Team Power Hawks Requirements

Breakaway Requirements

Prepared for

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Prepared by

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Programming Team Mentors

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1 REQUIREMENTS EXECUTIVE SUMMARY

This requirements document should be viewed as a contract between the various teams making requests of the Programming team and the Programming team itself. When requirements are described verbally, they can misinterpreted, not received correctly, etc. By writing the requirements into a document, both parties, those making the requirements and those fulfilling the requirements (Programming Team) can agree on them and then point to the document if and when disagreements occur.

Each requirement should have a designated priority (1, 2 or 3) assigned to it by the team submitting the requirements. Use a "1" to denote something of most importance. If a "1" is used, it should indicate Team Power Hawk's best chance for success if that requirement is fulfilled. A "3" should be used for ideas that would help the team to be successful in competition – but it's okay if it is not accomplished. A "3" would be placed next to "nice to have's". A "2" is the middle ground where it's important for the Programming team to accomplish, but should be worked on after the "1" requirements are met.

Additionally, each requirement should have a difficulty level assigned to it. The Programming team should review each requirement and assign a difficulty value of 1 to 3 to it. A difficulty value of 1 would indicate that the Programming team believes it will be easy to accomplish. Simple math is applied to create a score of each requirement [PRIORITY x DIFFICULTY = SCORE]. Scores that are low (1, 2, 3) are easiest to obtain according to the Programming team and best for the overall team. Scores that are high (6 or 9) are hardest to obtain and not as of interest to the team giving the requirement. Therefore, the Programming team will focus on the lower scored requirements.

Team Power Hawks is one team. It's structured into the following sub teams ('teams' going forward). The team captains are as follows:

	Sub Team	Sub Team Lead
1.	Programming Team	Brandon Hoffman
2.	Drive Team	James Batterden
3.	Mechanism Team	Patrick Gomoljak
4.	Controls Team	Drew Hutchison
5.	Electrical Team	Case Marker
6.	CAD Team	Katie Breitwieser / Sean Bruegman
7.	Communications Czar	Matt Parangot

The following table breaks requirements into those that come directly from a single sub-team (Drive, Mechanism and Controls) and areas of interest (Camera, Autonomous Period, Teleoperated Period).

Requirement-Type & Description	
DR	Drive Requirements
MR	Mechanism Requirements
KR	Camera Requirements
DC	Driver Game Controller – Controls Requirements
OC	Operator Game Controller – Controls Requirements
BC	Driver Station Board Controls – Controls Requirements
AR	Autonomous Period Requirements
TR	Teleoperated Period Requirements

It's expected that only three teams (Drive, Mechanism, and Controls) are to give requirements to the Programming team. Should other teams have requirements, bring them to Mr. Dressel (mentor) or the Programming team lead.

- Drive Requirements (denoted with prefix "**DR**") – The Drive Requirements section defines any requirements upon the Programming team in the area of operating (driving) the Robot. No reference to HOW the Robot it is to be controlled by the driver station (Driver or Operator) is to be placed in the requirement. The goal in this section is to understand how the wheels, swivelling/stirring, etc, are to work. Additionally, if there are controls or settings on the motors or devices controlling them that are of interest to the Drive Team, they should be documented in the Drive requirements.

- Mechanism Requirements (denoted with prefix "**MR**") – The Mechanism Requirements section defines any requirements upon the Programming team in the area of operating the mechanisms themselves. No reference to HOW the mechanism it is to be controlled by the driver station (Driver or Operator) is to be placed in the requirement. The goal in this section is to understand how individual mechanisms are to be operated, and what types of systems that power them (motors, pneumatics, etc.). Additionally, if there are controls or settings on the mechanisms or devices controlling them that are of interest to the Mechanism Team, they should be documented in the Mechanism requirements.

- Controls Requirements are broken down into three areas (denoted with prefix "**DC**", "**OC**" & "**BC**") – The Controls Requirements section defines any requirements upon the Programming team in the area of how a Controller (Driver or Operator) would control the various mechanisms on the Robot from the driver station. Additionally, if there are indicators, inputs and/or outputs on the Driver Station board, they are to be documented here. Their viewpoint is in reference of controlling the movement of the Robot (Driver) as well as the operation of the various mechanisms (Operator).

  - **NOTE:** The Controls Team must be the advocate of the Driver and Operator of the Robot. Since Drivers and Operators will utilize their controls, the Controls team needs to have a thorough knowledge of how both the Driver and Operator intend to use their controls.

Each requirement has a unique identifier starting with the prefixes given above plus numbers. The idea here is that each team can refer to a specific requirement in verbal discussions, electronic and

otherwise. Please continue to use the unique identifiers as requirements are communicated between teams.

NOTE: Each requirement has a unique identifier. As a result, should a specific requirement be withdrawn, its unique identifier is to stay intact but crossed out and left as part of the document with an explanation of why it was withdrawn.

The following illustration is an example of what occurs when various groups don't communicate their ideas or if one groups doesn't listen to its customer. The tree swing picture depicting a tire and rope swing in various states of dysfunctionality, illustrates the pitfalls of poor product design, or poor customer service, and the dangers of failing to properly listen to customers and interpret their needs.

The tree swing also demonstrates the dangers of departmental (read: sub-teams) barriers, and failures of departments to talk to each other, and to talk to customers (i.e. the sub teams giving the requirements).

The various 'thoughts' that each group had envisioned the solution.		**If the customer (Drive, Mech., Controls) wants a 'tree swing', build them a tree swing. Listen! Write it down.**
what marketing suggested	what management approved	as designed by engineering
what was manufactured	as maintenance installed it	what the customer wanted

2   DR: DRIVE REQUIREMENTS

See **Section 1: Requirements Executive Summary** for the explanation of the Priority and Difficulty columns in the table as well as the description for Drive requirements.

NOTE: There are two items that may be of interest to the Programming team. One – Jaguars have jumpers that determine whether motors BREAK or COAST. Jaguars also have the ability to program this determination at competition time. The Drive team doesn't have any interest for this ability to be utilized. Programming team determined that they will not pursue it either. Two – each drive motor will be outfitted with an Encoder device that allows for the speed of the wheels to be known (as well as figuring out how far the Robot will have rolled in a specific direction). The Drive team doesn't have an interest in this ability. However, Programming team is looking into the usefulness of Encoders for Autonomous Period.

Req.	Priority (1-3)	Difficulty (1-3)	Drive Requirement Descriptions
DR 01	1	1	**Drive:** The wheels on each side of the Robot will be connected together. Controlling of wheels is described in the Control Requirements section.
DR 02	1	1	**Drive:** There will be one motor to control the drive system on each side of the Robot.
DR 03	1	1	**Drive:** The Robot will move forward when both drive systems move forward.
DR 04	1	1	**Drive:** The Robot will move backward when both drive systems move backward.
DR 05	1	1	**Drive:** The Robot will turn left when the right drive system goes forward and the left drive system is stopped or moving backwards.
DR 06	1	1	**Drive:** The Robot will turn right when the left drive system goes forward and the right drive system is stopped or moving backwards.
DR 07	1	1	**Drive:** The Robot will stop moving when both drive systems are not moving.

3 MR: MECHANISM REQUIREMENTS

See **Section 1: Requirements Executive Summary** for the explanation of the Priority and Difficulty columns in the table as well as the description for Mechanism requirements.

When the Kicker action occurs via button press, it will go through the following steps:

1. Stop Roller
2. Extend Piston-A (Latch) via energized solenoid-1of2, to release Gate Latch
3. Timer (0 – 2000 milliseconds) ← Testing will determine this amount
4. Timer Starts for FRC Rule imposed two second delay between kicks.
5. Retract Piston-A via energized solenoid-2of2
6. Timer (0 – 2000 milliseconds) ← Testing will determine this amount
7. Extend Piston-B (Reset Kicker) via energized solenoid-1of2
8. Restart Roller

Grappler-Winch is a CIM motor that will start at 100% power. It's a single direction. No 'release' or 'reverse' action is possible.

Req.	Priority (1-3)	Difficulty (1-3)	Mechanism Requirement Descriptions
MR 01	1	2	**Kicker:** There must be a 2 second delay between Kicker operations. This is per FRC rule G30 ("The Game" manual)
MR 02	1	2	**Kicker:** The Kicker operation must be initiated by the Driver. See above list of activities to be accomplished when the Kicker is utilized.
MR 03	1	2	**Kicker:** The Kicker will have a single amount of force (no dual action such as a Soft and Hard kicks).
MR 04	1	2	**Kicker:** When the Kicker is initiated the Roller needs to be halted prior to the operation of the Kicking mechanism.
MR 05	1	2	**Kicker:** After each Kicker operation the Roller needs to be re-started.
MR 06	2	1	**Roller:** The Roller will operate at a predetermined constant speed during the match.
MR 07	3	1	**Roller:** The Operator must be able to turn the Roller on and off.
MR 08	3	1	**Roller:** The Operator will have the ability to change direction of Roller.

MR 09	3	1	**Ball Indicator:** Robot will have an 'inset' where ball can enter and be controlled by the Roller. An indicator is warranted to alert Operator that ball is correctly in front of Kicker.
MR 10	2	1	**Grappler-Arm:** The Grappler-Arm movement must be initiated by the Operator. The Mechanism team expects the Grappler-Arm will be extended by firing a piston.
MR 11	2	1	**Grappler-Arm:** The Grappler-Arm needs to be able to be extended or retracted by the Operator
MR 12	2	1	**Grappler-Winch:** The Grappler-Winch will raise the Robot off the ground by retracting a cable with a one way Winch. When Grappler-Winch is engaged, the Roller is to be turned off.
MR 13	2	1	**Grappler-Winch:** The Grappler-Winch will be turned on and off by the Operator. This is accomplished by Operator holding down button (Grappler-Winch in operation) and releasing button to stop the Grappler-Winch.

4 KR: CAMERA REQUIREMENTS

See **Section 1: Requirements Executive Summary** for the explanation of the Priority and Difficulty columns in the table.

Overall priorities for Camera:

1. Driving mode is more important than Targeting mode
2. Stationary camera mounting should be easiest to accommodate
3. Panning action (X-axis) is preferred by the Driver compared to Tilting action (Y-axis)
4. Panning and Tilting together is desired by the Driver

Camera Targeting mode:

- Targets are mounted on all four corners of the field. Targets are the same for both Red and Blue alliances
- The Camera will pan and tilt automatically to locate a Target
- Once the Target is located it will stay locked on that Target
- When the Target is located it will notify the Driver and Operator (KR11)
- The Camera will stay in Targeting mode until it changed to Driving Mode by the Operator (KR12)
- Targeting mode will operate when the Robot is moving or stopped

Req.	Priority (1-3)	Difficulty (1-3)	Camera Requirement Descriptions
KR 01	1		**Camera:** The Camera is to have two main modes: Driving and Targeting. Camera will always be in one of the two modes.
			Autonomous Period: Camera will only be in Targeting mode
			Teleoperated Period: Camera will be in Driving mode with the ability to switch to Targeting mode when warranted.
			In Targeting mode, the Camera is independent of the Driver and Operator as it looks for the targets of the goals.
KR 02	1		**Camera:** In Driving mode, the Camera is controlled by the Operator. If possible, make it operational by the Driver as well.
KR 03	1		**Camera:** In Teleoperated period, the default mode of Camera is Driving mode.
KR 04	1		**Camera:** Camera operation must not require the Camera to be mounted centered on the Robot (left-to-right). It may need to be mounted off to the left or right side of the center line of the Robot.

KR 05	1		**Camera:** The Camera's default position (viewing wise) will be directly in front of the Robot. This is to be considered the center line and/or 0 degrees. This is true for both Pan (X-axis) and Tilt (Y-axis).
KR 06	1		**Camera:** The Camera will be able to PAN 45 degrees on either side of the center line on the X-axis
KR 07			**Camera:** The Camera will have the ability to TILT 45 degrees up/down on Y-axis.
KR 08			**Camera:** The panning and tilting of the Camera will be Operator or Driver controlled. When this occurs, Camera is to switch to Driving mode.
KR 09	3		**Camera:** The Camera will turn on when the Robot is powered up and assume its default position.
KR 10	3	3	**Camera:** The Operator needs to control whether video is displayed on Driver Station or not. Should video streaming cause lag in control of Robot, Operator needs to turn off video feed as necessary to correct lag.
KR 11	3	3	**Camera:** The Operator and Driver will be notified that the Camera has locked on to the target via an audio/visual mechanism, Ear piece?
KR 12	3	3	**Camera:** The Camera will switch to driving mode when either of the Operator controller joystick's (Button-11 or Button-12) are used when the Camera is in Targeting mode.

5 CONTROLS REQUIREMENTS

Controls Requirements are broken down into three areas of Driver, Operator and Board (denoted with prefix of a "**DC**", "**OC**" or **"BC")**. The Controls Requirements section defines any requirements upon the Programming team in the area of how a Controller (Driver or Operator) would control the various mechanisms on the Robot from the Driver Station. Control requirements are to be based on interviews of a Driver and Operator of the Robot and how they intend to control it.

As of February 2010, both the Driver and Operator controls will be a Logitech game controller.

Driver Quick List:

11 – Left Joystick:
Controls the Left Drive system. X-axis is ignored for speed.

12 – Right Joystick:
Controls the Right Drive system. X-axis is ignored for speed.

6: Kick

Operator Quick List:

11 – Left Joystick: Tilt camera up/down. X-axis movements are ignored.

12 – Right Joystick:
Pan camera left/right. Y-axis movements are ignored.

6: Turn on/off Grapple-Winch

8: Extend/Retract Grapple-Arm

2: Turn on Camera Targeting mode

5.1   DC: Driver Game Controller – Controls Requirements

Where a requirement in another section is addressed by a requirement below, the requirement is placed at the end of the text in bold print.

Req.	Priority (1-3)	Difficulty (1-3)	DRIVER Controls Requirement Descriptions Answers: How is Driver's Control Laid Out?
DC 01	1	1	**Driver Control:** Button 11-Left Joystick: The Left Joystick will control the operation of the left drive system, forward, reverse, and stop. **DR01, DR02**
DC 02	1	1	**Driver Control:** Button 12-Right Joystick: The Right Joystick will control the operation of the right drive system, forward, reverse, and stop. **DR01, DR02**
DC 03	1	1	**Driver Control:** Button 11/12 combos – The Left and Right Joysticks, used together, will move the Robot in the desired direction by the Driver. **DR03, DR04, DR05, DR06, DR07**
DC 04	1	1	**Driver Control:** Button 11/12 combos – The Left and Right Joysticks will only move in a forward and back motion (Y-axis). All side to side motion (X-axis) is ignored.
DC 05	1	1	**Driver Control:** Button 11/12 combos – Left and Right Joysticks: The further the joysticks are pushed in either direction (Y-axis) will cause an increase in the speed of the Robot.
DC 06	1	1	**Driver Control:** Button 11/12 combos – Releasing both joysticks will bring the Robot to a halt. **DR07**
DC 07	1	1	**Driver Control:** 6-BUTTON: 6 - Button initiates the Kicker. If Kicker is activated and Robot is in the two second delay period – button press is ignored. **MR01, MR02, MR03, MR04, MR05**

5.2   OC: Operator Game Controller – Controls Requirements

Req.	Priority (1-3)	Difficulty (1-3)	OPERATOR Controls Requirement Descriptions Answers: How is Operator's Control Laid Out?
OC 1	2		**Operator Control:** Button 11-Left Joystick: Tilt camera only. The Camera will only accept up/down movements to tilt camera up/down 45 degrees. Ignore X-axis movements. **TR03, KR02, KR07, KR08**
OC 2	2		**Operator Control:** Button 12-Right Joystick: Pan camera only. The Camera will only accept left/right movements to pan camera left/right 45 degrees. Ignore Y-axis movements. **TR03, KR02, KR07, KR08**
OC 3	1		**Operator Control:** 8-BUTTON: Extend or Retract the Grapple-Arm. Button press does not need to be continuous. **MR10, MR11**
OC 4	1		**Operator Control:** 6-BUTTON: Button 6 will toggle the Grappler-Winch on and off. If Grappler-Arm is stowed, button press is ignored. Button must continuously be pressed for Grappler-Winch motor to run. **MR12, MR13**
OC 5	3	3	**Operator Control:** 2-BUTTON: Button 2 will turn Targeting Mode on. **KR01, KR12, TR02**

5.3   BC: Board Control – Controls Requirements

Board Controls represent controls placed on the Drive Station that are not on either the Driver's game controller or the Operator's game controller.

Req.	Priority (1-3)	Difficulty (1-3)	Board Control Requirement Descriptions — Answers: How is the Driver Station's Inputs/Outputs to be utilized?
BC 01	2		**Board Control:** Difficulty-Switch: 2-Position switch. Position switch to set the complexity of the Autonomous program. There are two options "Simple" and "Complex". Switch setting is ignored in Teleoperated Period. **AR02, AR04**
BC 02	2		**Board Control:** Zone-Switch: 3-Position switch that will determine which zone (Near/Middle/Far) the Robot has been located. Switch setting is ignored in Teleoperated Period. **AR02, AR03**
BC 03	2		**Board Control:** Delay-Switch: Potentiometer where the full range of potentiometer is used to represent 0-15 seconds. 15 seconds represents the full amount of time in the Autonomous period. Switch setting is ignored in Teleoperated Period. **AR02**
BC 04	2		**Board Control:** Roller-Direction-Switch. 3-Position switch that sets the Roller to forward action, reverse action or off. Center position of switch will cause Roller to stop. **MR07, MR08**
BC 05			**Board Control:** Ball-Indicator – This indicator lights when ball is in position to kick. When a ball is not available, indicator is not on. **MR09**
BC 06			**Board Control:** Kicker-Indicator – This indicator represents Kicker is ready to kick or not. It turns Red after Kicker has been utilized and is in the two second delay. It turns Green otherwise. NOTE: There is no sensor in place to indicate there is enough pressure in the pneumatic system. **MR01, MR02**
BC 07			**Board Control:** Camera-Mode-Indicator – This indicator displays Green when in Driver Mode and Red when in Targeting mode.
BC 08			**Board Control:** Target-Acquired-Indicator – This indicator displays Green when target has been acquired. This is true for either the Autonomous or Teleoperated Periods. **KR11**

BC 09		**Board Control:** Camera video feed is displayed by default on Classmate (Driver System). If BC10 is accomplished, video feed will display based on 2-position switch setting.
BC 10	3	**Board Control:** Camera-Feed-Switch. 2-Position switch that causes the Camera video feed to appear on Classmate (Drive Station) or not. **KR10**

6   AR: AUTONOMOUS PERIOD REQUIREMENTS

Autonomous Period Requirements (denoted with prefix "**AR**") – The Autonomous Period Requirements section defines any requirements upon the Programming team when the Robot is running in autonomous period.

Req.	Priority (1-3)	Difficulty (1-3)	Autonomous Period Requirement Descriptions
AR 01	3		Autonomous Period: The Robot will operate for the full 15 seconds of the Autonomous Period.
AR 02	3		Utilizing the inputs of the three Board Control switches (Difficulty-Switch, Zone-Switch, Delay-Switch), the appropriate sub-Autonomous program will execute.
AR 03	3		There will be three sub-Autonomous Period programs available: 1. Near Zone (Offensive: represents Robot in zone closet to our targets/goals as well as the Driver/Operator). 2. Middle Zone (In Autonomous Period, neither Defensive nor Offensive) 3. Far Zone (Defensive: represents Robot in furthest zone from Driver/Operator)
AR 04	3		There will be two levels of difficulty for each sub-Autonomous Periods: 1. Simple 2. Complex

7 TR: TELEOPERATED PERIOD REQUIREMENTS

Teleoperated Period Requirements (denoted with prefix "**TR**") – The Teleoperated Period Requirements section defines any requirements upon the Programming team when the Robot is running in the Teleoperated period.

Req.	Priority (1-3)	Difficulty (1-3)	Teleoperated Period Requirement Descriptions
TR 01	1		During the Teleoperated Period the Camera will be in one of the following states: • Driving Mode (default) • Targeting Mode
TR 02			The Operator must initiate the Targeting Mode.
TR 03			The Operator may cancel Targeting Mode. This occurs when Operator utilizes the Tilt or Pan related joystick buttons.