions because our device has high melting point and high cold resistance. So we can confirm that application of device with our technology can be very wide.

**Examples of RC helicopter manufacturer.**

Robbe:

It is one of well known German companies which produce RC models. In this company we can also notice in higher priced helicopter there are applied lightweight elements. Some of helicopters are reaching price 1000 euro, but this is not our exact market. Our technology is
expected to produce the best gears and aluminium parts. We are able to look for our markets in companies which produce RC helicopters for army and for special missions or occasions. This is one of the most important part of improving properties of device.

**DragonFlyer:**

It is a Canadian UAV manufacturer producing RC helicopter for police use. Its helicopters are sold about 20 000 US Dollars each.

**Big-size RC**

Some company produce RC helicopters whose price can reach 1 million euros. Our technology is designed for this segment of market. Therefore our company should be on the market for some time to gain the interest of these companies.

Nevertheless we have not found these companies because they are very well secured. It is possible to meet them on trade fairs or exhibitions which are focused on new technologies of materials. After creating reliable and popular brand it will be easier to persuade main producers to our technology and show effects, advantages and that we are now working in Military robots market.
Military robot

*Why military robots?*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>What we want</th>
<th>What we have</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project criteria</strong></td>
<td>To produce a lightweight gearbox</td>
<td>We can apply our lightweight gearbox in this market to reduce weight of the army robot and increase mechanical properties</td>
</tr>
<tr>
<td><strong>Evolution of market</strong></td>
<td>We need a new market that its consumer will increase in geometric ratio in the nearest future</td>
<td>The increase in use in army robot in war has increased immensely and in the nearest future robot will be replaced by solider.</td>
</tr>
<tr>
<td><strong>Size of market</strong></td>
<td>A small market with less competition</td>
<td>The only consumer in our army robots are the military. If we can manufacture a good quality of lightweight gearbox the military are willing to pay.</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>A profitable market</td>
<td>The military are willing to pay high for a new technology of a gearbox to ensure the safety of its solider and citizen</td>
</tr>
</tbody>
</table>

*Table 4: Criteria of choice*
We can deduce from the table in the previous page that the army robot qualifies for all the criteria needed for our market but we have to understand the effect on the environment, history and current market state of the army robot.

The military robot is a high technology which will be the future of the military wars. The military is a radio controlled gadget and there are different types of different military robot. The newest battle robot is called the MAARS, it weighs up to 350 pounds and the battery can last up to 7 days in sleeping mode. The weight of the military robot is important because the speed depends on the weight of the machine. When apply our technology to the army robot and decrease the weight of our gearbox by 60% which is about 500 grams lighter. It is quite a weight loss considering that the gearbox is just a small part of the whole robot.

**Facts on Military Robot**
- US military are ready to spend 230 billion dollars on automated robot.
- Growing market( In 2003 handful robot and 2008 there are 12 000 robots)
- It is high technology which can be employed in the future.
Impact

- **Save soldiers’ life**: The military manufactures the army robot to reduce the loss of life. With the quality and mechanical properties of our lightweight gearbox we will be contributing our part of reducing the loss of life in the battle field. The robot can also be employ not only in battle field but also in spying mining.
- **Increased precision**: The military robot precision is high compare to soldier because it’s controlled by remote, does not feel fear of its opponent and follow its task without considering its own damage.

Past, present and future uses of military robot

There are more than 4000 US military robots on the ground in Iraq, as well as unmanned aircraft that have clocked hundreds of thousands of flight hours. The first three armed combat robots fitted with large-calibre machine guns deployed to Iraq last year, manufactured by US arms maker Foster-Miller, proved so successful that 80 more are on order, said Prof Sharkey. South Korea and Israel both deploy armed robot border guards, while China, India, Russia and Britain have all increased the use of military robots.

Washington plans to spend $US4 billion ($4.3bn) by 2010 on unmanned technology systems, with total spending expected rise to $US24bn, according to the Department of Defence Unmanned Systems. James Canton, an expert on technology innovation and chief executive of the Institute for Global Futures, predicted that within a decade military deployments could include 150 soldiers and 2000 robots. Mr Arkin pointed out that the US Department of Defence $US230bn Future Combat Systems program – the largest military contract in US history – provided for three classes of aerial and three land-based robotics systems. But they aren't just science fiction anymore. The military has deployed thousands of them for use in Iraq and Afghanistan. The most well known are remotely controlled unmanned aerial vehicles, like the Predator. Less noticed are ground robots, but they're a growing part of the war effort. The military has bought more than 6,000 of them since 2003 at an average cost of $100,000 to $200,000 each. One of these is the TALON, which is designed to deal with improvised explosive devices.
A case study: iRobot

The company Irobot is a big company who builds different kinds of robots including the military and government robots. The U.S. Company was founded in 1990 by two men and their professor. They made their vision of making practical robots true.

In 2009 this company had a turnover of more than 298 million U.S. dollars

One of their military robots the 510 PACKBOT costs 73000 U.S. dollars which was sold 3000 times worldwide.

Comparing our cost for the light weight gearbox with the total cost of the robot, we came to the conclusion that it is acceptable.

Irobot builds different kinds of ground and maritime robots. The ground robot pack boot is used for bomb disposal and other dangerous missions for war fighters and first responders while the ground robot 210 NEGOTIATOR has its usage in cities helping police officers and firemen to explore for example a house.

There can be different devices attached to the robots like arms and cameras, depending on the needs.

http://www.irobot.com/gi/

Technology of the product: from materials to end-product.

Materials

For production we are using two aluminium alloys presented below:

<table>
<thead>
<tr>
<th></th>
<th>Aluminium alloy 7075</th>
<th>Aluminium alloy 2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary element</td>
<td>Zinc</td>
<td>Copper and Magnesium</td>
</tr>
<tr>
<td>Composition</td>
<td>5.1-6.1% Zinc, 2.1-2.9% Magnesium, 1.2-2.0% Copper</td>
<td>3.8-4.9 Copper, 1.2-1.8 Magnesium, Manganese 0.3-0.9</td>
</tr>
<tr>
<td>Other elements</td>
<td>Silicon, Iron, Manganese, Titanium</td>
<td>Silicon, Iron, Chrome, Zinc, Titanium</td>
</tr>
<tr>
<td>Mechanical properties</td>
<td>Strong, good fatigue strength, average machinability, low resistance to corrosion</td>
<td>Good fatigue resistance, high strength-to-weight ratio, average machinability, not weldable, poor corrosion resistance</td>
</tr>
<tr>
<td>Price</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

We will apply our technology to these materials and enhance its mechanical properties and compete with titanium and steel.

Titanium is usually used for special constructions like space shuttles because of its low weight, high yield strength and high price. Our aluminium alloy should have high density, high yield strength and good mechanical properties could replace titanium because it can compete with its yield strength but it’s far much cheaper as you can see on table.

The raw price of aluminium is 12% of the price of titanium and if we apply our technology to the aluminium alloy its mechanical properties is harder than low carbon steel and also lighter. The steel market is very huge towards the aluminium market, which gives us the possibility to get a share of the steel market. With our new material we want to specialize in building gears, which aren’t produced with aluminium alloys, but usually with steel. By decreasing the weight in a general and accordingly in gearboxes we will improve speed and fuel efficiency for e.g. in a car. Therefore we were searching for markets where weight in a construction matters a lot.
<table>
<thead>
<tr>
<th>Material</th>
<th>Density</th>
<th>Melting Point</th>
<th>Vickers Hardness</th>
<th>E (MPa)</th>
<th>Thermal Expansion W/(m*K)</th>
<th>Tensile Stress (MPa)</th>
<th>Yield Strength (Mpa)</th>
<th>Prices Dollar/Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium</td>
<td>4.51</td>
<td>1668 °C</td>
<td>60</td>
<td>20.8</td>
<td>331</td>
<td>241</td>
<td>19836</td>
<td></td>
</tr>
<tr>
<td>Aluminium</td>
<td>2.7</td>
<td>660 °C</td>
<td>15</td>
<td>250</td>
<td>110</td>
<td>95</td>
<td>2320</td>
<td></td>
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<tr>
<td>Magnesium</td>
<td>1.74</td>
<td>650 °C</td>
<td></td>
<td>44000</td>
<td>156</td>
<td>20</td>
<td>20</td>
<td>2900</td>
</tr>
<tr>
<td>Aluminium-Alloy 7075</td>
<td>2.81</td>
<td>477-635.0°C</td>
<td>240</td>
<td>71000</td>
<td>630</td>
<td>550</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium-Alloy 2024</td>
<td>2.78</td>
<td>502 - 638 °C</td>
<td>230</td>
<td>73100</td>
<td>506</td>
<td>356</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium-Alloy Ti-6Al-4V</td>
<td>4.43</td>
<td>1604 °C</td>
<td>396</td>
<td>114000</td>
<td>1170</td>
<td>1100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Materials
Manufacturing of a gear

The aim of the technology is to create a mechanical piece made of aluminium alloy with the following properties:

- Higher Vickers Hardness
- Low coefficient of friction

To increase the Vickers hardness of the aluminium alloy we have to reduce the size of the grains and make the precipitate smaller and dispersed. To achieve a low coefficient of friction we have to employ coating to our aluminium alloys.

The technology consist five phase for achieving high Vickers hardness and low coefficient of friction which are:

- 1st thermal treatment
- Plastic deformation
- 2nd thermal treatment
- Milling of the gear
- Gradient Coating

1st heat treatment

This is the first phase for preparing the introducing the aluminium alloy in high temperature for about 10 hours. The impact of this process the precipitate is dissolved into the aluminium alloy. Atoms of elements making the precipitate move to the octahedral sites inside the cube-centre-face structure of aluminium alloys. This thermal treatment does not change the size grain but a merely a preparation step before the plastic deformation which is going to reduce the size of the grains. In fact a plastic deformation on a structure full of precipitates is likely to create cracks inside the structure and therefore to worsen its mechanical properties.

After the thermal treatment then the aluminium alloy a quick quenching is needed (putting the alloy in a cold fluid to make its temperature lower FAST in order to FREEZE the structure previously described, structure which is not stable at ambient temperature)
This is the second stage of our technology after 1st thermal treatment and quenching of the aluminium alloys. The process reduces the size of grain thereby increasing the Vickers Hardness. The diagram below is a press showing how a plastic deformation can be performed.
The second treatment is applied after the plastic deformation. The aluminium is heated in the furnace for about 10 hours. This is needed to increase the durability of our lightweight gear. This part of technology creates small and dispersed precipitate inside the small grains thus increasing once again the hardness of the material.
Milling of the gear

The aluminium cylinder is later cut using a CNC machine.

The CNC machine used for manufacturing our project is a five multiaxis machine. The five multiaxis are XYZQ and B allows increasing precision when performing milling on our gears. We combined our CNC with conical tools and a ball nose cutter to improve the milling precision without impacting speed. The CNC helps to have the desired dimension of a given gear.

![CNC Machine Diagram](image)

*Picture 6: A CNC machine*
Gradient coating

This phase is required to decrease the coefficient of friction as well as to protect the aluminium alloy against oxidation. In fact the presence of aluminium oxide at the surface of the alloy creates the risk of delaminating.

Coating is made by a plasma enhanced chemical vapours deposition using diamond-like carbon which.

We deposit a thin film at low temperatures on manufactured gears.

We had an option to utilize the CVD reactors without settling for a lesser film quality but we want to achieve the best properties. The reason for our high quality diamond like carbon deposit films was because our deposits was at 300 to 350 degrees centigrade while comparing the same operation with CVD the requirement temperatures will range from 650 to 850 degrees centigrade to produce similar quality films.

Plasma Enhanced chemical vapour deposition uses electrical energy to generate a glow like plasma in which the energy is transferred into a gas mixture. This changes the gas mixture into reactive ions, radicals, molecules, and other highly excited species. These atomic and molecular fragments combine with a substrate and, depending on the nature of these interactions, either deposition or etching processes occur at the substrate. Since the formation of the energetic species in the gaseous phase which occurs by collision in the gas phase, the substrate can be maintained at a minimal temperature. Hence, deposition of film formation can occur on substrates at a lower temperature than is possible in the conventional CVD process, which is a major advantage of PECVD.

Some of the desirable properties for our gears while using the PECVD films are good adhesion, low pinhole density, good step coverage, and uniformity.
Scheme 4: a PECVD machine

Graphical presentation of the phase

- **Temperature**
- **Medium temperature heating**
- **Quenching**

10 Hrs

**Time**
Hardness

Scheme 5: Hardness (t)

- Heating
- Plastic Deformation
- High T
- Medium T

Time
A business plan for the company

Now that we, the technology transfer company, know the product and its market, it is time to design the business plan of the Gear Experts, which is the company we are going to create.

In this part we will remind the scheme of the company and then first make a SWOT analysis of the product in the two markets and then calculate the production cost, calculate the Net present value and present the financial scheme of the company.

SWOT Analysis

Introduction: what is SWOT?

A scan of the internal and external environment is an important part of the planning process. Environment factors internal to the market chosen can be classified as strength (S) or weaknesses (W), and those external to the team can be classified as opportunities (O) or threats (T) such an analysis of the strategic environment is called SWOT and this tool is employed in our project. This analysis provide information that is helpful in matching our resources and capabilities to the competitive environment in which it operates.

SWOT Analysis Framework
SWOT Analysis of RC Helicopter

Strengths

The RC helicopter’s strengths are its resources and capabilities that can be used as a basis for developing a competitive advantage. The strengths of our company are listed below.

- Saves lives (military)
- Improve Information from TV channel
- Creates better security (control the city from the height instead of policeman)

Weaknesses

The lack of certain strengths of the RC helicopter’s market is viewed as its weakness.

- Quiet expensive device
- This is quite new market so we don’t know how long it will be running

Opportunities

The external environmental analysis may reveal certain opportunities for profit and growth. We have listed our opportunities below

- This market is very wide. It covers police station TV Station and Army.
- It is new market whose future is unknown

Threats

The change in the external environment also may present threats to our chosen market. Future threats are listed below

- Shift in consumer taste away from the RC helicopters
- Emergence of substitute technology on gearboxes
• Long time of establishment on the market.
• Competition from company with bigger financial firepower.

<table>
<thead>
<tr>
<th>SWOT analysis</th>
<th>O1</th>
<th>O2</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>W1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>W2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6: SWOT Matrix of military robots

In these SWOT analysis tables we are able to recognize that we will achieve a positive result if we apply “Aggressive strategy”. Aggressive strategy has 5 points or less. This market is new, so if we are going into this market quite aggressive we will achieve our purpose and block the competition. We should employ this aggressive strategy to reduce competition in the market.

Firstly our company should build hard and strong foundations by creating parts of military robots gearboxes. It is a very reliable market, consumers demand high quality and we offer the best from the lightest materials.

After 3 to 4 years our position on the market will be better and cost of leasing machine will have decreased. We will then at last be profitable. This will be further explained in NPV analysis part.

Everything can be focused on marketing campaign strategies. It can take a long time to look for reliable and big companies, who wants to produce Professional RC fuel helicopters.

After doing SWOT analysis we can say that we are sure about that we will start from the market of military robots, because in the beginning we must limit our expenses it is easier to build our brand image in a stable market.
Army robot swot analysis

**Strengths:**

- New Technology: We have a material which is unique. No one has ever built a gearbox with that yield strength combined with this low friction and such a light weight.
- Saves life

**Weaknesses:**

- Small company, no support from e.g. a parent company
- Low and tight calculated budget
- No experience in leading a company
- No historical record about lightweight gearbox, hard to predict outcome.

**Opportunities:**

- Labour cost in Poland: Labour cost in average is low compared to the other countries within the European Union which reduces our production costs.
- Availability of manpower
- Low inflation rate on automation and technology: we will be the first ones on the market and can grow very fast without competitors in a short term.
- A new and strong growing market: It is a government market, which means big money in proportion of the number of customers. The Army robots market is a long term market and not effected by trends. Potential demand could be anywhere in the world. Promotion cost should be low because of the small amount of customers (governments).

**Threats**

- Exchange Rate: The location of the manufacturing is important because most materials are bought in international currency euro and dollars but the present location of our manufacturing is in Poland where the currency is in zloty. The rise and fall of zloty will affect our cost analysis.
Copyright problem: Big companies could copy us and produce cheaper and more efficient in a long term.

Military robots SWOT matrix

<table>
<thead>
<tr>
<th>Swot analysis</th>
<th>O1</th>
<th>O2</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>S2</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>W1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>W2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7: Military robots SWOT Matrix

O1 Well trained manpower
O2 Inflation rate low
S1 Know-how
S2 Unique Product
T1 Threat by bigger companies
T2 Unstable exchange rate
W1 small Company
W2 Small budget

We have got competition but we are well prepared for fighting we have our technology there are some companies which are producing parts for military robots but there is no monopolistic company which produces the most. Our technology is innovative in comparison to company which is on the market now.

Model for cost estimation

There are a lot of techniques and tools used in cost estimation during our research we documented all this technique and the best available to employ in our project. We decided to estimate our cost with the production of one gear, price of buying, leasing and outsourcing. When calculating our profit we have to forecast for 10 years of working our company. In the first three years it is possible that our company will be at loss because we have to entice and have time of gain customers. The company is established for long term profit making. As mentioned earlier our cost estimate is based on what we buy, what we lease and what we outsource.
What we buy

The materials needed for our project will be purchased depending on the price of the materials. We shall also keep inside the company the machines and materials which contain our know-how. The know-how part of our technology is important because we have to prevent copy right and fraudster. The materials to be purchased are documented and there prices are checked in the internet, contact with manufacturers and estimate price from experts. The taxes on products bought are also considered when buying a machine needed for or technology and the amount needed for our technology to gain the maximum profit.

What we lease

A leasing is a contract by which an owner (the lessor) of a specific asset grants a second party (the lessee) the right to its exclusive possession and use for a specific period and under specified conditions, in return for specified periodic rental or lease payments.

The team concluded that materials or machines which are expensive and are parts of our know-how technology can be leased for a particular period and if the maximum profit is made we can purchase the materials or machine. We made research on leasing and discover all the types of leasing which can be employ in our technology and we chose operating leasing.

Operating leasing the lessor has the full risk for the leasing object. He is responsible for the maintenance, the insurance, the repair etc. The contract can be cancelled right the way or on a short term. The object can be rent out over and over again. We as the lessor have the full control and own the materials or machines.

Outsourcing

Outsourcing involves the contracting out of a business function to an external provider, while in leasing we own and control the materials, machine or technology involve. This method is cheap, reduces cost and increase profits. But we can’t allow the know-how part of our technology to be outsourced. The team documents the materials, machines and technology which does not consist of the know-how part be performed and expensive be performed by outsourcing.

All the three points above are major steps we consider while computing the cost estimation and few minor steps are listed below.
– Identifying technology performance and/or technical goals.

– Laying out a program schedule.

– Selecting a cost element structure (cost data base).

– Collecting, evaluating, and verifying data.

The employers’ salaries are also calculated by numbers of shifts/hours the employers made. It makes our work much more fast and efficient.

The table below show the choices we made as far as leasing/buying is concerned.

### Tables of buying and leasing

<table>
<thead>
<tr>
<th>Outsourcing</th>
<th>Buying</th>
<th>Leasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNC Machine</td>
<td>Slicer</td>
<td>Furnace</td>
</tr>
<tr>
<td></td>
<td>Forms</td>
<td>CVD Machine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Press</td>
</tr>
</tbody>
</table>

*Table 8: Buying or leasing*

We can outsource the milling of the gear because it does not show our know-how. And we don’t have to worry about competition.

We can buy slicer and forms used for plastic deformation because they are not very expensive. Slicer is cheap in comparison to other parts. Forms so prepared specially for our company so we should pay for them now.

We also need expensive machines such as PECVD. It is the best idea to lease these machines for 10 years time because it is cheaper, easy to cancel and it includes maintenance services.
Where do we produce?

It is important to know the dimension of our production building because it will have an influence on the renting price.
Where do we produce after 4 years?

Where do we produce after 6 years?
Cost estimation

As the excel sheet shows the price of a gear is around 9.37 Euros.

Cost is divided as follow:
The repartition of cost is typical of a new industrial technology. The process is more capital intensive and work account for only 13% of the cost.

A cost of around 10 Euros is valid for the industry since even with 50% margin

**Net Present Value Analysis**

The business plan of our company shows profitability of our company. NPV is much greater than zero. IRR is greater than discount rate. In our calculations we have assumed 50% of discount rate because it is business with high risk

In the calculus sheet is the analysis of the Net Present Value of our company. It also includes a forecast of our profitability for next ten years.

The increase of the number of PECVD machines decreases our price per gear by 5% per additional machine because it increases the use ratio of other machines.

Each one CVD machine can take load of production of 5000 gearboxes by year. We are starting from 0 year because this assumption is necessary for calculations of NPV. Our income was calculated from formula:

\[
\text{INCOME} = \text{NUMBER OF PRODUCED GEARS} \times \text{PRICE FOR CUSTOMERS}
\]

\[
\text{LOSSES} = (\text{COST OF LEASING PER ONE GEAR} \times \text{CAPACITANCE OF PRODUCTION}) + \text{MARKETING COSTS} + \text{RESEARCHES COSTS} + (\text{NUMBER OF PRODUCED GEARS} \times \text{PRODUCTION COST PER ONE GEAR})
\]

\[
\text{TOTAL COST} = \text{COST OF LEASING PER ONE GEAR} + \text{PRODUCTION COST PER ONE GEAR}
\]

\[
\text{PRICE FOR CUSTOMERS} = \text{MARGIN} \times \text{TOTAL COST}
\]

\[
\text{TAX} = (0.22) \times \text{INCOME}
\]

\[
\text{REVENUES} = \text{INCOME} - (\text{LOSSES} + \text{TAX})
\]

We have started from margin 65% and by each addition of PECVD machine we have added 5% to our margin. Instead of this fact our total price for one gear for customers decreases and we are more competitive. We are not focusing on generating profits but also on marketing and researches to develop our company.
The 50% discount rate is very high in our NPV calculations because it is very risky business. Companies which are connected with technology transfer and new technologies are not similar to bakery and wholesale with popular products.

More data about costs calculation is given in database in excel in this database is also showed NPV which is positive for our company.

We have taken a uniform tax of 22% of our income. It is uniform tax for this type of element from aluminium. In the beginning we start from 2 PECVD machines and after 10 years we will be able to have 6 PECVD machines which can produce about 30000 parts yearly.

What is also very important is 8% of our income. We have divided this sum over marketing and researches. If we need more customers we are applying more money advertisement. If our situation is good we can focus on developing our technology and invest more money in improvements of our technology. For example we have putted more money 8% of income into marketing in sixth year, because we were supposed to rescue our customers and look for new.

If our company runs better more money are putted into advertising and researches. It is very good method to invest each year some of earned money to develop everything.

NPV is positive so our company is worth to take into consideration this business plan. Our company will be profitable NPC coefficient shows us if is it profitable.

IRR coefficient is about 58% so is greater than discount rate. It shows us that our business will be profitable and we will achieve profits. IRR coefficient shows us the level of discount rate for which our NPV of company will be equal to 0.

The table below shows a simulation of the financial situation of our company in 10 years.

<table>
<thead>
<tr>
<th>Years</th>
<th>What are we doing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-Buying CVD Machines</td>
</tr>
<tr>
<td></td>
<td>-Entering Military Robots Market</td>
</tr>
<tr>
<td></td>
<td>-Marketing 6%, researches 2%</td>
</tr>
<tr>
<td></td>
<td>-Negative Profit</td>
</tr>
<tr>
<td></td>
<td>-Look for customers</td>
</tr>
<tr>
<td>2</td>
<td>-Development in Military Robots Market</td>
</tr>
<tr>
<td></td>
<td>-Marketing 6%, researches 2%</td>
</tr>
<tr>
<td></td>
<td>-Negative Profit</td>
</tr>
<tr>
<td></td>
<td>-Look for customers</td>
</tr>
<tr>
<td></td>
<td>Development in Military Robots Market</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>-Marketing 4%, researches 4%</td>
</tr>
<tr>
<td></td>
<td>-Positive profit</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-Buying CVD Machine (very good situation)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-Buying CVD Machine (very good situation)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>-Crisis</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-Very good position in military robots market, since 7 years and after Crisis</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>-Distribution For military robots</td>
</tr>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>-Distribution for Military Robots</td>
</tr>
<tr>
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<td></td>
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</tbody>
</table>
Final Report

Technology Transfer Company

- Production very high
- Look for customers
- Lower price per gear

<table>
<thead>
<tr>
<th>10</th>
<th>Distribution for Military Robots</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Going into RC Helicopters market</td>
</tr>
<tr>
<td></td>
<td>Marketing 4%, researches 4% (more work on researches technology)</td>
</tr>
<tr>
<td></td>
<td>Positive profit</td>
</tr>
<tr>
<td></td>
<td>Production very high</td>
</tr>
<tr>
<td></td>
<td>Slower looking for customers</td>
</tr>
</tbody>
</table>

Table 9: 10 years in the life of our company

Finance scheme of the company

In that part is detailed the financial aspect of the project. It includes:

- The sources of money it is possible to use
- The financial scheme of our company
- What do we need to apply for funds?
Sources of capital

A new, innovative and promising company can get money from many sources. It should also have several sources of funding. Being financially supported will help to boost the image of the project to the banker. Sources of money can be:

- **Personal funds**
  
  It may be our own money or money of relatives. They may prove the banker you are committed to the project.

- **Bank loans**
  
  It can be difficult to get money from a banker at the beginning. Guarantee from personal funds of goods or from someone external can help. Having investors already involved in the project increase confidence.

- **Venture capitalists**
  
  Those are investors interested in high-tech and growing sector such as IT telecoms and biotechnology. In exchange from their money they get a share of a company and therefore a part of your decision-making project. Venture Capitalists usually expect high return. They stay in until introduction on stock exchange.
  
  Venture Capitalists firms include small teams with technology backgrounds (scientists, researchers) and others with business training or deep industry experience.

  Plus: Add skill beside capital, ready to take high risk

  Minus: require high return on investment, have their look in the management.

  Scope: $1m projects.

- **Business angels**
  
  They are usually rich retired businessmen who help small companies with experience, connection and with managerial or technical know-how. They get the right to monitor the company.

  Looking for a business angel is not easy, since it’s not a formal process. Networks of business angels do exist. But finding the good one is a matter of personal contact and connection.
Moreover the business angels network are more developed in the US, developing in Western Europe but at still an infant stage in Central Europe (and Poland).

Plus: Give connections and experience as well as money.

Minus: Difficult to raise big sums of money

Scope: 25 000 Euros – 100 000 Euros

Links


http://www.franceangels.org regional French network


http://www.lba.pl/en a more developed one.

“Seed” capital (which includes VC and BA) is a rather developed business. Website such as can help getting contacts and information. http://entrepreneurs.gate2finance.com

- State subsidies – EU funds

In general, companies face huge competition in order to get them. The most common model is co-finance, which requires the company to provide a minimum share of the money.

Subsidies may come from local, national and European authorities.

EU commission offer subsidies to companies.

75% are structural funds given mostly to companies in less developed countries. Poland can apply.
25% are grants given in specific programs of the European commission
As a technology transfer company it is possible to apply for structural funds.

It is necessary to apply directly to the European Commission or an executive agency which runs the program in question.

Funds may also be provided through financial institution: loans guaranteed by EU funds are given under the JEREMIE program of the European commission, a program specifically dedicated to SMEs (small and medium companies).
- Private company subsidies:

Some companies offer awards and grants for innovative companies. For instance Deloitte Fast50 subsidizes companies with huge potential growth.

**Other links**

http://www.earlystageinvestors.org

**Non-cash capital**

- Business incubator:

  Allow newly-born companies (up to 2 years) to share buildings and materials...

**What are the needs**

Most of our machine will be leased over ten years thus reducing the amount of capital needed at the start.

We need a starting capital to:

- Cover the first three years of running the company where no profits will be done (see profits parts) : estimated to 50 000 Euros

  Provide guarantee for the financial partners especially the leasing company

  Keep running funds to fund current production

Therefore we estimate our starting capital to 80 000 Euros
Our financial scheme:

Repartition should be as follow:
What next?

In this report we have drawn the outline of the company which is going to produce the gearbox, but we still need to develop some parts if we wanted to create a real Business Plan. Among those parts are:

- Contacting leasing companies in order to know what are the real costs of leasing our machines.
- Devising the real time and means of production by manufacturing a prototype.
- Getting contact with business partners: business angels, banks …
- Get in touch with the companies likely to be our customers: RC helicopters manufacturing companies, robots manufacturers … and also with suppliers, in our case the one milling the gears.
- Find out information about tax-free places in Poland.
- Find out the place where the production should take place.
We have contacted a German leasing company in order to get information about the cost of leasing of a CVD machine. Here is the information we sent, first the original then an English translation.

Guten Tag Herr Lehwald,

Vielen Dank für Ihre Geschäftsleasing-Anfrage für Produktions- und Druckmaschinen.

Wir leiten Ihre Anfrage nun umgehend an unsere Partner weiter.

Ihre Referenznummer zu dieser Anfrage: #33501

Ihr Angaben zum Objekt:

Neu / Gebraucht....................: neu
Hersteller / Marke..................: IONBOND
Modell / Typ.......................: Bernex PA-CVD
Alter / Baujahr....................: 00/0
Betriebsstunden-Stand...............: 0 Stunden
Jährliche Betriebsstunden..........: unbegrenzt h
Preis in EUR.......................: 200.000,00 ohne Ust.
Gewünschter Liefertermin.........:
Listen-/Neupreis...................: 0,00 NettoAnzahlung......................:
0,00
NettoGewünschte Laufzeit..........: 24
Ihre Kontaktdaten:

Unternehmen.....................: Technische Universität
Abteilung.........................: Wissenschaftsabteilung
Branche...........................: Maschinenbau
Ansprechpartner...................: Herr Garvin Lehwald
Strasse / Nr.....................: Żwirki 36
PLZ / Ort..........................: D-90924 &£321;6d£378;
Nachricht des Kunden:
Es sollen 10000 Raeder im Jahr beschichtet werden mit einem Durchschnitt von 10 cm.
Vielleicht gibt es auch alternative Maschinen

Folgende Leasing-Unternehmen werden beauftragt, Ihnen ein unverbindliches Leasing-Angebot über das oben genannte Objekt zu erstellen:

- AXON Leasing AG, Grasbrunn bei München
- BLG Bizerba Leasing GmbH, Balingen
- defrasa ag, Saarbrücken
- FML Finanzierungs-u. Mobilien Leasing AG, Hamburg
- HW-Leasing GmbH, Wismar
- KML Kurpfalz-Mobilien Leasing GmbH, Edingen-Neckarhausen
- KR Leasing GmbH, Wolftratshausen
- LeaseForce AG, München
- Nürnberger Leasing AG, Nürnberg
- Rheinisch-Westfälische Leasing GmbH, Dortmund

Wir bedanken uns für Ihre Anfrage!
Ihr leasing.de AG Team!
Good day Mr. Lehwald,

Thank you for your business leasing request for production and printing presses.

We will forward your request immediately now on to our partners.

Your reference number to this request: # 33 501

Your Cabin information:

New / Used ...............: new

Manufacturer / brand ...........: IonBond

Model / Type .................: Bernex PA-CVD

Age / Year ...............: 00 / 0

Hour-Stand ........: 0 hours

Annual operating hours ....: indefinitely h

Price in EUR .................: 200,000.00 without tax.

Desired delivery date ....:

New price .............: 0.00 net deposit ....................: 0.00

Leasing period ..........: 24

Your contact details:

Company ..................: Technical University

Department ...................: Science Department

Mechanical engineering industry ......................:

Contacts ..............: Mr. Garvin Lehwald
Street / No ..............: Žwirki 36
Postcode / City ..............: D-90 924 Łódź
Phone .....................: 0048788272752
Mobile .....................: 0048788272752
Email .......................: garvin.lehwald@student.fh-kiel.de

Message of the customer:

It should coat 10000 wheels per year with an average diameter of 10 cm.

Perhaps there are alternative machines

The following leasing companies will charge you a non-binding contract

These are the Available leasing companies below:

- AXON Leasing AG, Grasbrunn / Munich
- BLG Bizerba Leasing GmbH, Balingen
- Defrasa ag, Saarbrücken
- U FML financing. Equipment Leasing AG, Hamburg
- HW-Leasing GmbH, Wismar
- KML-Palatinate Equipment Leasing GmbH, Enghien-Neckarhausen
- KR Leasing GmbH, Wolfratshausen
- Lease Force AG, Munich
- Leasing AG Nuremberg, Nuremberg
- Rheinisch-Westfälische Leasing GmbH, Dortmund

Thank you for your inquiry!

Your leasing.de AG Team!
References

Technology transfer
http://www.wright.edu/techtransfer/


http://www.gdrc.org/uem/techtran.html

Markets

Helicopters:
http://www.helihobby.com/

Scheme of Helicopter:

Military Robots:

Military Tanks
http://www.onthewaymodels.com/index.html

http://www.koenigstiger.net/Bauplane/Leo_1A4_Tamiya_1_16/leo_1a4_tamiya_1_16.html

http://members.tele2.nl/s_weggeman/CG.htm

http://www.mark-1-tank.co.uk/russian-t34.html


Business Model

SWOT:
http://en.wikipedia.org/wiki/SWOT_analysis

NPV Analysis:

http://en.wikipedia.org/wiki/Net_present_value
Finance:

http://www.businessknowhow.com/money/startup-money.htm


http://www.learnsaveinvest.com/4-simple-money-rules-to-get-you-rich

http://www.learnsaveinvest.com/4-simple-money-rules-to-get-you-through
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