CPR *ISS Division* 2020 Documentation

Cedar Park Robotics - Team 3663

CPR 3663

CPR Informatics & Scouting/Strategy

A Subdivision of Cedar Park Robotics

Table of Contents

CPR *ISS Division* - 2020 Documentation

More Than Just Robots...

ISS = Informatics & Scouting/ Strategy Division
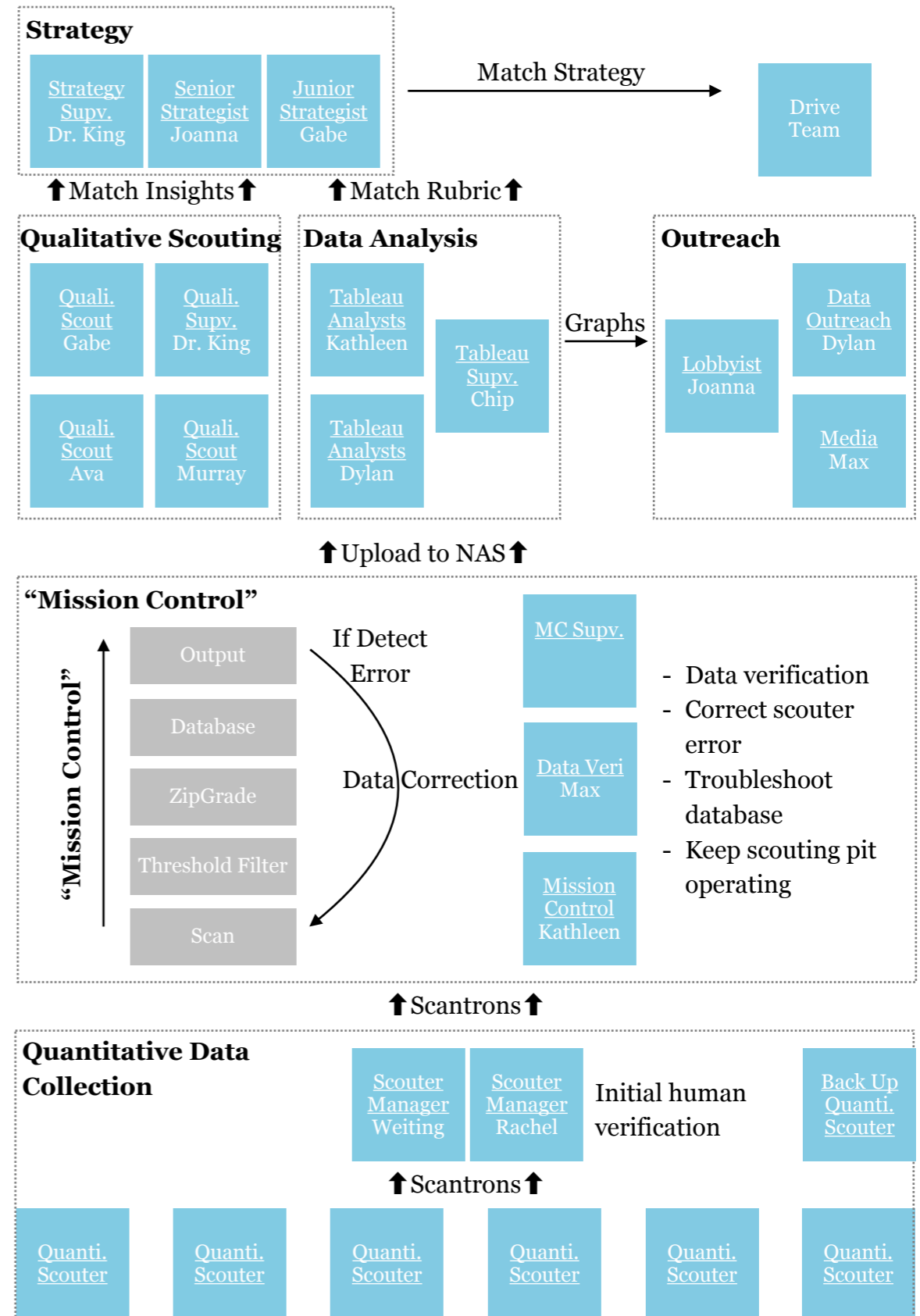
Visit Cedar Park Robotics website to learn more about us

Visit *ISS Division* page to learn more about how we scout

Visit our "Outreach & Learning" page for helpful resources

CPR 3663
CPR *Informatics & Scouting/Strategy*
A Subdivision of Cedar Park Robotics

2020 CPR *ISS Division*

Strategy
- Strategy Supv. Dr. King
- Senior Strategist Joanna
- Junior Strategist Gabe

→ Match Strategy → Drive Team

↑Match Insights↑   ↑Match Rubric↑

Qualitative Scouting
- Quali. Scout Gabe
- Quali. Supv. Dr. King
- Quali. Scout Ava
- Quali. Scout Murray

Data Analysis
- Tableau Analysts Kathleen
- Tableau Supv. Chip
- Tableau Analysts Dylan

Graphs →

Outreach
- Data Outreach Dylan
- Lobbyist Joanna
- Media Max

↑Upload to NAS↑

"Mission Control"

Output
Database
ZipGrade
Threshold Filter
Scan

If Detect Error

Data Correction

MC Supv.

Data Veri Max

Mission Control Kathleen

- Data verification
- Correct scouter error
- Troubleshoot database
- Keep scouting pit operating

↑Scantrons↑

Quantitative Data Collection
- Scouter Manager Weiting
- Scouter Manager Rachel
- Initial human verification
- Back Up Quanti. Scouter

↑Scantrons↑

- Quanti. Scouter
- Quanti. Scouter
- Quanti. Scouter
- Quanti. Scouter
- Quanti. Scouter
- Quanti. Scouter

3

Outreach & Learning

A part of our team's mission is to educate the innovators of tomorrow, but this goal extends beyond the personnel of our own team. Sharing our knowledge with the next generation and even other teams allows us to fulfill our responsibility to exhibit gracious professionalism.

Shining a Light in Our Community

Elevating the Level of Play for Everyone

Our team believes that Gracious Professionalism involves sharing the resources we have with others. As we pride ourselves on collecting accurate data, we have decided to make our data open and accessible to everyone. We believe that making well-informed decisions and strategies based on meticulous data elevates the level of play for everyone.

Sharing Data

We use the Tableau Desktop® and "Scantron" based "CPR Data Collection Interface" which ensures that our data is accurate and organized. The data is checked and then posted at regular intervals throughout the competition so

Scan to access our online match data & strategy tips
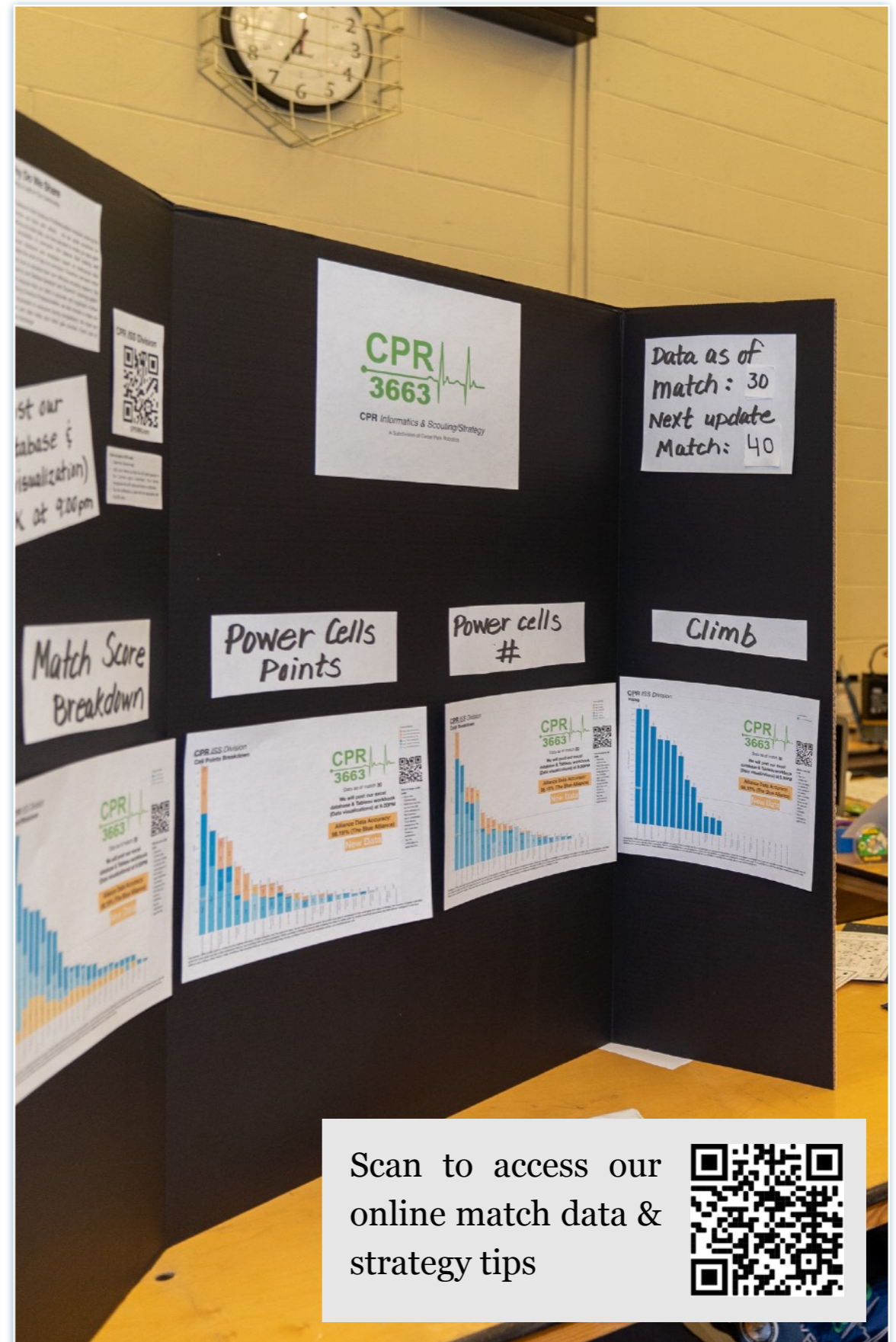
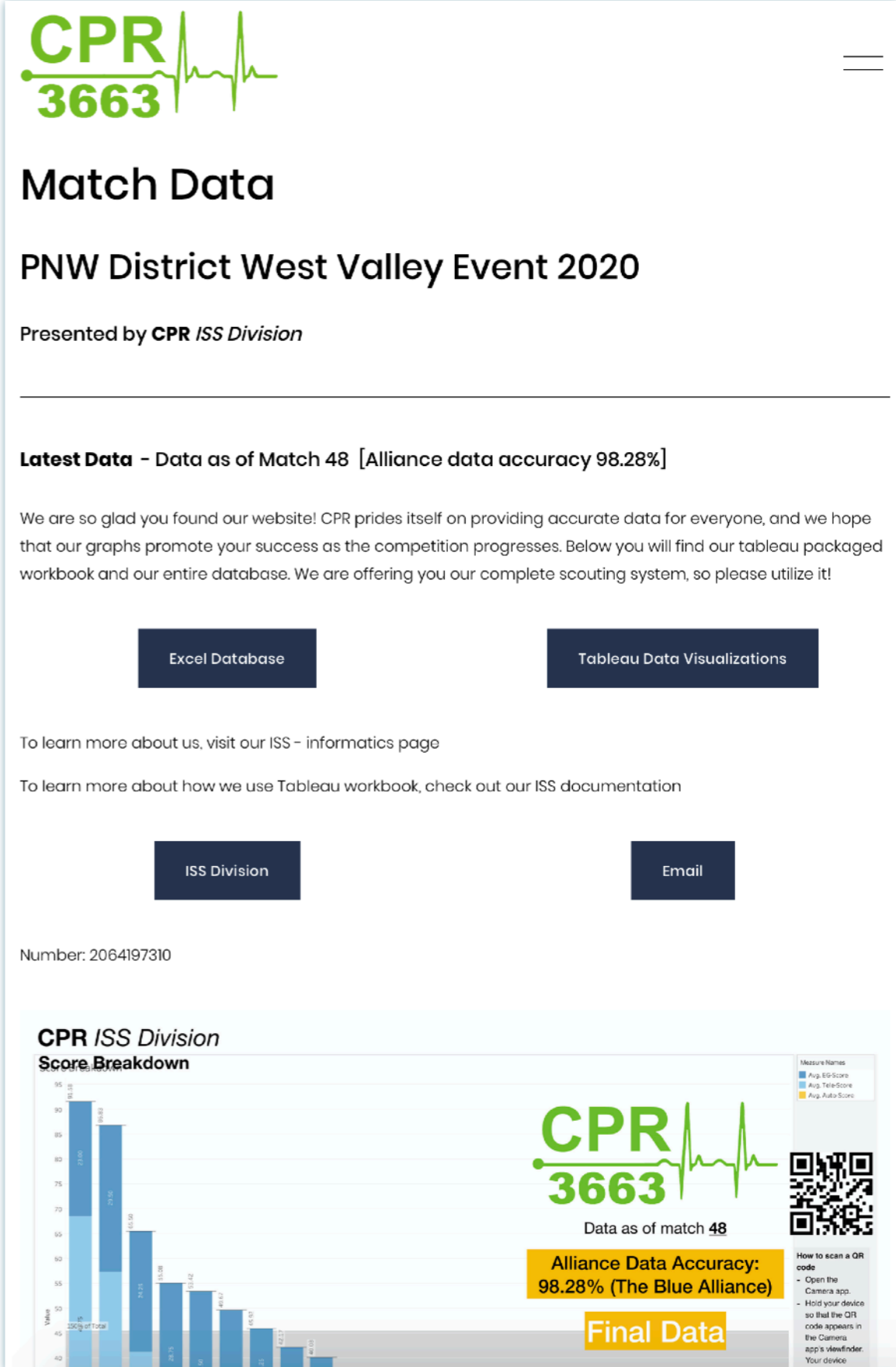that it is timely and relevant to all teams.

Posting Data online

In addition to posting data physically at the competition, we share stats on our website (cpr3663.com). By simply scanning our QR codes, competitors and visitors are able to access our full version "Mission Control" database, Tableau® data visualization, shared graphs, and match insights. Furthermore, they will be able to learn more about our ISS team structure and find helpful scouting and outreach information. This paperless method of sharing is not only environmentally friendly, but also gives everyone instant data access. Starting from PNW District - Glacier Peak Event in 2019 season, our website has received more than 1400 visits and 5000 page views. This enables us to reach out to more people and elevate the level of the play for everyone.

Scan to access our online match data & strategy tips

Competition Traffic	Unique Visitors	Visits	Page Views
Glacier Peak 2019	239	237	716
PNW Champ 2019	265	279	624
FIRST Champ 2019	321	317	786
Glacier Peak 2020	121	125	493
West Valley 2020	143	149	364

CPR 3663

Match Data

PNW District West Valley Event 2020

Presented by **CPR** *ISS Division*

Latest Data - Data as of Match 48 [Alliance data accuracy 98.28%]

We are so glad you found our website! CPR prides itself on providing accurate data for everyone, and we hope that our graphs promote your success as the competition progresses. Below you will find our tableau packaged workbook and our entire database. We are offering you our complete scouting system, so please utilize it!

Excel Database   Tableau Data Visualizations

To learn more about us, visit our ISS – informatics page

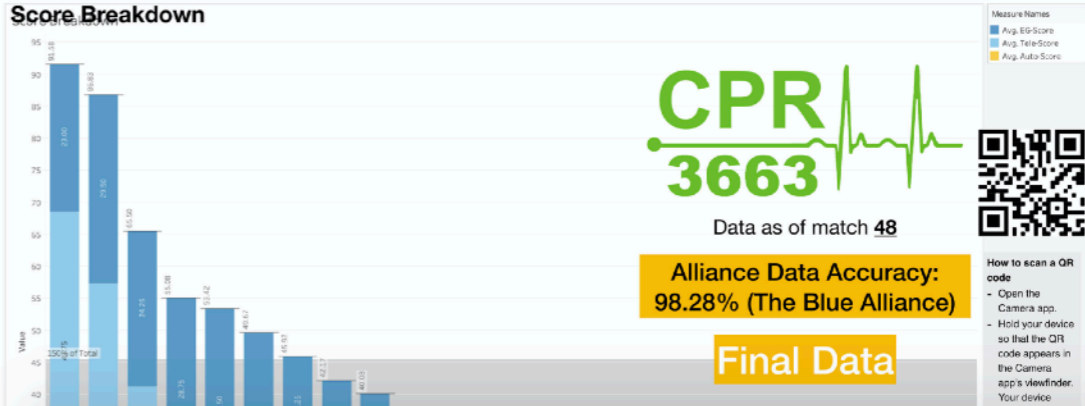To learn more about how we use Tableau workbook, check out our ISS documentation

ISS Division   Email

Number: 2064197310

CPR *ISS Division*
Score Breakdown

CPR 3663

Data as of match **48**

Alliance Data Accuracy: 98.28% (The Blue Alliance)

How to scan a QR code
- Open the Camera app.
- Hold your device so that the QR code appears in the Camera app's viewfinder. Your device

Final Data

Match Data & Strategy

Presented by **CPR** *ISS Division*

Our team believes that Gracious Professionalism involves sharing the resources we have with others. As we pride ourselves on collecting accurate data, we have decided to make our data open and accessible to everyone. We believe that making well-informed decisions and strategies based on meticulous data elevates the level of play for everyone. We use the Tableau Desktop and "Scantron" based "CPR Data Collection Interfaces" which ensures that our data is accurate and organized. The data is checked and then posted at regular intervals throughout the competition so that it is timely and relevant to all teams.

CPR prides itself on collecting accurate data; therefore, we deploy three separate techniques that ensure data accuracy. However, humans are prone to mistakes, and we cannot guarantee that everything we post is 100% accurate. If you do find conflicting data, please reach out to CPR ISS Division and we will address the issue immediately.

2020 Match Data

[2020 Glacier Peak]   [2020 West Valley]

The Essential Steps to Making a Solid Strategy:

For these steps, using the provided strategy sheet is quite beneficial.

Assess everyone's capabilities, both your alliance members and your opponents. Briefly record a couple numbers on whatever strategy sheet you are using. Having numbers on standby when explaining your strategy to your drive team is helpful because then you have tangible data to back up your decisions.

By understanding your alliance members' strengths and anticipating what your opponents are planning to do, design roles for auto, tele, and endgame, and do so with the mindset of maximizing the amount of points that each team can contribute.

- Auto: Position teammates in a way so that robots who have the ability to do multiple rounds of auto actually have the room and time to do so. This means making sure alliance members don't crash into each other by timing movements.
- Tele-Op: It is best to allocate roles to alliance members based on what they are most comfortable with/are best at doing. Keep in mind the amount of space each robot needs to accomplish tasks. For example, robots can't shoot from the same front trench space simultaneously, so in certain circumstances, planning out shooting positions is wise.
- Endgame: Determine whether or not you want certain alliance members to return to the rendezvous point for climbing. Sometimes it is wise to not have alliance members park in the rendezvous point at all if they can score more than 5 points through shooting. If aiming to balance the switch with a partner, be sure to strategize a plan including climb time and positioning.

Noting specifics doesn't hurt anyone

Write some match expectations; having goals during a match helps an alliance stay focused and committed, increasing the likelihood of completing that goal. On our strategy sheet, we mark whether or not we expect to reach capacity for either stage 1 or stage 2. We also write how many cells each alliance member is expected to score.
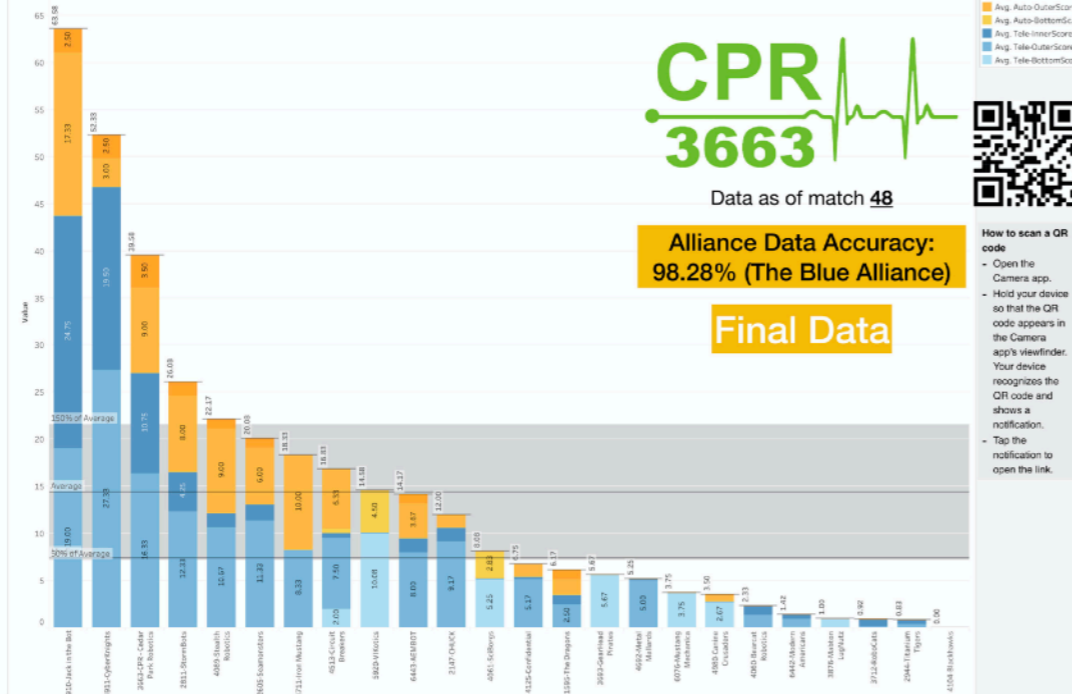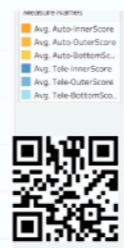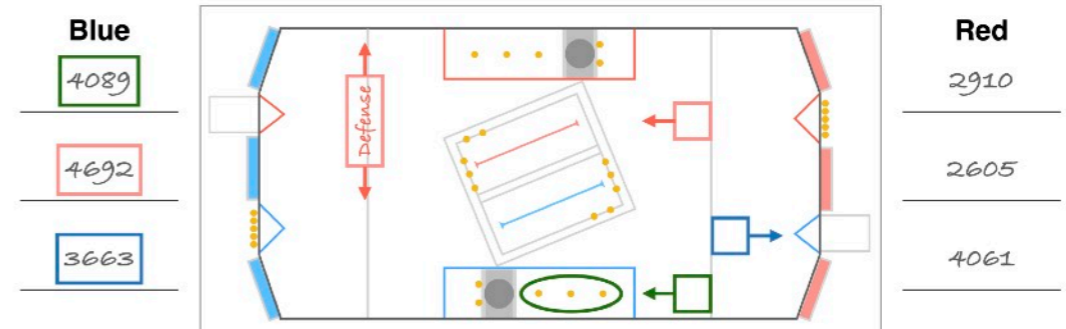
Matches can often be unpredictable, so approach them with a certain fluidity. However, it is still wise to form strategies so that robots don't crash into each other and point capabilities are maximized.

2020 Match Strategy Sheet

[2020 Match Strategy Sheet]   [2020 Match Strategy Example]

[Strategy Example]

CPR *ISS Division*   Match:_____

Blue		Red
4089		2910
4692		2605
3663		4061

Team	Autonomous			Tele-Operated					End Game		
	Move	Bottom	Outer	Inner	Bottom	Outer	Inner	Rotate	Position	Park	Hang	Defense
4089	✓		+ 2.27	✓ 0.18		+ 5.27	+ 0.55				+	
4692	+					− 2						✗
3663	+		+ 2.18	+ 0.64		+ 7.91	+ 3.36				+	

Stage 1	✓	AUTO
Stage 2		
Stage 3		
Cell R.P.		
Hang R.P.	✓	TELE

AUTO
3663 -> Sit in front of goal; move off line forward to stay out of 4089's way.
4089 -> Sit in front of trench, shoot, +grab +trench balls.
4692 -> Position away from 4980 + 3663, move off line.

TELE
3663 → Run trench. Shoot from initiation line if clear (we're most accurate here.) If under defense, shoot from triangle + attract defender here to gain penalty points.
4089 → Run trench, shoot from initiation (most accurate spot) If under defense, stay in trench & shoot → don't bother w/ initiation line.
4692 -> Defend near opponent goal; move alone initiation line, do not move off it (we don't want penalties). Stall 2910's shooting → don't let them shoot from initiation line (They are most accurate there

ENDGAME
3663 + 4089 Double climb w/ 30s. → NEED R.P.
4692 → stop 4061 from reaching rendezvous; cannot let opponent earn a double climb

CPR 3663
CPR Informatics & Scouting Strategy

Match Strategy Sheet   S10V1.0 B10227   CPR ISS Division — Cedar Park Robotics 3663 — Cedar Park Christian School, Bothell, Washington, USA   ***Any unauthorized copying, alteration, distribution, display or other use of this material is prohibited.

2020 Infinite Recharge - PNW District West Valley Event

Inspiring Others

Bringing Tableau® and Data Analysis to *FIRST* Community

Cedar Park Robotics strives not only to create an excellent robot but to also inspire others to push the limits of their robot's realm of possibility.

Scouting Outreach at 2020 PNW District Glacier Peak Event

Working to further the utilization of scouting and strategy, our team observed the Glacier Peak event and posted data for all teams, despite not being competitors ourselves. We diligently worked to publish our scouting data for a couple reasons: firstly, we want all teams to make well-informed decisions and create solid strategies, and secondly, we wanted to garner others' trust in believing that our data is non-biased. We were glad to have made the decision to

Scan to learn more about our outreach stories

scout at Glacier Peak, considering both teams 2930 and 1318 came to us, seeking complete sets of data. In addition to posting graphed data, we also shared our database and a Tableau packaged workbook. A second reason we went to Glacier Peak was to offer assistance to the three rookie teams attending the event; we believe FIRST is, above all, a community.

Scouting Outreach at 2020 PNW District West Valley Event

To continue our efforts in sharing with others the merits of scouting, we, again, chose to post all of our data, including our entire database and a Tableau packaged workbook. We were excited to see students and mentors of all different teams analyzing our freely-offered data.

FRC Team 2557 - SOTAbots

Our scouting team was invited to speak at Sotabots' Robotics Workshop during this past off-season. Excited to share, five CPR Informatics & Scouting/Strategy Division members prepared to give extensive presentations on all things scouting: quantitative data, qualitative data, Tableau, match scouting, and lobbying. Our team is fortunate to have a scouting team comprised of highly capable students; however, we understand that not every team has the man-power and resources needed to integrate every aspect of our extensive scouting system.

Scan to learn more about our outreach stories

Therefore, we explained how to integrate scouting even if only two students were available for scouting. Anticipating an increase in scouting, we hope the insight we provided is helpful to all teams this year.

FIRST Washington

One of the ISS division's primary goals is to promote scouting efforts throughout the world of FIRST. To carry out this goal, we met with FIRST WA President Erin McCallum to present how much the scouting world has grown and changed in hopes of establishing a scouting award. With this award, incentives to create smart scouting systems become even more enticing. Furthermore, we requested to establish the "Scouting Pits" at every PNW district competition. This dedicated location for scouting promotes communication between teams and brings the FIRST community even closer.

FRC Team 2930 - Sonic Squirrels

Our team is constantly looking for ways to improve our own systems; therefore, we contacted the Lead Scout of the Sonic Squirrels to discuss and compare our scouting systems. Not only did our understanding of scouting increase, but we acquired a valuable ally. Today, we continue to share strategy tips and even collaborate on efforts where we lead strategy and Tableau workshops.

Scan to learn more about our outreach stories

Start Scouting

Scale Scouting (ISS) to the Size of Your Team

We want everyone to experience the merits that come with scouting; however, we understand that not every team has the personnel or resources to establish a large scouting operation. Therefore, we have created a template that allows teams to scale scouting to as few as 1-2 students. Based on how many people your team has available, this template will guide your team in creating an excellent scouting team.

1-2 Students
- Qualitative Only, Use Excel or Paper; text strategy to Drive Coach

3-4 Students
- 2-3 Qualitative Scouters; 1 synthesizes information, communicates with Strategist

- 1 Strategist/Lobbyist–gathers information from Qualitative, develops more detailed strategy, speaks personally with Drive Coach. Lobbies to other teams.

5-6 Students
- 3 Quantitative Scouters with some Qualitative – (do red or blue side of match). There are not enough people to post data; consider joining another team and donating scouters.
- 1 Analyst – Excel or Tableau; works with Strategist to develop strategy.
- 1 Strategist/Lobbyist.

7-9 Students
- Consider a full 6 Quantitative Scouters (need a Manager among the 6).
- 1 Qualitative Scouter
- 1 Analyst (Can post data, but consider quality control)
- 1 Strategist/Lobbyist

10-12 Students
- 6 Quantitative Scouters
- 2-3 Qualitative Scouters
- 1 Analyst
- 1 Strategist/Lobbyist

Additional Students: Rotate Quantitative Scouters, more Qualitative Scouters, and Database Technician.

Informatics & Scouting

Informatics is a perfect cross-section between technology and humanity. At CPR, informatics helps us see hidden patterns and robot qualities that might not have been noticed. We created a scantron-like "CPR Data Collection Interface" that enables us to utilize a fast, accurate, and tangible data input workflow. To fully utilize the data we collect, we use Tableau Desktop® software to create elaborate visualizations. Our Match Rubric and Match Strategy Sheet display an organized presentation of the upcoming match stats and enable us to better communicate with our robot operators and alliance members. Our utilizations of informatics techniques give us a broader perspective and are imperative to our success at competitions.

CPR Data Collection Interface

Advanced Data Collection

Data is the essential foundation to any strategy and we had tackled both paper scouting and digital data collection via an app. Both had their strengths—paper was tangible, and the app was automated and fast—but both had their downsides: paper needed to be manually inputed into excel, taking hours, and the app was prone to producing untraceable errors. To achieve the best of both worlds, we created a scantron scouting system that integrated the best aspects of paper and digitalized scouting. If a scouter error was discovered, we could easily rectify the mistake by pulling out the physical scouting sheet for correction. Moreover, we would no longer need to painfully upload data inputs by hand.

So how does it work? Similarly to a standardizing test
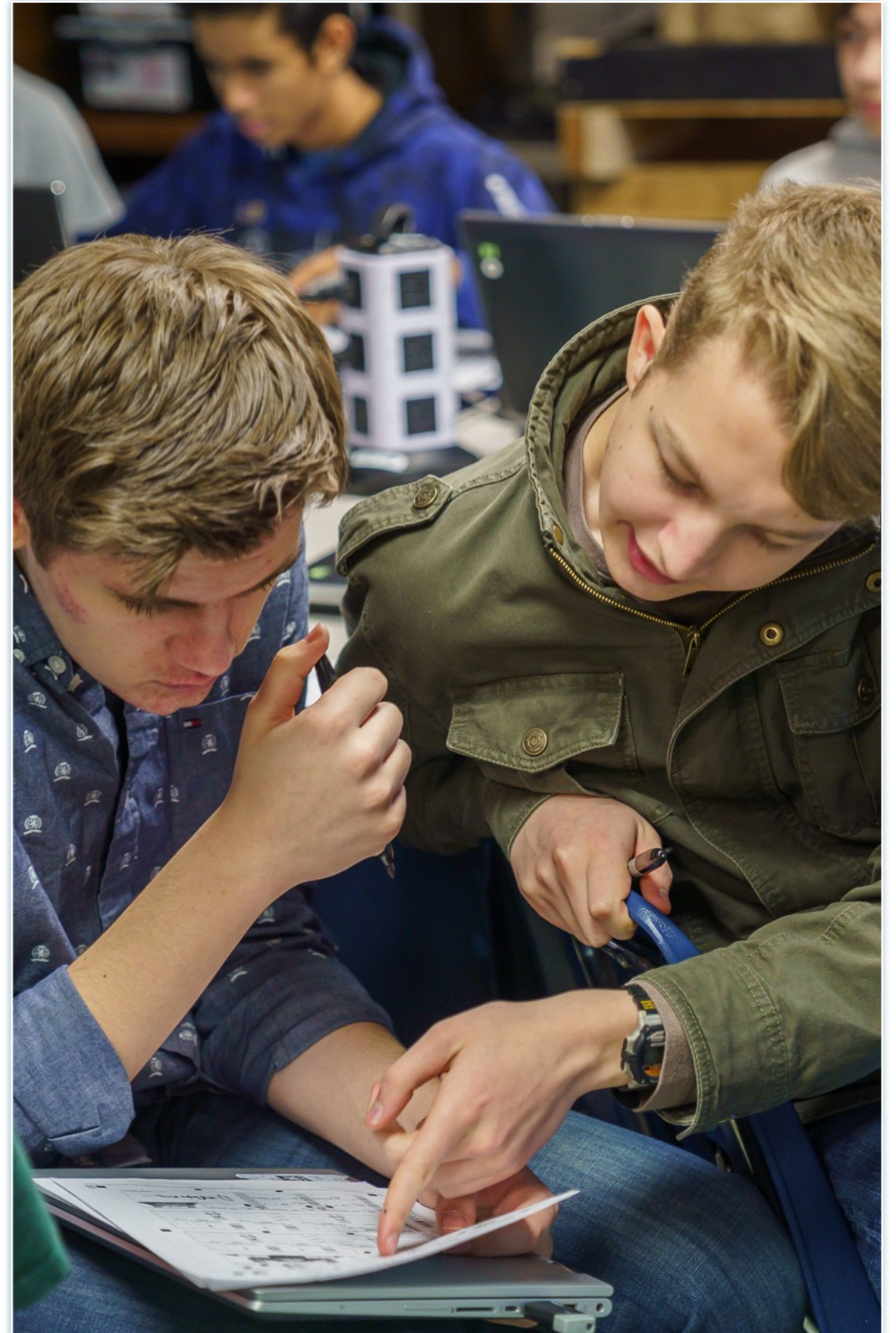
answer sheet, our scouters fill in answer bubbles on paper. These physical paper are quickly turned digital as we scan them with a student modified scanning app called ZipGrade. We find it amazing that, in an instant, random black dots from a "Scantron" scouting sheet can be automatically transformed into readable numbers and visualizations.

A Technical Explanation

Our "Data Collection Interface" is based on a highly modified ZipGrade marking arrays (ZipGrade 7913). Initially, there were one hundred input groups (4 columns x 25 rows), each having 5 individual input bubbles. This set up not only allows us to easily modify scouting sheet interface to suit different games, but also enables us to collect maximum data points (up to 500bit raw data) within a simple piece of 8.5x11 paper.

Then, we place scouter interface layer right above ZipGrade marking arrays. During the design, being human-centric is our top priority. Instead of having scouters bubble in information such as match number, we automated a way to pre-fill this info via a printer. This improvement saved our scouting team a significant amount of time and prevented possible human errors. We also created a Graphical User Interface to replace the old text based scouting sheet, this makes data recording much more intuitive and most scouters can easily use it without

2020 Data Collection Interface V1.0 B9304 vs.

ZipGrade 7913 Marking Arrays

intensive training. Furthermore, encouraged by the FTC team 11120, we increased our font size by 36%. This makes our "Scantron" scouting sheets much easier to read. In addition to regular "Data Collection Interface" scouting sheets, we implemented "Data Verification" system at 2019 Houston Championship. This enables us to compare scouter data to official score on The Blue Alliance or FIRST Inspired websites. In the 2019 and 2020 season, we enlarged each input bubble by 31.6% and implemented an image threshold mechanism; this increased our scanning accuracy to 99.94%. What this means is that for every 1,600 bubbles or pieces of data that are scanned, there would only be one easy-to-fix error at most. We also replaced our old iPhone scanner with the document feeder scanner, this change enabled us easier and safer data access and shortened our data delay to only two matches.

2020 Data Collection Interface V1.0 B9304

Used in 2020 PNW District West Valley Event

Mission Control System

Marking Arrays Detection & Interpretation (MADI)

Mission Control Database

After "Scantron" scouting sheets are scanned, raw data is quickly imported to our "Mission Control" database. By customized Excel functions such as "IF", "VLOOKUP", and "CHAR", we are able to instantly decode (Base-6) data to conventional numerals for Tableau®, our data analysis software. In addition to data export, we added even more features to assist our "Mission Control" manager.

Data Collection Error Detection

In addition to our old "sum based" error detection (Verifying bubble number), we use logic analysis to eliminate impossible scouter feedback. For an example, if a robot hangs during the endgame, then it should not be parking. These features help "Mission Control" manager to find and eliminate unnecessary human errors.

Data Collection Error Diagnose

Total Scantron:	288	Max. Match	48
Total Bubbles:	8015	Scouter Bubbles:	6575

InfoSection Errors:

AllErrors:

Re-Scout

36 41 210 212 235

Database Serial:	100	Schedule ID	1101
Match Number:	11	Alliance:	R1
Team Number:	2944	Overide Status:	0
Scouter Name:	Ryan S.	Official Name:	

InfoSect. Input#:	5	Input Check:	✓
UserFixed Input#	20	Scouter Check:	✓
UserDyna Input#	2	Logic Check:	✓
Re-Scout:	NO	Output?	✓

InfoCheck(x):	x	ScouterCheck(x):	x	LogicCheck(x):	x

Data Verification Error

Total Flagged:	
Ignored:	
Average Score:	91.

Scan to download our West Valley 20 "M.C." database

Data Verification Error Diagnose

Total Flagged:	0		
Ignored:	0	Unsolved:	0
Average Score:	91.46875	Accuracy:	98.28%

Unsolved:

Match Number:	44	Alliance(R/B)	r

	Tolerance		Data:	TBA:	Δ:
Move Score:	0		15	15	0
Auto Cell Score:	6		32	32	0
Tele Cell Score:	12		42	48	6
Ctrl.Panel Score:	0		0	0	0
Park Score:	0		0	0	0
Hang Score:	0		75	75	0
Level Score:	0		15	15	0

Data Verification Settings

Data Verification Input

#		Red Alliance (Cross / ACell / TCell / Ctrl. / Park / Hang / Lvl.)	Accuracy	Δscore	Flagged#	Ignore (X)
1		✓	93.44%	6	0	
2		✓	100.00%	0	0	
3		✓	98.91%	1	0	
4		✓	100.00%	0	0	
5		✓	100.00%	0	0	
6		✓	95.63%	4	0	
7		✓	100.00%	0	0	
8		✓	100.00%	0	0	
9		✓	100.00%	0	0	
10		✓	93.44%	6	0	
11		✓	100.00%	0	0	
12		✓	97.81%	2	0	
13		✓	90.16%	9	0	
14		✓	100.00%	0	0	
15		✓	100.00%	0	0	
16		✓	98.91%	1	0	
17		✓	98.91%	1	0	
18		✓	100.00%	0	0	
19		✓	96.72%	3	0	
20		✓	96.72%	3	0	
21		✓	100.00%	0	0	
22		✓	100.00%	0	0	
23		✓	100.00%	0	0	
24		✓	100.00%	0	0	
25		✓	100.00%	0	0	
26		✓	100.00%	0	0	
27		✓	100.00%	0	0	
28		✓	100.00%	0	0	
29		✓	93.44%	6	0	
30		✓	100.00%	0	0	
31		✓	100.00%	0	0	
32		✓	100.00%	0	0	
33		✓	93.44%	6	0	
34		✓	100.00%	0	0	
35		✓	100.00%	0	0	
36		✓	93.44%	6	0	
37		✓	100.00%	0	0	
38		✓	100.00%	0	0	
39		✓	83.60%	15	0	
40		✓	100.00%	0	0	
41		✓				
42		✓				
43		✓				
44		✓				
45		✓				
46		✓				
47		✓				
48		✓				
49						

Data Verification System

CPR prides itself on collecting accurate data; therefore, we implemented "Data Verification" system. This enables us to compare scouter data to official stats on The Blue Alliance or *FIRST* Inspired websites. "Mission Control" managers can easily set up error tolerances or check data accuracy right at "Mission Control" dashboard. Data integrity is our top priority. Once an error is found, it is automatically filtered from Tableau until the error gets fixed or receives "ignore" approval.

Scan to download our West Valley 20 "M.C." database

"Mission Control Database" - "Mission Control" section

1. Data input status
2. "Data Verification" status
3. Data output status
4. Data collection settings and diagnosis
5. "Data Verification" settings and diagnosis
6. Scouter status
7. Scantron Lookup
8. Schedule Input

Feedback & Diagnosis Feature

Scantron Lookup feature enables our "Mission Control" manager to look up imported "Scantron" scouting sheets digitally without manually digging through giant folders to find hard copies. This significantly shortened error-correction cycle time.

NAS Server and Real-Time Data

By using a Network Attached Storage (NAS) server, several data analysts can simultaneously access our database. This way, everyone gets what they need in an instant. NAS Server also enables everyone printer access without any complex setup. Furthermore, this setup provides analysts and strategists wired internet access without having a wireless hotspot.

Scouter Input

Data Collection Interface Input 1-20

Data Collection Interface Input 81-100

Data Collection Interface Input 21-40

Data Collection Interface Input 101-120

Data Collection Interface Input 41-60

Data Collection Interface Input 120-141

Data Collection Interface Input 61-80

Merge

DC Raw

Output raw data

DC Database
Decode raw data/ Basic data check

Team Info Data

Output scouting data

Output
Apply the filter

Output
Tableau Desktop ®

Rearrange & output scouter data

Data Verification
Compare data

Output a filter list

Output
Data Integrity Report

Output
Scouter Report

Output Official data

Mission Control Settings

Scouter Info

Schedule

Data Tolerance Settings

Data Verification Input

Official Data Input

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A Subdivision of Cedar Park Robotics

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19

Tableau® and Data Visualization

Professional Data Analysis

To fully utilize the data we collect, we use Tableau Desktop® Software to organize it into elaborate visualizations. Tableau Desktop® helps our analysts see hidden patterns or robot qualities that might not have been noticed in the never-ending, black and white numbers of an excel sheet. The visuals we create in Tableau® are imperative to our success in matches, lobbying, and alliance selections. To accomplish all these tasks, we use stacked graphs, scatterplots, and match rubric dashboards.

Scan to access our Tableau visualization tutorial

Scan to download our West Valley 20 Tableau Workbook
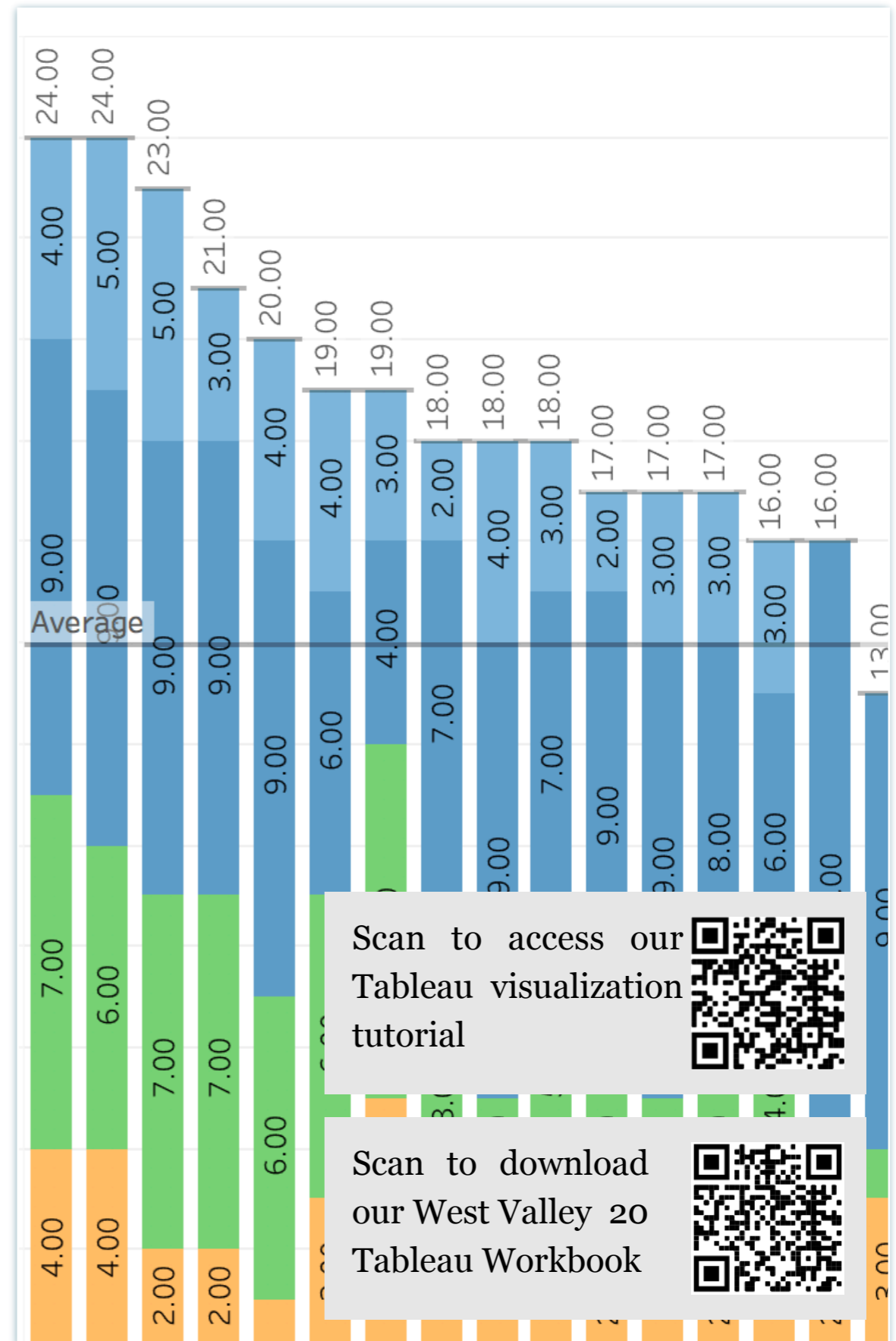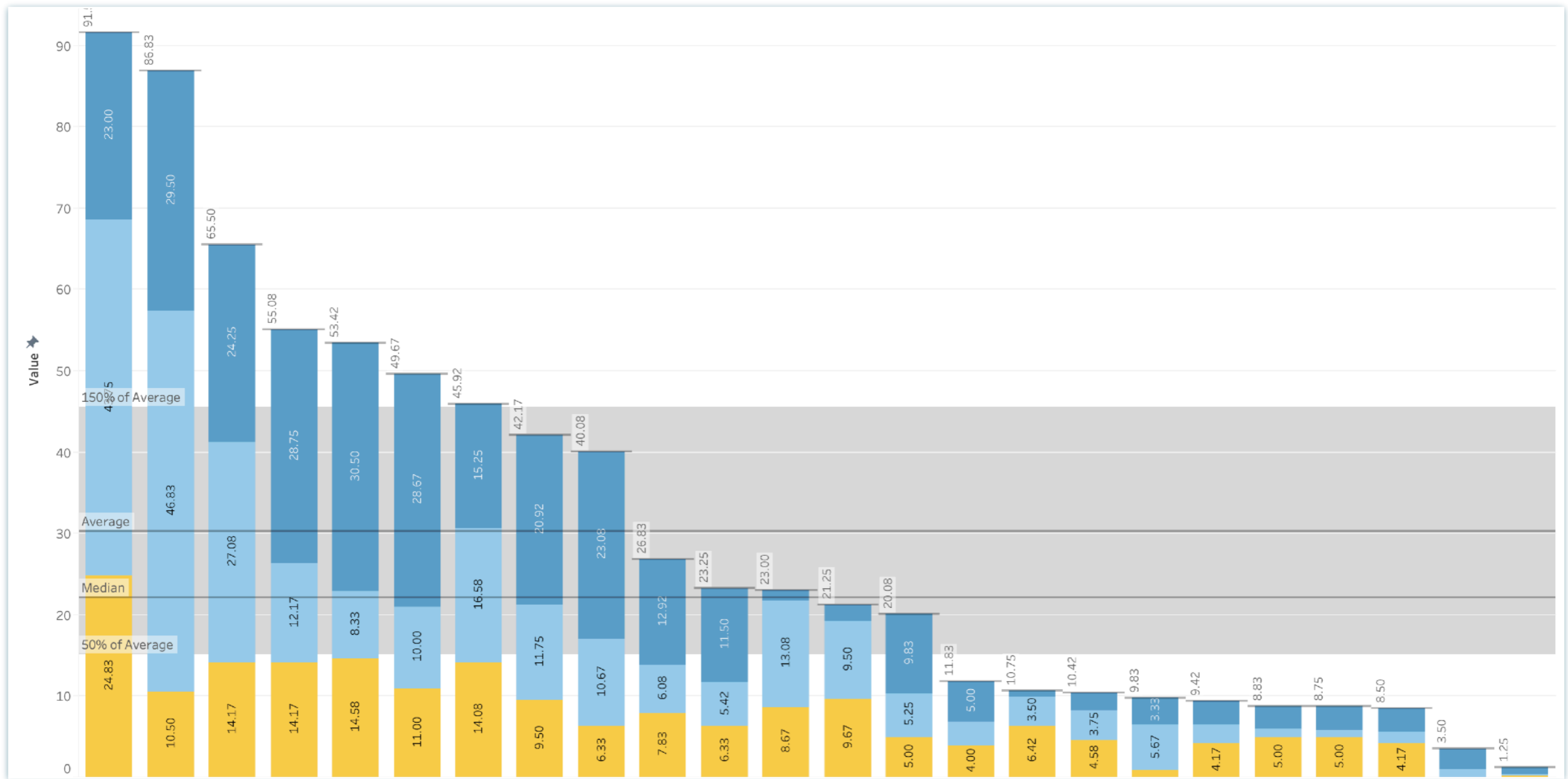
Score breakdown - Yellow-> Avg. Auto. Light blue-> Avg. TeleOp. Dark blue-> Avg. EndGame.

Stacked Graphs

One visual we like to create in Tableau is the stacked bar graph. This graph allows us to see many variables of data on only one sheet, enabling us to see what a robot is capable of during a match. When making stacked bar graphs, we can also weight the variables, which highlights the qualities we value the most; this is similar to how a teacher may weight the test category at 50%, trumping the homework and classwork categories which could be set at 25% each.
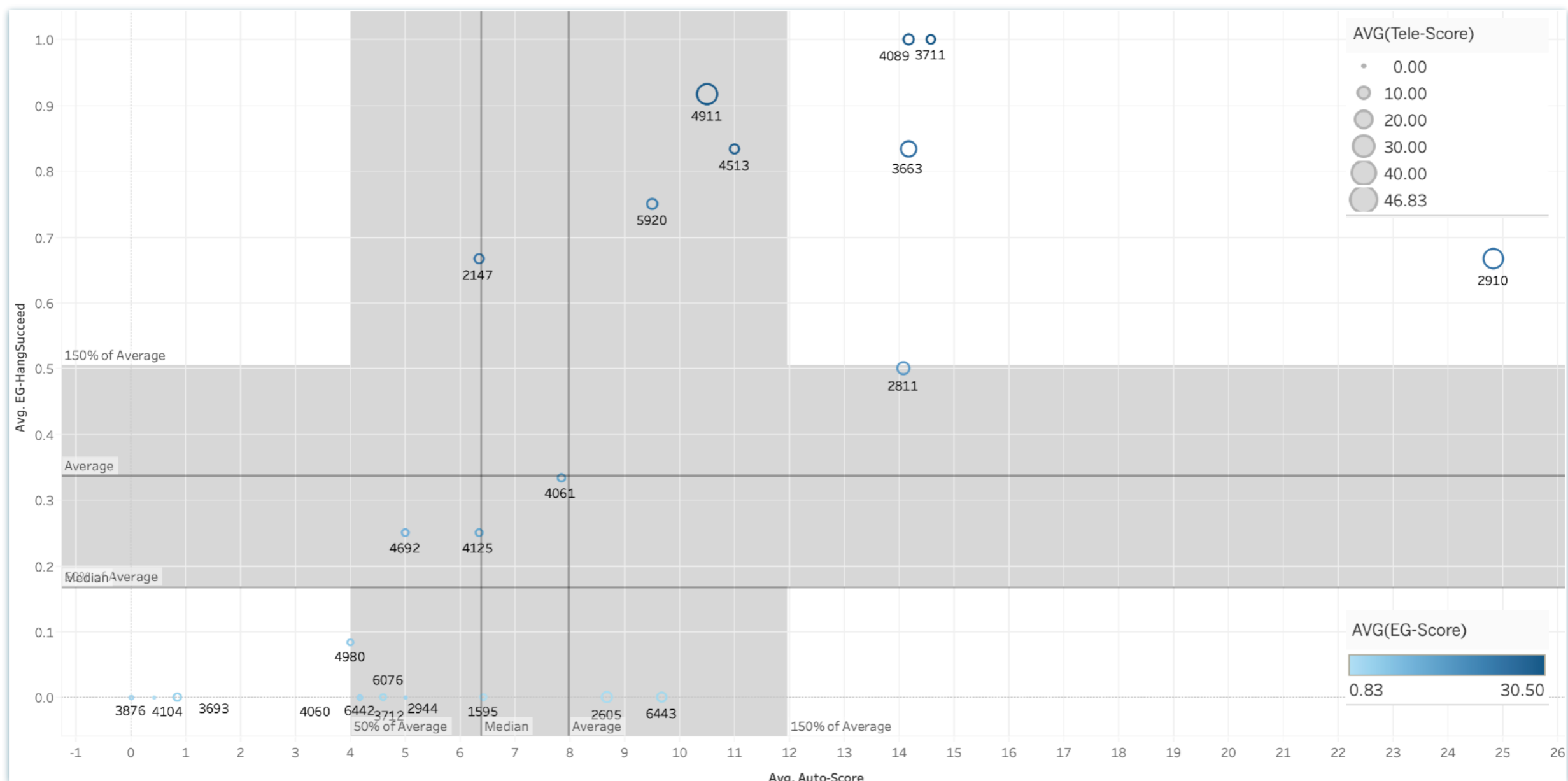
2020 Infinite Recharge - PNW District West Valley Event

X axis - Avg. Auto Score. Y axis - Avg. HangSucceed Rate   Circle Size - Avg. TeleOp Score. Color - EndGame Score.

Scatterplot Charts

Scatterplot Charts play a key role in preparing for alliance selections in the most logical manner possible. Scatterplots are one of the best ways to view many components of data on a single sheet. We use them to compare 2-4 robot qualities, helping us discover the most versatile robots in play. This season, we valued robots who were strong in both the auto score and hang succeed rate; using scatterplots we could quickly discover which teams were excellent in both qualities.

Match Rubric Dashboards

Match rubrics are dashboards that we specially format to display nearly all the information that a match strategist needs to create smart strategies. Concisely displaying information on all three teams of both our own alliance and the opponent's, a strategist can easily determine the most effective roles for our alliance partners by examining our team's strengths and anticipating what our opponents' aims are. Each match we play, we print out match rubrics customized to each new alliance that are given to our strategist and drive team. Having printed, trustworthy data on the spot helps the drive team build trust between the aligned teams as they prepare to work together.

Score predictions

In our Match Rubrics, we created a new graph that analyzes the alliance teams' past performances and then adds the three teams' potential together to estimate the number of points they could earn in a particular match. Having this estimation set as a goal, our alliance can maximize their potential. We are excited to see how our strategist and drive team utilize this new tool.
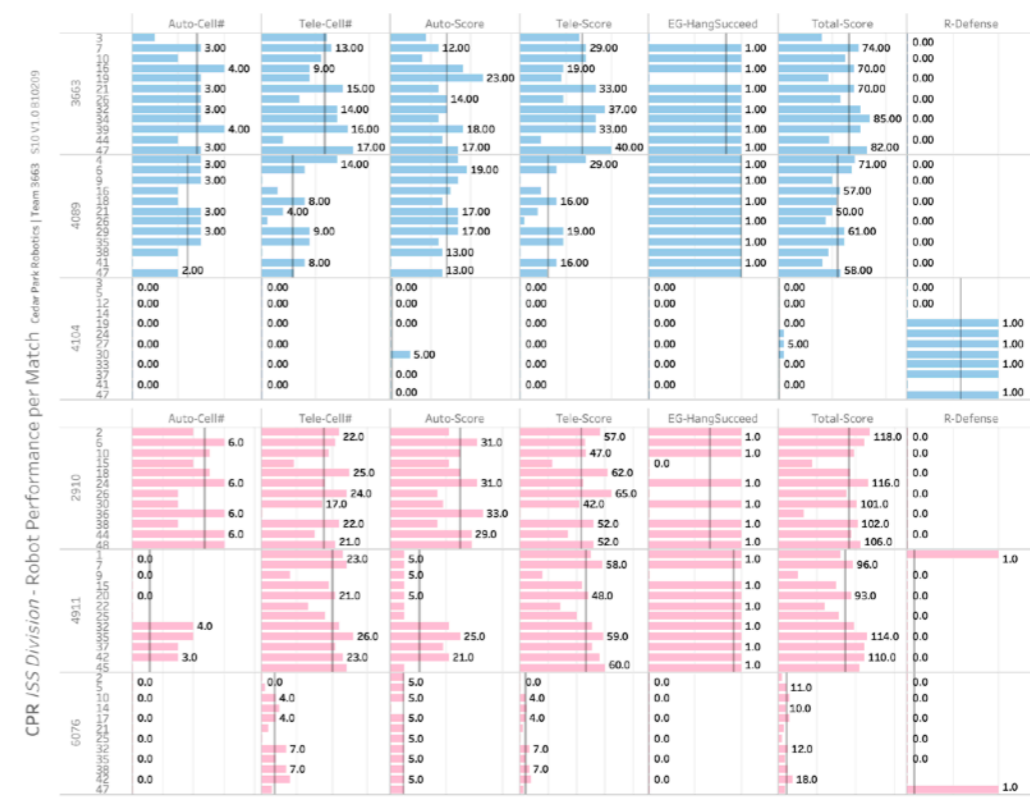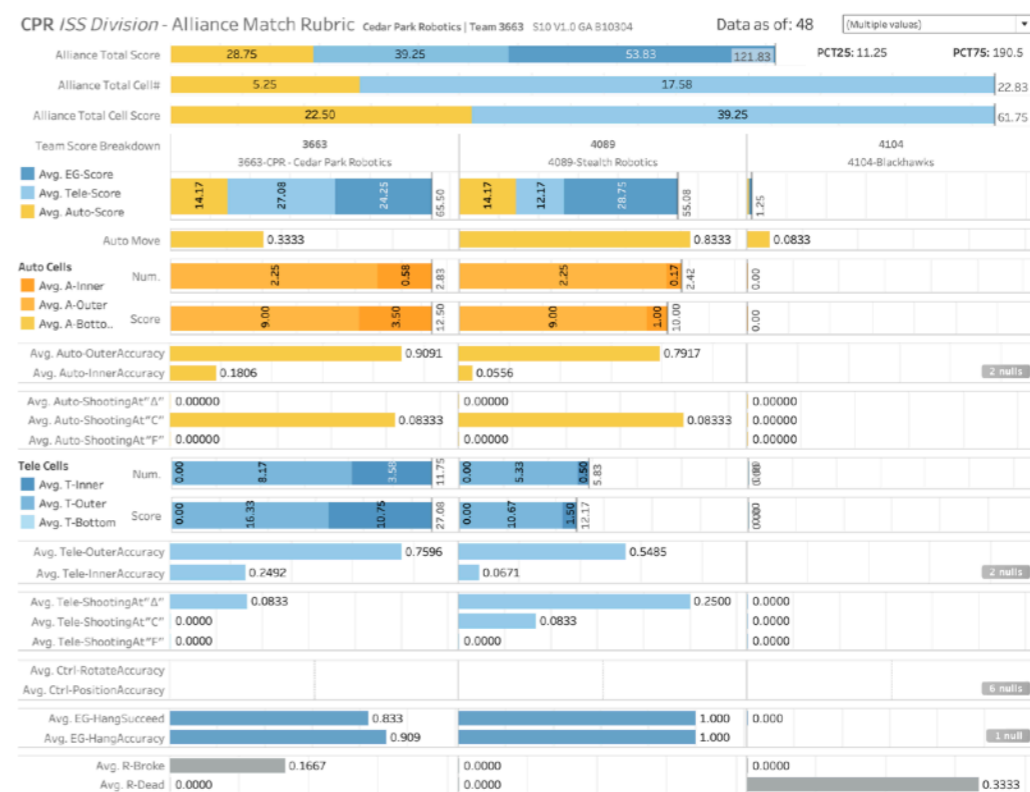
2020 Infinite Recharge - PNW District West Valley Event

Qualitative Data Insight

The Second Lens to Analysis

Our team is committed to accurate and precise data; therefore, we use qualitative scouting to double check our data and observe robot qualities that aren't caught by our quantitative scantron system. Qualitative data is essential to our team's match strategies because it helps us better understand the strengths and weaknesses of alliance partners and opponents. For example, qualitative scouters can rate a robot's aggressiveness to perhaps use them as a defensive bot, or if a robot constantly got stuck on the scale last year, we would consider placing them in a more fruitful position for points and not penalties.

A Low	A Out	A In	T Low	T 2pt	T 3pt	Loc	C Rot	C Pos	Park	Hng T	Hang	Level	Drive	PU	Depl	Smart	Def	Off D	All	Comment
4	1		4							N				B	B	NA	B			B
1			2							N				B	A	C	B	B	B	B
2M			2M(6)			init		`					B-	B-	C-				B-	PU slow b
1M2			I Line	3		d			Y					B-	B				C	B-
			M(4)								4	Y		C+	C	C			C+	Shots alwa
											3	Y	Y							Hardly mc
2	1		7	2						N				A	C	C	B			B
			6M(2)										B	D	B-				B-	poor intak
2	1		7	2						N				A	C	C	B			B
3			7	1			Y						C	A	A	C				B
4	1		4	1						N				B	A	A	A		C	A-
4			6				Y						A	B	NA	A		A-	A-
dk											F		C	NA	NA			D	jerky; war
		2M1		1M1							15	Y			B-	B				B+
M1				M5		Close up		Y					C	B	D					C-
2			M(2)5								6	N	C	C	B+				B+	top heavy
																				Has trbl sli
2							y						A	B	B	D		C	B
2							y						A	B	B	D		C	B
3	2		8	5						6	Y	Y	A	B-	A	A			A	Some trbl
4	1		6	7						4	Y	N	A	B	A				A
lots	some		17(M)	2							Y	Y	A	B	A			A+	Slow pu at
6			24M(4)	2						9	Y	Y		B+	A			A+	wkest: int
3				15M1		2	I Line			10	Y	Y		B+	A				A+
4	1		6	7						4	Y	N	A	B	A			A
5			14	3						3	y	y	A	A	A	B			A
2							Y						B-	C+	mb	C+		C+	lost a whe
							Y						C	C		C+		D+
			9			init				8	Y	Y	C+	B+				B+	Problems
			16M(4)			cg				7	Y	Y	B	A-				A	No auto
3			3M1			I Line		Y					B	B+	B			B+
			12					Y					A	A	B	A			A
4M	1		M(7) 16		C,init								B+	A-				A-	Nice feede
7			M(10)6								H	N	A-	B+	A-				Great auto
M1	3		5M1	T							B	B-	B				B+
2							Y						B	D	C			C	Feeder bo
3		2M(6)							9	Y	Y		B	D				C+	Secure fee
		M(2)	1									D	NA	C-			D	top heavy
			2M										C-	D	No	C-	C-
6			7	6							Y		A	A	A	A			A
2			5 2(M)1		D					8	Y		B	B-	B+				only pu 4;
6			7	6							Y		A	A	A	A			A
4																				
3			3	1						6	Y	N	B+	D	NA			B+	Stuck ball;
3			3	1						6	y	N	A	C	NA			B
1M(2)			2M (6)		init						Y	N	C+	C-	C		D	C+	drops balls
3			5								Y	N	C+	C+	B+			B	Good shoc
3			7M(4)		init						Y	Y						A-	Tele not g
3			3	1						6	y	N	A	C	NA			B
1			5								N		A	B	B	A			B+
2			4	2							N		A	B	B	A		B-	A-
																				Nice trolle
2M			3				Y						C+	C+				C+	Slow low p
										N			B	NA	B	B	B	C+
										N			B	NA	B	B	B	C+
							y						B	NA	B	C			C+
																		A-	Great Agg
										N			B	B	NA	B	C		D
										N			B	B	NA	B			B
													Swrv	D	NA				C-	Something
			M(5)9		init			Y					C+	C+	A-			B	Hard shot
2	1		6	2						N			A	A	B	B			A-
2M			10		C,G					25	Y	N	B	B	A	mb		A-	Ctr climb, c
2M			3M				Y				F		C	B+				C+	Sth wrong
											F		C				D	D
1M2		I Line		8M2		1	I, T			18	N	B-	B	B+		B	B+
2	1		6	2						N			A	A	B				A-
2	2		8	1						14	Y		A	A	B	B			A-
2		8		D						4	F		C+	C+	B			C+	Connected
1(M)			4	init		y					F		B	C+	A-			B+	st drops b

Lobbying & Strategy

An excellent robot is not the sole ingredient needed to form an excellent team. With this understanding, we maximize our alliance members' strengths by using an elaborate data system to formulate smart strategies.

Lobbying

Networking to Promote Fruitful Alliance

To place ourselves on the radars of top teams, our team's lobbyist advocates for why we would be excellent alliance partners in the playoffs. Our lobbyist first writes a report on each team she plans to lobby, reporting their strengths and weaknesses. When talking with other teams, respectful language is our favorite business technique. We always begin the conversation by stating what we admire about their team. Then, we advocate for how our robot's strengths would pair excellently with their strengths. To make sure our conversation is convincing and memorable, we leave them with a lobbying sheet that includes an explanation of our robot's capabilities and a couple Tableau graphs so they can see how we compare to other teams.

CPR TEAM 3663

CPR 3663

- **100% Auto Switch**
- **1st Highest Max. Exchange (9 Cubes)**
- **Capable of filling Exchange within 1 minute**
- **4rd Highest Max. Tele Scale (6 Cubes)**
- **We climb the side rung using our own support which leaves the center rung <u>completely free</u> for another robot.**
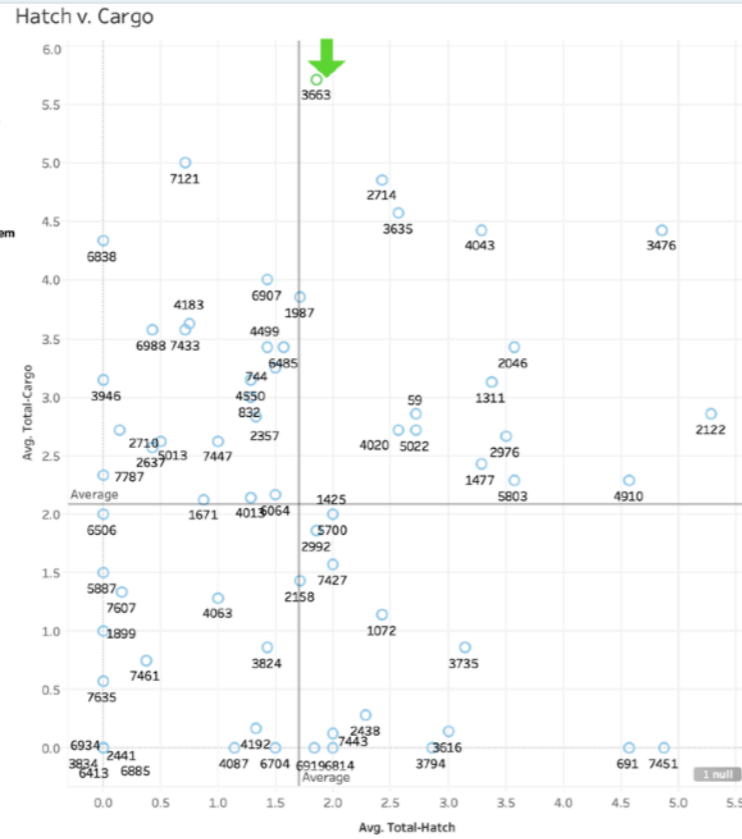
CPR *Strategy* Division

Hatch v. Cargo

- #1 Avg. Cargo (5.71) / #1 Median Cargo (7)
- #3 Avg. Game pieces (7.57) / #2 Median Game pieces (9.0)
- #1 Avg. Total Score (33.71pts) / #2 Median Total Score (34pts)
- #2 Avg. Tele Score (20.71pts) / #1 Median Tele Score (22pts)
- #4 Max. Total Score -> High capability
- High Climbing accuracy when attempted
- Fast maneuver with swerve drivetrain
- Detailed strategy backed up by comprehensive scouting system

Data as of match 82
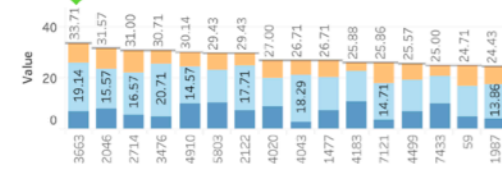
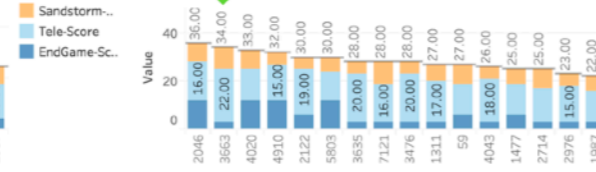Visit our Strategy Division Website for more information

CPR
3663

Avg. Score Breakdown - Top 16

Med. Score Breakdown - Top 16

Score Breakdown: Sandstorm-, Tele-Score, EndGame-Sc...

Avg. Tele Score - Top 16

Med. Tele Score - Top 16
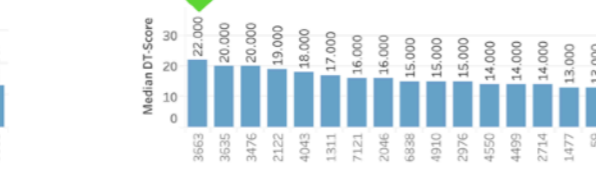
Avg. Game Pieces - Cargo & Hatch - Top 16

Med. Game Pieces - Cargo & Hatch - Top 16

Total Game Pieces (Cargo+Hatch): Cargo, Hatch
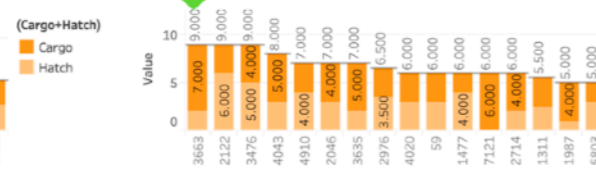
Avg. Cargo Number - Top 16

Med. Cargo Number - Top 16

Cargo: Sandstorm..., Tele-Cargo

CPR *Strategy* Division

- #1 Avg. Cargo (5.4)
- #3 Avg. Hatch+Cargo (7.9) / #2 Median Hatch+Cargo (9.0)
- #2 Avg. Total Score (37.1pts) / #2 Median Total Score (41pts)
- #2 Avg. Tele Score (19.8pts) / #2 Median Tele Score (20.5pts)
- #4 Max. Total Score -> High capability
- #1 Min. Total Score -> Consistent
- 100% Climbing accuracy when attempted
- Fast maneuver with swerve drivetrain
- Detailed strategy backed up by comprehensive scouting system
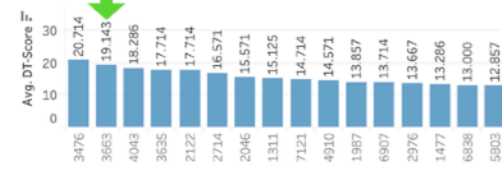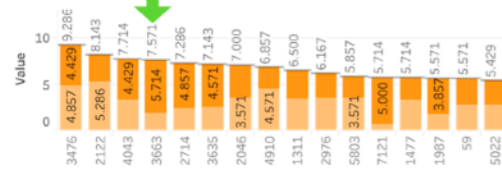
Data as of match 107

Our Website

Avg. Cargo v. Hatch

Incorporate Scouting & Strategy

Driven by Strategy

CPR *ISS Division* works hand-in-hand with our drive and build teams – it requires frequent communication in the design, build, drive practice, and competition phases of the season. This is more likely to what students will find in the workplace – program management, strategy, and teamwork.

Kick-off

We emphasize that our goal each season is to get to Houston *FIRST* Championship and to compete well there. To do that, we need to get District Points.

We look at what elements give us the RP needed to get the highest seeding and therefore the highest district points.

2020 Season

From day one we quickly established that climbing was our first priority. Of course our team members wanted a perfect shooter, but scouting reiterated multiple times that the climber had to be ready and tested for our first competition in order to increase our chances of earning an extra ranking point.

Beyond climbing, our second priority was auto. This meant finishing the robot in a timely manner so that our software division had the time they needed to program. Guiding priorities as a scouting team helped us reach these goals.

Build Season– The list of scouting features on the wish list typically exceeds the build team's ability to create them. This requires frequent communication between us and our Build team to clarify the priorities list.

Drive Practice – Focus on RP priorities. We find we need to remind the engineering teams frequently about what is important in matches.

Match Strategies

Making a Wiser Decision

Success isn't always spontaneous; therefore, our team's strategist will create well-informed plans to ensure we achieve the most successful match possible. I say well-informed because we use both quantitative (via Tableau match rubrics & data visualizations) and qualitative data. Looking at Tableau, a strategist can determine what each alliance partner excels in, which helps the alliance appropriately distribute roles; using qualitative data, a strategist learns about more subtle robot qualities, giving him the ability to create a more refined strategy. Being well prepared, a strategist uses our specially designed Match Strategy sheets to write a synopsis on our alliance partners and opponents that will be given to our drive coach. This sheet includes a picture of the game field so that our strategist can map out pathways for robots, especially during autonomous, to prevent "traffic jams."

Scan to learn how to create strategy with the data we provide

2020 West Valley Event, Match 26

Match 26 presented a challenge between two balanced alliances. The score according to our Tableau model predicted a **tie** at 141 points apiece. To gain the victory, we needed to perform at or above expectations and limit our opponents from achieving their averages. What made this match even more exciting: we were facing off against Team 2910, Jack in the Bot. A win would put us in 1st place and demonstrate that we were a serious contender at the competition.

We considered our Tele-Op strategy carefully. First, we optimized path flow by having Teams 3663 and 4089 take turns going under the Trench to traverse to and from the Loading Station. The initial plan was then to have Teams 3663 and 4089 shoot from the Initiation Line. We realized that we might face defense from our opponents so our contingency plan was to shoot from the Target Zone: this would both provide us safety when shooting and might also result in legally luring the defender to commit technical fouls against us. This is indeed what happened. The defense by Team 4061 was ferocious and we were unable to shoot at the Initiation Line. Both Teams 3663 and 4089 successfully shot from the Target Zone instead. We also were touched twice by Team 4061 while we were in the Target Zone. Another technical foul was committed against us in the Loading Zone by another opponent. These three technical fouls, however, were not

CPR *ISS Division*   Match: 26

Blue
4089
4692
3663

Red
2910
2605
4061

Team	Move	Autonomous			Tele-Operated					End Game		
		Bottom	Outer	Inner	Bottom	Outer	Inner	Rotate	Position	Park	Hang	Defense
4089	✓		+ 2.27	✓ 0.18		+ 5.27	+ 0.55				+	
4692	+		− 2									✗
3663	+		+ 2.18	+ 0.64		+ 7.91	+ 3.36				+	

Stage 1	✓	AUTO
Stage 2		3663 -> Sit in front of goal; move off line forward to stay out of 4089's way.
Stage 3		4089 -> Sit in front of trench, shoot, +grab +trench balls.
Cell R.P.		4692 -> Position away from 4980 + 3663, move off line.
Hang R.P.	✓	TELE

3663 → Run trench. Shoot from initiation line if clear (we're most accurate here.) If under defense, shoot from triangle + attract defender here to gain penalty points.
4089 → Run trench, shoot from initiation (most accurate spot) If under defense, stay in trench & shoot → don't bother w/ initiation line.
4692 -> Defend near opponent goal; move alone initiation line, do not move off it (we don't want penalties). Stall 2910's shooting → don't let them shoot from initiation line (They are most accurate there

ENDGAME

3663 + 4089 Double climb w/ 30s. → NEED R.P.
4692 → stop 4061 from reaching rendezvous; cannot let opponent earn a double climb

CPR 3663

Match Strategy Sheet S10V1.0 B10227

2020 Infinite Recharge - PNW District West Valley Event

Match 26 - Match Strategy Sheet

called. If we had lost the match by less than 45 points, we would have been disappointed. However, as strategists, we realize that we cannot count on penalties being called, especially at early competitions. The referees are trying to learn the competition just like we are. They sometimes miss calls that they might make in later competitions. We see scouting and strategy as all about **probability**. We strive to get every advantage we can in a match, with each element we include increasing the probability that we will win. That means that we put elements in like legally luring opponents to foul us with the idea that sometimes the fouls might be called. When the fouls are called, they can make the difference in the match. (see description of 2019 PNW Quarterfinals 3 in which planned penalty fouls won us the match by 3 points below).

As part of our strategy, we also wanted to use defense to limit Team 2910's productivity. The initial plan was to have our third alliance partner, Team 4692, traverse the Initiation Line on the opponent's side, disrupting Team 2910's favorite shooting position. Our partner was cautioned not to move far from the Initiation Line so that they would not incur technical fouls in the protected areas. In the *actual* match, Team 4692 stayed on our side's Initiation Line, interfering with Team 2910 traveling back and forth between their Loading Zone and their Trench. This may have been a decision among our alliance members about what they felt might be most effective. As strategists, we give our ideas on the best approach to a match, but we leave it to our alliance to determine what adjustments work best for them. In the match, Team 4692 did a great job of harrying and delaying Team 2910 to and from their Loading Station.

As the game clock wound down, our opponent, Team 4061 continued their aggressive defense, coming dangerously close to our Rendezvous area. During the last 30 seconds, they touched both Teams 3663 and 4089 in the Rendezvous area. These two technical fouls were, in fact, called. Team 4061 then extricated itself from our Rendezvous area and headed toward its own. Our defensive bot, Team 4692 was in position to further delay Team 4061. While Teams 3663 and 4089 had the full 30 seconds to climb, Teams 4061 and 2910 had less than 20 seconds to do so. Our alliance's robots successfully completed our climbs while our rushed opponents had difficulty. In the end, they were touching each other, one of them failed to climb, and they did not get any credit for the single successful climb. We won the match 147-107.

In summary, our victory in this match was due to a combination of careful strategy, solid play, and luck - much like most of our matches.

The Blue Alliance
Match Stats & Video

2019 Glacier Peak Event, Match 2

We were up against an alliance that was better than our own. Our opponents included Team 2930, who ended ranked second at the competition, and Team 488 who was a strong hatch bot. We knew their third member, Team 4173, would most likely play defense on us. Regarding our alliance, we were a strong bot who could do well at cargo, adequately at hatch, and could climb to the third level of the platform. Our partner, Team 3588 was limited in their cargo ability but they were adequate at hatches. Our final partner, Team 1899 could do limited cargo. In analyzing this match, we knew that we had to manage our resources carefully to maximize our points while also limiting Team 2930's high point capability. We conferred with our alliance partners and arranged for Team 1899 to do one to two cargo on the cargo ship and then head over to play defense on 2930. Meanwhile, we used our swerve drive to effectively evade their defender and put in several cargo. Our partner, Team 1899 did two cargo and then went and played very effective defense on Team 2930. Our other partner, Team 3588 efficiently focused only on hatches, enabling us to put in cargo in hatched bays. We watched the clock tick down until there were only 15 seconds left, deploying as many game pieces as possible. We then headed over to the platform and climbed in 10 seconds. Team 2930 failed their climb and we won 78-51 with three ranking points. In this match, we showed that a less-skilled alliance can win if they have a coordinated strategy that capitalizes on their alliance's strengths. Our partners were excited that they could significantly contribute to beating a superior foe.

The Blue Alliance
Match Stats & Video

2019 PNW Championship, Quarterfinals 2 & 3

The PNW Champs Quarterfinals were a good lesson about the limits of data and the importance of adapting to changing conditions. We lost our first match which was a shock to us because our combined alliance predicted score was much higher than that of our opponent's. Data simply cannot predict a behavior that has never heretofore been seen. Team 1425, who previously had only played offense in its matches, took on the defensive role in eliminations. Their defense was ferocious, targeted, and effective in cutting our deployment of game pieces by half. We put our heads together and used our knowledge of the game rules and experience developing strategies to come up with several changes to our match strategy for the next two matches. First, we moved our alliance partner Team 4513 to the other side of the field to play defense on Team 2471. This cut the output of Team 2471 and opened up space for Team 2147 and our team to

maneuver more easily. Then, we split our side of the field between Team 2147 and us so that Team 1425 would have to choose one of us to defend while the other partner was free to score. We also had the human player throw out balls so that even if Team 1425 cut us off from going back to the feeder, we still had cargo available to deploy. You can see our team deploy two balls under Team 1425's nose due to this strategy. Finally, we told out driver that when trying to evade 1425, drive alongside the wall or cargo ship and stay there. That way, 1425 would be forced to move out of our way or else they would be called for pinning. That is exactly what happened: 1425 incurred 12 penalty points (six more than our defensive partner did) and we won the final match by three points. It was a hard-fought battle against an excellent alliance and it required thorough knowledge of the game and creative problem-solving in order to prevail.

The Blue Alliance
Match Stats & Video

2018 Glacier Peak Event, Match 40
This match appeared grim for our alliance. Our more limited alliance was facing two of the competition's strongest scale bots: Shockwave 4488 and Titans 492. Undiscouraged, we focused on creating the smartest strategy. Looking at qualitative scouting sheets, We noticed how wonderfully aggressive our partner the Vallhalla Bots 3268 were. Utilizing this rare quality, we asked 3268 to play defense. Working as a team, 3268 ruined 492's scale cycle times by forcing them to obtain cubes from the far portal. Moreover, 3268 blocked off 4488 in the platform zone, preventing them from reaching the scale. 3268 excellent efforts allowed us to take over the scale and completely fill the exchange. Further using strategy, we were also able to even out End Game points. In the end, we won the match. We were so grateful for strategy and having such a collaborative alliance.

The Blue Alliance
Match Stats & Video

2018 PNW Championship, Match 96
This match was a fair face-off between two strong alliances, but to ensure a victory, we created a smart strategy that utilized our alliance's strengths and exploited our opponents' weaknesses. One of our partners Skunkworks 1983 could deposit a cube in the switch during auto 100% of the time. Having them take care of the switch, we focused on the scale in auto because we knew that getting a head start on scale cubes presented a

great advantage when facing two strong scale bots. Our other alliance partner SHREC 5450 was a shooter bot. Now we discovered that when the scale was full of cubes, a shooting mechanism became unreliable; therefore, we made sure that SHREC could shoot into the scale at the start of the match when the scale wasn't quite full. With data, we knew that our opponents had a tendency to contend for the opponent switch/our alliance switch. Armed with this knowledge, after auto, we made sure our switch was well-stocked and guarded. Immediately after our opponents abandoned the scale to attack our alliance and play defense, we went to work on their undefended switch. Playing smartly with strategy, we eventually prevented them from earning any points. Finishing with a double climb, our alliance won the match with four Ranking Points.

The Blue Alliance
Match Stats & Video

strategy because our opponents had what we lacked: strong fuel capability. Using all our sources of data, we conjured a plan that would hamper their efforts in gaining fuel points. We focused on defending fuel-shooting robots while one of our alliance partners opened all fuel hoppers, scattering the fuel. This deprived our opponents from attaining any fuel for themselves. Wisely using defense, we were able to out-score our opponents in fuel. To further ensure a victory, we continued performing defense through End Game. Preventing two of our opponents from climbing, all of our robots were still able to climb. This victory propelled us into the second seed.

The Blue Alliance
Match Stats & Video

2017 PNW Championship, Match 117
Our alliance statistically was at a disadvantage. We were facing the very respectable teams Mean Machine 2471 and Dragons 1595, who together could complete three rotors while efficiently scoring on fuel. Even though we were a strong gear bot, we knew we needed to shift our

Alliance Selection

Creating a Stronger Alliance

No team can deny the importance of forming a strong alliance. Therefore, we often have a six hour long scouting meeting the night before alliance selections to ensure our pick list is refined to near perfection. To make well-informed decisions, we create a panorama of Tableau graphs and qualitative data sheets.

Mocking Alliance Selection

In addition to meticulously creating a pick-list, we also perform mock alliance selections. In other words, we anticipate the second and third picks of the top eight teams to see where we would fall and who we might compete against during the playoffs. This helps us better prepare not only for alliance selections but also for the playoff matches.

Scan to download our Mock Alliance Selection Sheet

Scan to visit ISS
Division Hall of Fame

2020 Core ISS team

Chip Tang - *Informatics & "Mission Control" Mentor* | ***Gabe H.*** - *Jr. Strategist, Jr. Quantitative Data Analyst, Jr. Qualitative Data Analyst* | ***Murray C.*** - *Qualitative Scouter* | ***Kathleen K.*** - *Jr. Quantitative Data Analyst, "Mission Control" Manager, Data Verification* | ***Dylan C.*** - *Jr. Quantitative Data Analyst* | ***Max L.Y.*** - *"Mission Control" Assistant. Data Verification* | ***Dr. Kristi King*** - *CPR ISS Division Lead Mentor, Qualitative & Strategy Mentor* | ***Joanna P.*** - *CPR ISS Division Lead Scout, Sr. Strategist, Lobbyist, Sr. Quantitative Data Analyst, Qualitative Data Analyst* | ***Ava H.*** - *Qualitative Data Analyst*

Rachel G. Weiting C - *Quantitative Scouter Manager* | ***Jeremy H. Jae H. Camdon C. Easen H. Micah U. Ryan S. Sam L. Zack H.*** - *Quantitative Scouter*