



“Bureau of Technology Incorporated”

“B.O.T Inc.”

“Becoming the Essence of Survival”

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# Section 1

## Executive Summary

Velocity Prep is a program sponsored by Skillpoint Alliance designed to give high school students opportunities to experience Science, Technology, Engineering, and Mathematics (STEM) fields. The students are hired as contractors that are given a challenge that they must create a product prototype for a specific client. The main concern for students are finding a productive solution to the challenge and relating their product to a wider market. Students must present their design as an oral presentation and product proposal.

The challenge for this product was sponsored by the Department of Mechanical Engineering at the Cockrell School of Engineering at UT. Students were hired to participate in a RoboTech program that would design and construct a prototype robot for search and rescue purposes. A total of 17 students from Del Valle High School participated in building a robot to help save lives after a natural disaster occurs by searching for humans in the rubble found after a natural disaster.

Our company, B.O.T developed a robot prototype that is able to walk on different surfaces not only on a straight surface. The robot is designed to search through rubble to find any people that the disaster left behind. The creation of our robot is made to help save people without endangering any workers.

# Section 2

## Company Introduction

Our company is named Bureau of Technology Incorporated; our purpose is to make a successful prototype that will benefit the society after a natural disaster has taken place. As a team our goal is to make a good impact on society and help save someone's life using our robot. The mission for our team is to save those in society without injuring any humans in the process, Bill Hanson of Star Flight stated, "there are many risks faced from being a part of the Star Flight team, as a team they face medical issues and life and death situations". Mr. Hanson believes there are steps to mediate those risks the steps are to train hard, identify hazards before someone is hurt, and lastly to act quickly. In the same way, it is our company's mission to become the essence of survival by designing a robot that will save the lives of those it helps to rescue and prevent injuries to rescuers during the process of their assistance. We are honored to help the field of search and rescue and saving someone's life will be one of the best accomplishments achieved in life.

# Section 3

## Problem Statement

Our goal is to help save lives after a natural disasters using robotics. ‘name of the robot’ will be able to search for people that need to be rescued. The goal for our team is to keep the workers from doing dangerous jobs that could possibly get them injured.

### DID YOU KNOW?

On May 23, 2011 in Joplin, Missouri a tornado destroyed 30% of the town and cut a six mile path through the city.





- “Occasionally, two or more tornadoes may occur at the same time”
- Violent Tornadoes are 70% of all tornadoes and lifetime can exceed 1 hour.
- 29% are strong tornadoes, nearly 30% of all tornadoes deaths, may last 20 minutes or longer, winds are between 110-205mph

# Section 4

## Project Management

The first week on the project all of the student employees were split into two teams to create their own businesses or corporations. When each team was split apart we had to decide on the type of situation to focus on; as a team we decided to build a robot that would search for people in rubble after a disaster occurs.

The Bureau of Technology Incorporated (BOT, Inc.) is managed by Ricardo Camacho. During the course of the project, BOT took the concept of determining the level of difficulty and structure to create a final robot prototype that would be able to help search and rescue people that are found after a natural disaster. To get the robot prototype to work properly we had to reconstruct and be determined to finish. The building of the prototype was a bit difficult because of small errors and getting off task. We spent our first week getting to know each other and searching different types of disasters. The design that was chosen changed probably every second after someone else came up with a seemingly better idea. Everyone had a different idea to put into the building process of the robot and not every idea was used but in the end we came to a conclusion on the building structure of 'name of the robot'.

Dillon Rowan, Rodrigo Contreras, and Wolf Thomas worked as the mechanical team to build the robot's structure. They examined different formats of building structures and determine an outcome based on how the structure will affect the programmers design. The most difficult part of the design was keeping the gears in place; to keep the gears in position screws were inserted into a very small area. The robots bottom structure was also a challenge because it was supposed to be light enough to be lifted by the wheels while in motion but because of its weight and gears it had to be reconstructed until the wheels could move with the weight of the base.



Ricardo Camacho, Kayla Tovar, Joshua Dussault, and Wolf Thomas participated in the programming of the robot. The programmers were tasked with making the robot move properly. Programmers must anticipate all of the moves the robot should make and determine how the robot will function without glitches. Programmers and the mechanics worked closely together during the course of the robot's construction.



Written resources and materials were collated into a project proposal and presentation by Brionna Waldon and Yessica Tabarez. The proposal and presentation detail the steps taken by BOT during the robot's creation.



From the start of the project the team had a few problems but learned to overcome all of these obstacles. As a team we had different opinions to what the final product should include; we talked things through and discussed the variety of functions the robot should have. The most challenging thing was agreeing on the design to build, and applying the wheels to the robots structure.

# Section 5

## Final Product

“Name of robot” is made to keep rescuers from doing dangerous things that can get them injured. The robot is designed to find people that are in an emergency situation and rescue them from that habitat.

During the project each team had a few struggles with the way the robot prototype was to be designed and how much they should work. To begin the project the programming team started off using a Labview tutorial. Labview is a step by step program that helps beginning programmers get started on programming a robot. Labview has different types of programs but the most useful of the programs is called “diagram”. Diagram shows every step on how a robot will and should function. Using the program was very challenging because the students didn't know how to properly use the system. As they kept using the program things got easier and they understood the program even more . Another useful program was “Schematic Editor”. Schematic Editor allows you to see the ways that the motor will be put on and the proper way it should work. The most difficult thing was trying to figure out where to put the wires inside of 'name of the robot' ,and making sure the wires and the motors didn't get tangled with what was already located inside of the robot.

The Beginning of the project the mechanical engineers had to think about the way the robot should be built. The team thought about all the ideas to make the robot better but there was always a negative outcome. There were disagreements on the size of the wheels and on how the size of the base would affect wheels. The most difficult stuff were the smallest details on the robot, there were many errors such as constructing the base and getting the robot in motion. The base had to be built perfect because it had to be able to support the weight of the gears, motors, and wires.

Item	Quantity	Part Number	Retailer	Individual Cost	Subtotal
D-Link DCS-1000 Ethernet Internet Camera	1		<a href="http://www.amazon.com">www.amazon.com</a>	\$34.00	\$34.00
The Hillman Group 8 in. x 12 in. Plastic For Sale By Owner Sign	2	045899393147	<a href="http://www.homedepot.com">www.homedepot.com</a>	\$4.50	\$9.00
Multi-purpose Drip Oil	1	79567100348	<a href="http://www.homedepot.com">www.homedepot.com</a>	\$1.485	\$1.485
2x2 Foam Linking Mats	1	295099	<a href="http://www.lowes.com">www.lowes.com</a>	\$17.98	\$17.98
Wagner HT1000 10 Amp Heat Gun	1		<a href="http://www.homedepot.com">www.homedepot.com</a>	\$22.96	\$22.96
				<b>Total:</b>	<b>\$85.425</b>

## Parts List:

- Tetrix Channel 288
- Tetrix Channel 160
- Tetrix Angle 144
- Tetrix Bracket Flat
- Tetrix Plate 64mm x 192mm
- Tetrix DC Motor mount
- Tetrix Keys Nut 6-32
- Tetrix Screw SHCS 6-32 x 1.5
- Tetrix Screw SHCS 6-32 x 1.25
- Tetrix Screw SHCS 6-32 x 0.5
- Tetrix Axle D-shaft
- Tetrix Nylon Spacer Small
- Tetrix Bronze Bushing
- Axle Set Collar
- Tetrix DC Motor
- Tetrix DC Motor Controller
- Tetrix Servo Controller
- Tetrix Servo
- Tetrix Power Switch
- Tetrix Battery Pack
- Red Wire
- Black Wire
- Motor Wire
- Servo Extension
- Tetrix Bracket L-Angle
- Tetrix Hub Spacer
- Tetrix Gear 40
- Tetrix Gear 80
- Tetrix Allen Wrench

# Section 6

## Improvements and Recommendations

There are many improvements that could be done to “name of robot”. The robot does not have threads for the wheels; using threads would help the robot walk better on any surface. If the wheels were threads it would be easier to go over rubble. It would be simpler if the robots controller had more control over the actions the robot could make. The robot should have heat sensors instead of infrared, but do to a limited budget we only have infrared. Heat sensors are needed because they are good at sensing body heat at any time given and make it easier to see at night. Researchers have proven that there are a lot of high winds after a disaster; therefore the robot should be able to withstand high winds. Along with withstanding high winds the robot cannot be too heavy, the robot must have a limited amount of weight to ride in an emergency helicopter. During the time of rescue there can be hail, which in time creates rain causing for the robot to be able to resist water without any difficulties.

## Things Still Needed In Search and Rescue

During our research we visited the hard workers at star flight stated that they could use an infra-red or thermal camera to make night rescue a bit simpler. They would like for their moving map to be updated when the city builds more roads and maybe the map could be color coded with time topography (distance of elevation in meters or feet). They recommended that the robot be equipped with navigation and is able to update found information to nearby aircraft. The robot should be able to send information via satellite such as the kind of condition the area is in and if there is any human life.

# Section 7

## Appendices

# Resources

The American Red Cross, NOAA FEMA. "Tornadoes....Nature's Most Violent Storms."  
*NOAA's National Severe Storms Laboratory*. Web. 15 June 2011.  
<<http://www.nssl.noaa.gov/edu/safety/tornadoguide.html>>.

Fisher Communications, Inc. "Rescuers Race to Find Survivors of Missouri Tornado |  
Bakersfield Now - News, Weather and Sports." Bakersfield Now - News, Weather and Sports.  
BakersfieldNOW.com. Web. 23 June 2011.  
<<http://www.bakersfieldnow.com/news/national/122455234.html?tab=gallery#img4>>.

- ❖ Jack Dobbler
  - Emergency Management of Texas
- ❖ Andrew Olsen
  - ("The World of Work ")
- ❖ Erika Gonzalez-Lima
  - Department of Psychology
- ❖ Skillpoint Alliance for such a great opportunity
- ❖ Bill Hanson
  - Star Flight
- ❖ National Instruments
- ❖ Sponsors
  - The Greater Austin Chamber of Commerce
    - Gold: Spansion | UT Department of Mechanical Engineering
      - Silver: Total Facility Solutions

# Employee Company Profiles

## Ricardo Camacho

I am 18 years old, attending Austin Community College. My goal for RoboTech is to have a successful prototype that will help other engineers. My desire in life is to become a successful accountant.



## Wolf Thomas

I am 16 years old, I am an incoming junior at Del Valle High School. My goal with RoboTech is to finish the robot. Getting the robot finished and working is my main goal to help others



## Yessica Tabarez

I am 16 years old, I am an incoming junior at Del Valle High School. My goal with this project is to save people's lives from the natural disasters we have on earth. Helping save the life's of others makes me feel great; in the future I look forward to becoming a nurse.



## Brionna Waldon

I am 17 years old, I am an incoming senior at Del Valle High School. My goal with RoboTech is to come up with an idea that will help save someone's life. There are many different things in life that require someone else assistance and it should be something to help them through any life changing issue.



Rodrigo Contreras

I am 16 years old, I am an incoming junior at Del Valle High School. My goal related to RoboTech is to sell “name of robot”. This project will help save people’s lives, and that is what I look forward to accomplishing.



Kayla Tovar

I am 15 years old, I am an incoming junior at Del Valle High School. My goal in RoboTech is to help build “name of robot”. I like putting things together and helping on projects that will help save others life.



Dillon Rowan

I am 16 years old, I am an incoming junior at Del Valle High School. My goal with this project is to get the frame of the “name of robot” built .My desire in life is to get a good job.



Joshua Dussault

I am 17 years old, I am an incoming senior at Del Valle High School. My goal for this project is to help people. My desire in life is to change the world “Sound inspiring”.

