

COMPETITION

ABOUT

We believe preparing for and analyzing competition performance is a crucial aspect of our team's success. This section outlines our team's effort to constantly improve upon our scouting, deeply analyze the good and bad of each competition, and record robot performance from competition to competition, as well as season lessons learned.

TABLE OF CONTENTS

SCOUTING	F-2
COMPETITION ANALYSIS	F-9
WHITE MOUNTAIN	F-9
ALAMOGORDO	F-12
SOCORRO	F-15
SANDIA PARK	F-18
ARIZONA STATE	F-20
COMPETITION PROGRESSION	F-22
SEASON LESSONS LEARNED	F-23
ROBOT	F-23
COMPETITION	F-23
FUNDRAISING	F-24
OTHER	F-25

SCOUTING

Scouting is a very important component of FTC competitions due to alliance selection. We have found on past teams that it is best to ask other teams what they can do before matches start (usually on Friday night) and neatly record it so that we can strategize if aligned together for qualification matches. Then on competition day (Saturday), our scouting team watches matches and records what each team can actually do, as we know that things break or don't always work to their capacity. Then before alliance selection, the scouting team can analyze the data and choose what teams we would work best with if we have the opportunity to pick a team for alliance selection.



WHAT WE LOOK FOR IN A TEAM & WHAT WE HOPE TO EXUDE

1. Gracious Professionalism
 - a. Kind and having fun
2. Good communication
3. Easy to work with/flexible
4. Reliable robot
5. Complimenting robots

ALLIANCE PARTNER ANALYSIS

WHITE MOUNTAIN

RANK	ALLIANCE PARTNER IN ELIMINATION MATCHES	HOW FAR WE WENT
#8	Capable of everything we were capable of	Semi-finalist

ALAMOGORDO

RANK	ALLIANCE PARTNER IN ELIMINATION MATCHES	HOW FAR WE WENT
#1	Capable of everything we were capable of	Finalist

SOCORRO

RANK	ALLIANCE PARTNER IN ELIMINATION MATCHES	HOW FAR WE WENT
#2	Good autonomous, complimented our driver controlled	Finalist

SANDIA PARK

RANK	ALLIANCE PARTNER IN ELIMINATION MATCHES	HOW FAR WE WENT
#1	Complimented our autonomous and driver controlled	Winning Alliance

ARIZONA STATE

RANK	ALLIANCE PARTNER IN ELIMINATION MATCHES	HOW FAR WE WENT
#9	Complimented our autonomous and driver controlled	Winning Alliance of our Division

STRATEGY CHANGES

WHITE MOUNTAIN | OPTIMAL ALLIANCE PARTNER: ANOTHER STACKER

Our main goal was to stack as high as we could. When we were aligned with another stacking robot, our plan was to stack two separate skyscrapers. When aligned with a pushbot, our plan was to stack and for them to push stones across the skybridge. There was never a definite plan for endgame, so the foundation sometimes ended up staying in the building site, and both robots rarely parked. We also never placed our capstone because we would have to go all the way to the depot to get it and ran out of time to do so.

ALAMOGORDO | OPTIMAL ALLIANCE PARTNER: NO PREFERENCE

Our main goal was to do everything in the endgame because we found that most of the points came in the endgame. When we were aligned with another stacking robot, our plan was for one of us to act as a pushbot and push stones across the skybridge, and for the other to stack in order to avoid robot traffic. Our strategy stayed the same when aligned with pushbots. There was always a clear plan for autonomous, tele op, and especially endgame. We successfully placed our capstone a few times, moved the foundation out almost every time, and had a hard time parking both robots because there was no room.

SOCORRO | OPTIMAL ALLIANCE PARTNER: FAST PUSHBOT

Our main goal was to stack as high as we could and consistently do everything in the endgame. **This time, we really emphasized the importance of alliance partners working together efficiently; it is much better for one robot to deliver stones, and the other to stack, instead of them both constantly driving back and forth. Because we communicated this to all of our alliance partners, we were able to stack 4-6 consistently!** For the endgame we placed our capstone 10/11 times because we pre-loaded it, moved the foundation out 10/11 times, and parked every time because of our **dowel mechanism**, which caused our average points to substantially increase.

SANDIA PARK | OPTIMAL ALLIANCE PARTNER: FAST PUSHBOT, CONSISTENT AUTO

Our main goal was to use our new skystone autonomous, stack as high as we could, and consistently do everything in endgame. As we did in Socorro, we emphasized the importance of alliance partners working together efficiently; it is much better for one robot to deliver stones, and the other to stack, instead of them both constantly driving back and forth. Because we communicated this to all of our alliance partners, we were able to stack 5-7 consistently! Our skystone autonomous also worked in every match, so it was very reliable! For endgame we placed our capstone 9/10 times, moved the foundation every time, and parked almost every time. We were able to set the new New Mexico record for match points at 97!



ARIZONA STATE CHAMPIONSHIP | OPTIMAL ALLIANCE PARTNER: FAST PUSHBOT, CONSISTENT AUTO

Our main goals were to create a four stone (2 skystone and 2 regular stone) autonomous, stack as high as we could, and consistently do everything in endgame. We continued to emphasize the importance of alliance partners working together efficiently; it is much better for one robot to deliver stones, and the other to stack, instead of them both constantly driving back and forth. Because we communicated this to all of our alliance partners, we were able to stack 5-8 consistently! We were not able to get the four-stone autonomous working consistently, so we reverted to the 2-skystone autonomous from Sandia Park because our philosophy teaches us to prefer consistency over big potential points. We had technical problems with our battery and controllers during the qualifying matches. Our autonomous claw also did not retract in the early matches. We were able to overcome these difficulties with help from other teams, and some quick pit work on the robot. Once repaired we consistently scored over 100 points, and set a new personal best of 127 points! Unfortunately, we were accruing penalties for our autonomous starting early, due to a difference in interpretation of the rules about “fixed” starting positions for our servos. When we tried to avoid these penalties by starting our autonomous a few seconds later, our autonomous claw got stuck on the wall of the playing field, resulting in our lowest score of the tournament, 30 points.

SCOUTING SHEET

TEAM NAME

TEAM NUMBER

_____	_____
-------	-------

ABILITIES

Move Foundation	Deliver Stones Under 14" Skybridge	Stones Dumped on Foundation	Skyscraper
YES NO	YES NO	YES NO	YES NO

AUTONOMOUS

Autonomous Program	Move Foundation	Sense and Deliver Skystone	Stone(s) On Foundation	Park Under Skybridge
YES NO	YES NO	YES NO	_____	YES NO

TELE-OP

Stone(s) Delivered Under 14" Skybridge	Stone(s) on Foundation	Skyscraper Height
_____	_____	_____

END-GAME

Move Foundation Out Of Building Zone	Park In Building Site	Place Capstone
YES NO	YES NO	YES NO

RELIABILITY

Autonomous (It works x/5 times)	Do you have a mechanism that often breaks
1/5 2/5 3/5 4/5 5/5	YES NO _____

MATCH SHEET

MATCH NUMBER TEAM NAME TEAM NUMBER ALLIANCE

_____	_____ _____	_____ _____	Blue/Red
-------	---------------	---------------	----------

ABILITIES

Move Foundation	Deliver Stones Under 14" Skybridge	Stones Dumped on Foundation	Skyscraper
YES NO	YES NO	YES NO	YES NO

AUTONOMOUS

Autonomous Program	Move Foundation	Sense and Deliver Skystone	Stone(s) On Foundation	Park Under Skybridge
YES NO	YES NO	YES NO	_____	YES NO

TELE-OP

Stone(s) Delivered Under 14" Skybridge	Stone(s) on Foundation	Skyscraper Height
_____ _____	_____ _____	_____

END-GAME

Move Foundation Out Of Building Zone	Park In Building Site	Place Capstone
YES NO	YES NO	YES NO

SCORE

Autonomous	Tele-Op	Total Score	Penalties
_____	_____	_____	Minor____ Major____

SUMMARY SHEET

#1

Team Name	Team Number	Average Auton Score	Average Tele-op Score	Average Total Score	Consistency

Why would they work well with us?

#2

Team Name	Team Number	Average Auton Score	Average Tele-op Score	Average Total Score	Consistency

Why would they work well with us?

#3

Team Name	Team Number	Average Auton Score	Average Tele-op Score	Average Total Score	Consistency

Why would they work well with us?

#4

Team Name	Team Number	Average Auton Score	Average Tele-op Score	Average Total Score	Consistency

Why would they work well with us?

COMPETITION ANALYSIS | WHITE MOUNTAIN QUALIFIER

OUTCOME

- Ranked 8th; won 3 matches and lost two (ran into some unfortunate situations with our alliance partner's robot)
- Advanced to the semifinals; was picked by the #1 ranked team
- 2nd place motivate, 2nd place control, **1st place Inspire at our first tournament as a rookie team!**



LESSONS LEARNED

- Most points are in autonomous and especially endgame
 - You must have a plan for endgame
 - You must move the foundation out and park in the building zone
- Communication between alliance partners and a clear plan is extremely important and should be initiated far ahead of the actual matches
- Use blue lock-tight instead of red since red can be too strong
- Drive coach needs to update drivers on time, especially during endgame
- Drive coach needs to know who our alliance partner is before our matches
- **Everyone needs to thoroughly understand the rules**
- Pre-loading capstone is better; picking up the capstone from the depot is a nightmare
- Avoid fixing the robot on a practice field -it is rude to other teams
- Always tuck away all wires (so that the battery does not get ripped out, oops)
- Stay calm and have fun!

ROBOT | WHAT WORKED

- The vertical lifts- we didn't believe this would work since we had many problems with it during practice
- The roller claw

- The servo arm that pushes the stone within the robot- there were many problems with the stone hitting the claw because of the accuracy of this arm while practicing but we sorted them out just in time
- The intake worked well, except for some small occasional issues
- The horizontal slides also worked well, except for the string getting tangled once in our first match

ROBOT | WHAT DIDN'T WORK

- The drivetrain: robot not driving/strafing straight affecting autonomous and driver-controlled
 - Set screws on hubs for wheels and sprockets loosening constantly
 - Intake sprocket on the bottom of the robot scraping the floor
- Foundation movers: were a tad bit too short, and would sometimes slip when moving the foundation

SMALL ONE TIME PROBLEMS

- Intake: plastic chain fell off in one match
- Intake: mechanical stops loosening, causing one side of the intake to rest too far inside of the robot
- Horizontal slides: pulley string loosening, causing it to tangle
- Battery wire: loose and snagged by our alliance partner and battery was ripped out
- Wire management: one of the bundles of wires moved and blocked the stone from sliding into the roller claw

TASKS BEFORE NEXT COMPETITION

- Get the robot to drive straight
 - Change set screw hubs to clamping hubs (so hubs are not loosening)
 - Use blue lock-tight
 - Fix intake sprocket (no longer scraping the ground)
 - Mess with weight distribution
- Fix intake mechanical stops
- Make foundation mover bars longer
- Redo blue autonomous
- Check and replace (if needed) vertical lift pulley caps
- Add to engineering notebook about qualifier and changes
- Add to presentation about qualifier and changes
- Make a laminated diagram of the field
- Program a button that reverses intake
- Program a button on driver one's gamepad that also controls the roller claw plate
- Tell drive coach to update us on time, ESPECIALLY endgame
- Make a pit and robot setup checklist



NEW COMPETITION STRATEGY

- **PRE-MATCH**

- Pre-load our capstone
- Good communication with alliance partners

- **AUTONOMOUS**

- Move foundation into building zone and park under skybridge

- **DRIVER CONTROLLED**

- If autonomous doesn't work, make sure to put foundation in building site
- Run capstone out through the intake
- Stack two-three stones

- **END GAME**

- Stack capstone
- Move foundation out
- Park in building zone

COMPETITION ANALYSIS | ALAMOGORDO QUALIFIER

We were not expecting to compete at this qualifier as it was the very next weekend after the White Mountain qualifier, but we got a message from the director of NMFTC asking us to compete, because a team had dropped out, and they didn't have enough teams to be considered an official event. Even though it threw off our schedule, and we weren't very prepared, we decided to attend so that NMFTC could have its first official tournament as a new region!

OUTCOME

- Ranked **1st!** Won 4 matches, lost 1
- Advanced to the finals, but unfortunately, lost as both us and our alliance partners ran into some unexpected mechanical and autonomous issues
- Won 2nd place Connect award, 2nd place Design award, 2nd place Collins Aerospace Innovate award, and **1st place Inspire again!** However, after our qualifier, we were contacted by Jim Jackson, the head of NMFTC, who told us that winning the inspire award twice is technically illegal for the same level of competition, and the Alamogordo judges were not aware of this rule. So, the award will be given to the Brain Hackers at our next competition. In exchange, we will receive 1st place Think award! **So, in summary, we won 2nd place Connect award, 2nd place Design award, 2nd place Collins Aerospace Innovate award, and 1st place Think award!**





LESSONS LEARNED

- Judges presentation needs to be shorter; judges want to be able to ask questions
- It is hard to run a good match with two robots that can do the same thing (we work better with push bots)
- Drive team needs to have better communication (yell less)
- Alliances, including us, need to have better communication during a match
- We need to have parts that are likely to break on our cart, not all the way in the pits
- Immediately mark faulty parts and electronics (our broken battery) so that we don't accidentally try to use it again
- We need more members to help with scouting
- Anything that has gone wrong even once, will go wrong again
- With mecanum wheels, we absolutely need to be using dead wheels and a gyro sensor in autonomous
- We should try to stack the blocks the long way- perpendicular to the robot so that we don't have to extend the horizontal slides as far

ROBOT | WHAT WORKED

- Drive train -at least better than at our last qualifier
- Intake -but we have improvements
- Horizontal slides -the actual sliding worked, but the mounting needs to be reinforced
- Vertical slides -but we have an improvement
- Servo arm that pushes stone within robot

ROBOT | WHAT DIDN'T WORK

- Roller claw plate -the servo was not mounted very well, so the plate that holds the stone in kept bending, so the roller claw kept dropping the stone or holding it at an angle
- Horizontal slides mount -the whole slide mechanism kept moving and resting at a large angle causing the roller claw to be unaligned, running into the electronics and the large wheel sprocket
- Foundation movers -kept slipping when moving the foundation

TASKS BEFORE NEXT COMPETITION

- Improve the mounting of the horizontal lift
- Take off unnecessary rollers from roller claw
- Add weather stripping to roller claw

- 
- Improve mounting of roller claw plate servo
 - Remove some flexibility from the intake
 - Put stone stopper on a servo (so we can free the stone if dropped on stone stopper)
 - Put the capstone on a servo on the vertical slides so it is preloaded and stays on robot
 - Add two plates and rubber to foundation movers so they stop slipping
 - Add a servo that moves skystone in autonomous so we don't rely on intake to pick it up
 - Add a program or hard stop that stops string from vertical lift from unraveling
 - Install our dead wheels for accuracy in autonomous
 - Integrate gyro into autonomous
 - Program an autonomous that delivers 1 skystone, moves foundation, and parks under skybridge
 - Learn all the line dances so we can do them at competitions

PLANNED TASKS AFTER NEXT COMPETITION

- Add vex motor to horizontal slides
- Add a motor to the intake to gain speed and power back, and eliminate complicated chains
- Lift intake wheels

COMPETITION ANALYSIS | SOCORRO QUALIFIER

OUTCOME

- Ranked **2nd!** Won 4 matches, lost 1
- Advanced to a very intense finals, winning the 1st match, losing the 2nd match, and a staggering tie in the 3rd match! We unfortunately lost in the 4th match due to both ours and our alliance partners autonomous programs failing.
- Traded our inspire award from the Alamogordo qualifier with team 11054 Brain Hackers
- On average we achieved 60 points per round
- **Set the New Mexico state record for match points!**





LESSONS LEARNED

- Control Award is something we need to fill out and bring prior to the competition
- The Judging Presentation needs to be shortened and better practised
- Our answers to the new set judging questions need to be thoroughly thought out, clearly documented in the engineering notebook, and better practised
- Our Engineering Notebook needs to be higher quality, better organized, and printed well so that everything is clearly visible

ROBOT | WHAT WORKED

- Servo claw plates -never dropped the stone
- Vertical Lift - Performed consistently, however we have improvements
- Horizontal slides - Performed consistently, however we have improvements
- Drive train -No unwanted drifting
- Dowel Parking Mechanism - Worked consistently, and was very useful in matches

ROBOT | WHAT DIDN'T WORK

- Foundation Movers - Rubber bands broke when we grabbed the foundation, and during autonomous one side slipped twice in the finals; they also knocked over our skyscraper in a match because of their orientation
- Intake -Stone would sometimes get jammed in the intake guides; the gears that reverse the direction of one side of the intake moved and were not making very good contact, which caused one side of the intake to stop rotating under too much stress
- Capstone Mechanism - Capstone unintentionally fell out during a match

TASKS BEFORE NEXT COMPETITION

- Remove the 1 motor drive on the intake, and replace it with two vex motors (count as servos in FTC)
- Add a neverest orbital 20 gearmotor to the horizontal slide in order to speed it up (20:1 reduction instead of 40:1)
- Add two neverest orbital 20 gearmotors to the vertical lifts in order to speed them up
- Add an internal set of compliant wheels to the intake, and replace front compliant wheels with smaller wheels
- Replace pulley caps for both lifts
- Make both slides sturdier
- Redo Foundation Movers so that the foundation no longer pulls on the servo gears causing them to slip

- 
- Install dead wheels for odometry
 - Reprogram foundation moving autonomous
 - Program an autonomous that delivers 2 skystones and parks under the skybridge
 - Reposition phone mount for skystone autonomous
 - Improve Engineering Notebook
 - Improve Judge's Presentation

COMPETITION ANALYSIS | SANDIA PARK QUALIFIER (JUST FOR FUN)

OUTCOME

- Ranked **1st!** Won all five qualification matches
- Won the semi-finals and finals!
- **Winning Alliance Captain** -did not win any other awards because this was our fourth qualifier so it was just for fun
- On average we achieved 80 points per round
- **Set the New Mexico state record for match points at 97!**



LESSONS LEARNED

- Really pay attention to the consistency of robots in qualification matches when picking an alliance partner

ROBOT | WHAT WORKED

- Claw
- Vertical Lift - Performed consistently, however we have improvements
- Horizontal slides - Performed consistently, however we have improvements
- Drive train -No unwanted drifting
- Dowel Parking Mechanism
- Foundation movers
- Intake
- Capstone mechanism



ROBOT | WHAT DIDN'T WORK

- Vertical lifts -pulley caps busted

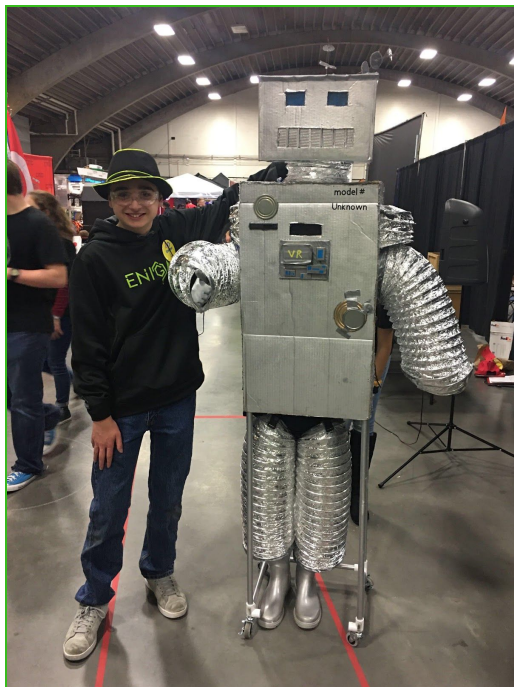
TASKS BEFORE NEXT COMPETITION

- Switch out all linear slides to smoother long robotics ball bearing slides
- String vertical lifts cascading
- Mount odometers for autonomous
- Mount claw for stones in autonomous
- Possibly redo capstone mechanism
- Possibly add measuring tape parking mechanism
- Program a two skystone and two stone, deliver/place, move foundation, parking autonomous
- Improve Engineering Notebook
- Improve Judge's Presentation

COMPETITION ANALYSIS | ARIZONA STATE

OUTCOME

- Ranked 9th, **Winning Alliance of our Division**, 2nd place Motivate
- **Set the personal record high score of our division at 127 points!**
- We achieved an average of 88 points per round
- Advanced to a very intense finals (final of the two divisions), where we had connection issues and autonomous inconsistencies. We unfortunately lost both finals matches, but learned a lot!





LESSONS LEARNED

- Practice and troubleshooting with the robot before a competition is **extremely** important
- Anything can happen, no matter what rank you are
- At every competition, all you can do is come with your best and have fun!
- If a servo moves drastically in init of teleop, it is counted as an early start
- Autonomous scoring is super important. Next season we need to analyze what the largest autonomous points total is and build around that.

ROBOT | WHAT WORKED

- Intake
- Driver controlled claw
- Measuring tape
- Drivetrain -it was really fast and the new mecanum wheels were very smooth
- Foundation movers

ROBOT | WHAT DIDN'T WORK

- Vertical lifts
 - String kept unspooling and wrapping around the motor shaft
- Horizontal slides
 - Bottom slide loosened, so the whole slide started leaning
- Capstone mechanism
 - Capstone key was too loose in the extrusion, so the capstone was leaning and jamming in the robot
- Autonomous claw
 - Inconsistently went to positions
- Parking dowel flag
 - Loosened on the servo head and kept hitting the pulley caps of the horizontal slides

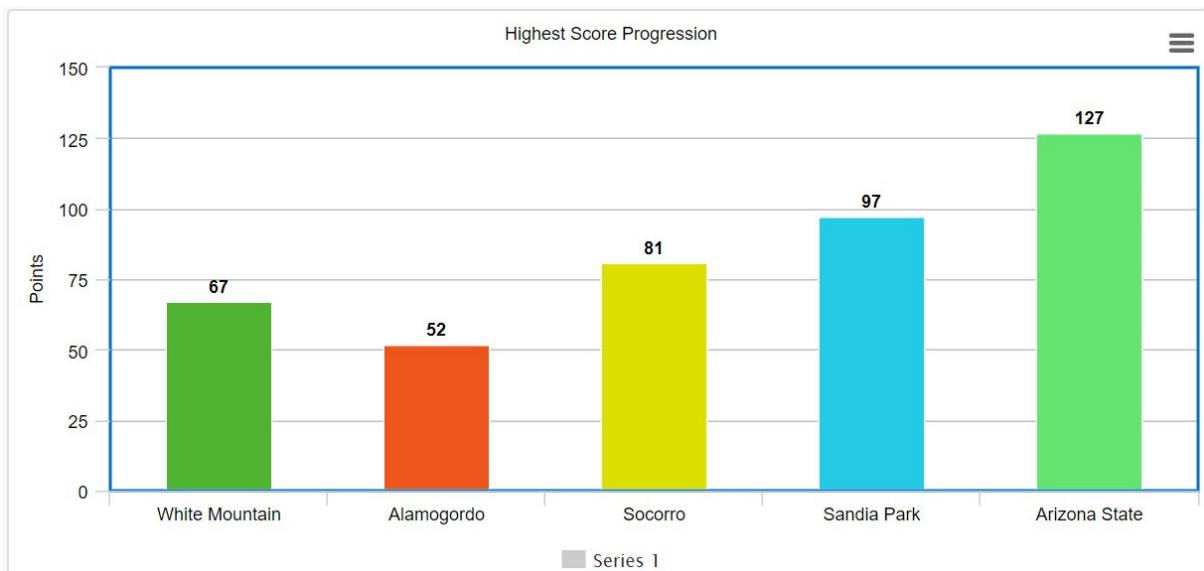
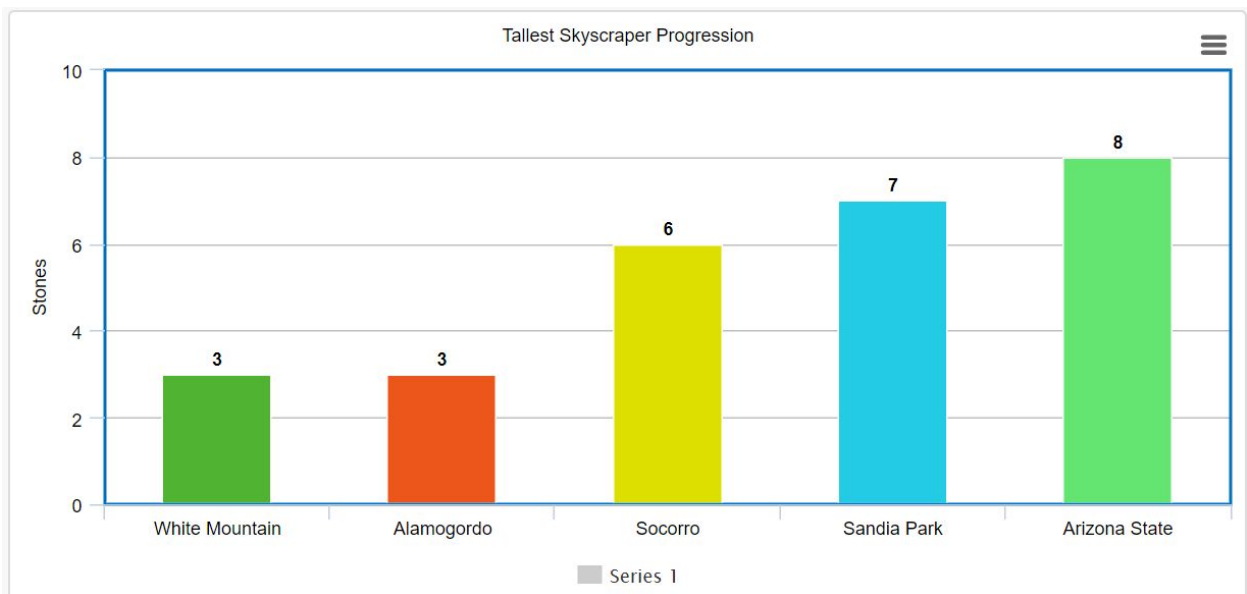
TASKS BEFORE NEXT COMPETITION

- Practice and fix any additional breaks (we fixed a lot of the issues we were having at the competition)
- Refine/polish autonomous
- Add to the engineering notebook
- Practice judging presentation

COMPETITION PROGRESSION

NOTE: Alamogordo was not planned and took place just one week after White Mountain

COMPETITION	Rank	Average Score	Highest Score	Tallest Skyscraper
White Mountain	#8	32 points	67	3
Alamogordo	#1	37 points	52	3
Socorro	#2	50 points	81	6
Sandia Park	#1	80 points	97	7
Arizona State	#9	88 points	127	8



LESSONS LEARNED LOG

We believe that keeping track of season lessons learned is very important to the development and success of our team. Lessons learned are recorded at the end of each competition in “Competition Analysis” and at the end of each meeting in the meeting log’s “Lessons Learned section,” and are then added to this list. **NOTE:** this list is not in any particular order

ROBOT

- Use blue loctite instead of red because it is less permanent
- Using the correct size Phillips head screwdriver is extremely important
- Robot weight distribution is extremely important with mecanum wheels
- Clean mecanum wheels regularly
- When a piece needs to be rigid, make sure the mounting of it eliminates movement in all directions
- If something is broken, fix it right away
- If something breaks once, it will break again
- Wires must always be secure and out of the way
- The team needs to always be thinking about how we can follow the design process as closely as possible
- Main mechanisms need to be hard mounted
- Faulty parts and electronics must be immediately marked so that they are not accidentally reused
- When using mecanum wheels, encoders on the motors are simply not enough for a truly accurate autonomous
- When designing and even building, it is extremely helpful to have sketches and CAD in order to communicate ideas and include as many people on the project as possible
- When making a cut on metal, ALWAYS go very SLOW
- When initializing the robot make sure either the robot is not on a table or put stops on the table so that the robot will not drive off the table if something goes wrong

COMPETITION

- The control award content sheet needs to be filled out before hand and brought to the competitions
- A clear plan and efficient communication between the drive team and alliance is very important

- 
- It is important for the drive coach to update the drivers on time
 - Always make sure all wires, especially the phone and battery wires, are tucked away and tightly plugged in
 - Most points are in autonomous and endgame
 - It is extremely useful to have a pit and robot checklist to ensure the robot is ready for each match
 - EVERYONE on the team needs to have a thorough understanding of the rules
 - The team and alliance should always prioritize the tasks that are high scoring
 - Do not fix the robot on the practise field as it is rude to other teams
 - The engineering notebook **MUST** have the team number on it or else the team will not be considered for any awards
 - The judging presentation needs to be at least 30 seconds shorter than 5 minutes because it is very easy to run out of time when presenting
 - The judging presentation must be a huge priority and practised multiple times
 - It is hard to run a good match with two robots that can do the same exact things
 - It is most important for everyone to remain calm, cool, collected, and have fun
 - Parts that are likely to break need to be on the robot cart, readily available in case the pits are far away from the competition area
 - More than one student needs to be on the scout team and involved in the decision making for alliance selection
 - Practise and troubleshooting with the robot before a competition is **extremely** important
 - Anything can happen, no matter what rank you are
 - At every competition, all you can do is come with your best and have fun!
 - If a servo moves drastically in init of teleop, it is counted as an early start
 - Autonomous scoring is super important. Next season we need to analyze what the most points is and build around that.

FUNDRAISING

- Companies do not have a lot of time, and they don't need that much information in order to make a decision of sponsoring or not, so make the presentation short (under five minutes) and make any documents/flyers short (1 page) (such as the sponsorship packet)
- Calling companies does not seem to be the best way to get a hold of them



OTHER

- Always assign someone to photography at meetings, events, and competitions or else pictures will not be taken
- Brief meetings before and after each meeting are very important to make sure everyone is on the same page and that we are filling out meeting logs and taking pictures
- Also begin meetings by writing an agenda with specific tasks on the white board
- Always take your time and do things right the first time