NCAS 2019

NASA Community College Aerospace Scholars

NASA Community College Aerospace Scholars Company Handbook

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Moon, Mars and Beyond

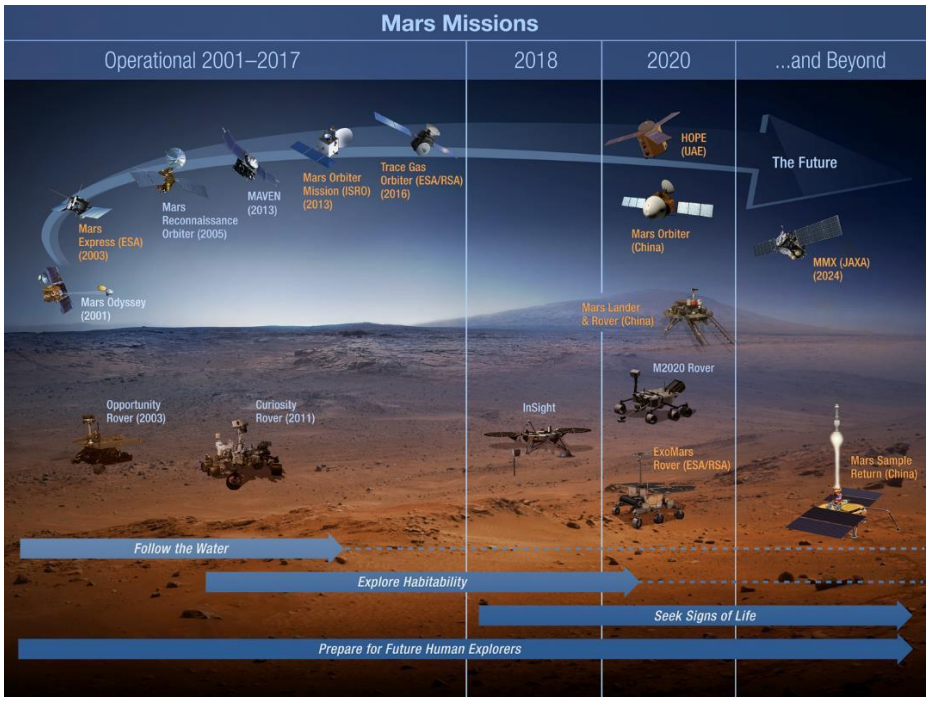
In December 2017, President Donald J. Trump gave NASA a new direction, telling the agency to work with international and commercial partners to refocus exploration efforts on the moon, with an eye to eventually going on to Mars and even beyond. As stated in Space Policy Directive-1, "The NASA Administrator shall, 'Lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and to bring back to Earth new knowledge and opportunities. Beginning with missions beyond low-Earth orbit, the United States will lead the return of humans to the Moon for long-term exploration and utilization, followed by human missions to Mars and other destinations.' ”

NASA is developing the capabilities needed to send humans to the Moon and then to Mars in the 2030s. Why Mars? Mars is a rich destination for scientific discovery and robotic and human exploration as we expand our presence into the solar system. Its formation and evolution are comparable to Earth, and could help us to learn more about our own planet’s history and future. In our lifetimes, NASA and its partners can answer some of humanity’s fundamental questions about life beyond Earth:

- Was Mars home to microbial life? Is it today?
- Could it be a safe home for humans one day?
- What can it teach us about life elsewhere in the cosmos or how life began on Earth?
- What can it teach us about Earth’s past, present and future?

Today, our robotic scientific explorers are paving the way. NASA’s robotic scientific explorers have studied Mars for more than 40 years. A fleet of robotic spacecraft and rovers are already on and around Mars, dramatically increasing our knowledge and charting the course for future human explorers. Together, humans and robotics will pioneer Mars and the solar system.

There are solvable challenges for human missions to Mars: getting there, landing, living and working on Mars and safely returning to Earth. The journey is worth the risks. The endeavor will improve lives on Earth by advancing scientific knowledge and discovery, new technologies, economic opportunities and U.S. leadership in the peaceful, international exploration of space.



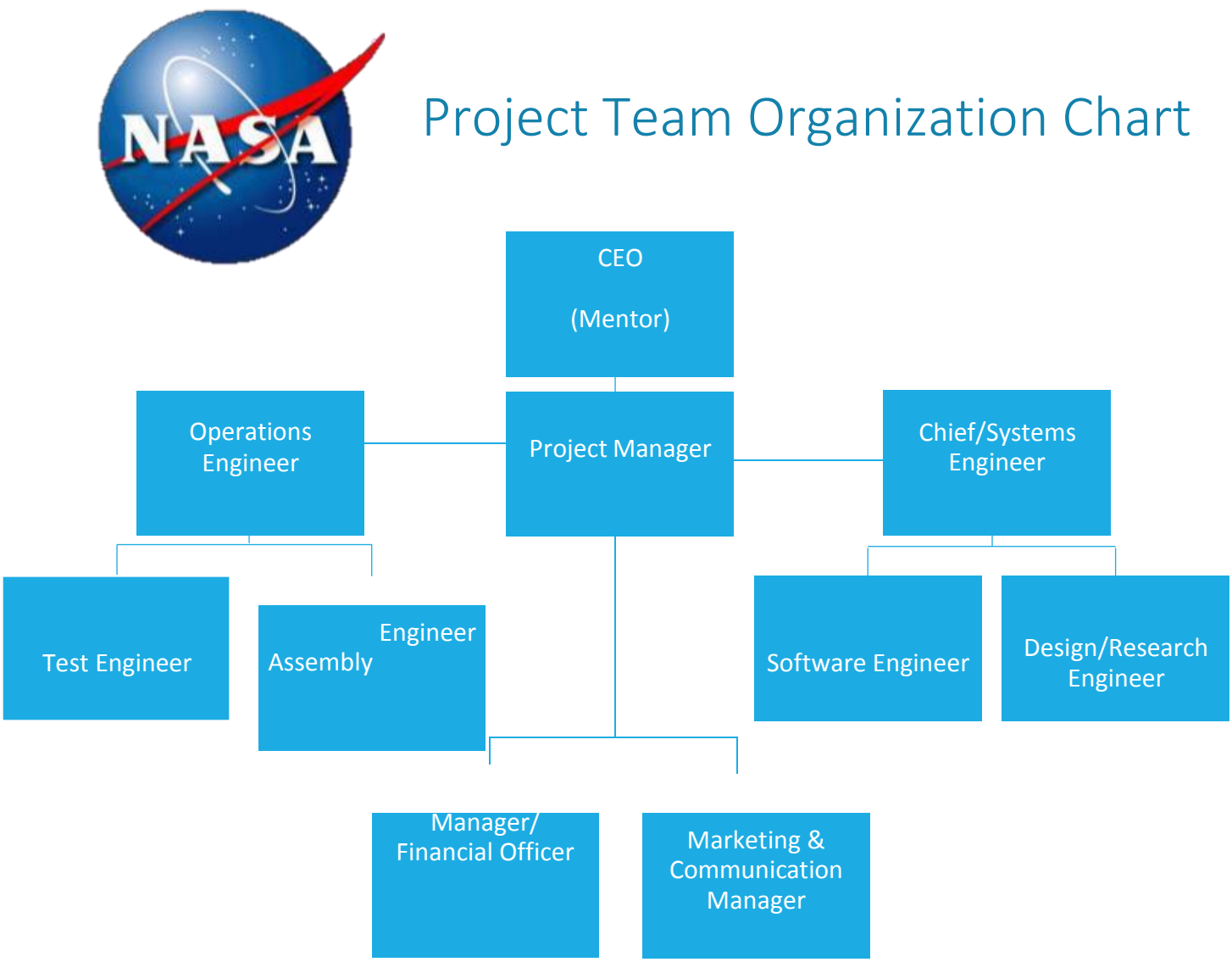
The NCAS Experience

As NASA prepares for future human explorers, your challenge this week is to:

- Form a new aerospace company to compete for a NASA award.
- Create a Statement of Work and provide progress reports to HQ.
- Design and build a rover prototype with the EV3 kit.
- Organize, market, and promote your company and its capabilities to NASA in a final presentation
- Compete in 2 mock missions on a simulated Mars terrain.
- Manage your budget with fiscal responsibility.

Your company's goals must align with NASA's goals for Mars exploration and with NASA work culture and expectations. In this simulation, your company is trying to prove that it should be selected to build the next Mars rover by engineering a rover that performs well, presenting your company with confidence and style, learning from your successes and failures, and managing your budget wisely.

Company Organization



Project Team Job Descriptions

Work with your CEO to determine who will fill each of the roles below based on your knowledge, skills, and interests. Turn in your company org chart along with your company name, logo, and motto along with your SOW on the **first day**.

CEO (Mentor)

- Provides information about concepts
- Answers questions and/or directs to someone who can assist
- Encourages problem solving and advises solutions
- Alerts HQ of activity deserving of bonuses or fines

Project Manager (1 NCAS student)

- The **only** point of contact between headquarters and project team
- Coordinates any meetings between team members
- Mediates between headquarter management and project team
- Responsible for keeping up with Company Handbook (non-budget reports)

Chief/Systems Engineer (1 NCAS student)

- Serves as technical lead of rover
- Coordinates rover design and development
- Ensures that software engineers coordinate with design/research engineers and that all interfaces are understood

Design/Research Engineer (1-2 NCAS students)

- Designs rover and researches most efficient vehicle
- Incorporates team input into the rover design

Operations Engineer (1 NCAS student)

- Ensures project is ready to compete at designated time
- Verifies that rover will not hurt anybody
- Part changes must be approved by Operations Engineer
- Responsible for returning all purchased parts (at the end of the competition)

Assembly Engineer (1 NCAS students)

- Build and test rover according to design/research engineer specifications

Software Engineer (2 NCAS students)

- Develops, tests, and programs mission-critical software for carrying out mission goals

Test Engineer (1 NCAS student)

- Identifies, designs, and performs tests to make sure the rover is ready for the competition
- Verifies that all procedures were followed
- Reports all unsafe conditions

Procurement Manager/Financial Officer (1 NCAS student)

- Manages company budget
- Must approve all monetary transactions and records
- Obtains supplies from headquarters
- Responsible for completing budget report

Marketing & Communications Manager (1 NCAS student)

- Manages all social media content
- Responsible for developing and communicating outreach events
- Communicates team's objectives
- Leads final presentation preparation

Rover Specifications

Each team receives a full EV3 kit. During the research and development phase, examine and try out anything contained in the kits. **USE**[1] of a part to build the rover, you have purchased it and it must enter into your budget accounting.

Rover System Architecture

1. Rover Chassis is required to carry operating systems and allows for successful deployment of scientific instrumentation.
    a. Power source - battery pack
    b. Sensors - ultrasonic, touch, color, gyro - include at least 1 in the design
    c. Robotic-mechanical arms - capability to reach/extend to move, push or scoop up objects
    d. Mobility – Use of tracks, wheels, ball of steel
2. Communications Package: EV3 brick and software for navigation
    a. Program different elements on the brick of the rover
    b. Program the brick to be able to return back to the base autonomously

3-D Printed Part

Each team may bring a unique[2] 3-D printed part to earn a bonus of $6,000,000. A team who brings more than one part may earn more bonus money, at the discretion of the judges. More information on the specifications of the part is located on the Canvas page under the Content tab.

Budget Considerations

Starting Budget: $600,000,000

Expenses:

- ✓ Costs –
    - Prototype
    - Rock Samples
        - Large $500,000
        - Medium $300,000
        - Small $100,000
    - Mars Terrain Tile (per tile): $1,000,000
    - Extra 2 minutes Rover Course Viewing Time: $2,000,000
    - Test Buggy: $2,000,000
    - Mars Terrain Imagery Set: $1,500,000

[1] You may pick up and examine the part, but **not** attach, or run a program with an unpurchased part.
[2] A part printed and designed by a member of the team. Should not look like a part already created by Lego.

Awards:

- Successful Rock Retrieval and Mineral Identification Mission
- Successful Rover Rescue and Mineral Identification Mission
- Bonuses
- Reporting and Communication
- Presentation
- Team Spirit and Professionalism

Final Presentation

Your final presentation will be given on the last day. You should be working toward the second competition at the same time you are creating this presentation. A progress report is due at the end of your second day. This presentation is expected to be about 7-10 minutes in length and the goal is to win funding from headquarters. You may use any presentation format, but Power Point or i-movie are recommended. All students must participate in the presentation.

Items that must be included in your presentation:

- Company name and logo
- Company motto
- Organization of company
- Desired performance outcomes for rover and their alignment with NASA goals
- Report of prototype testing results
- Modifications, if any, to prototype
- Overall budget along with points earned for missions and challenges your team faced
- Lessons learned
- Public outreach and education plans
- Conclusion
    - Why should your team be awarded the contract for the next Mars Rover mission?
    - What about your team stands out over the others?

Winning Team Selection

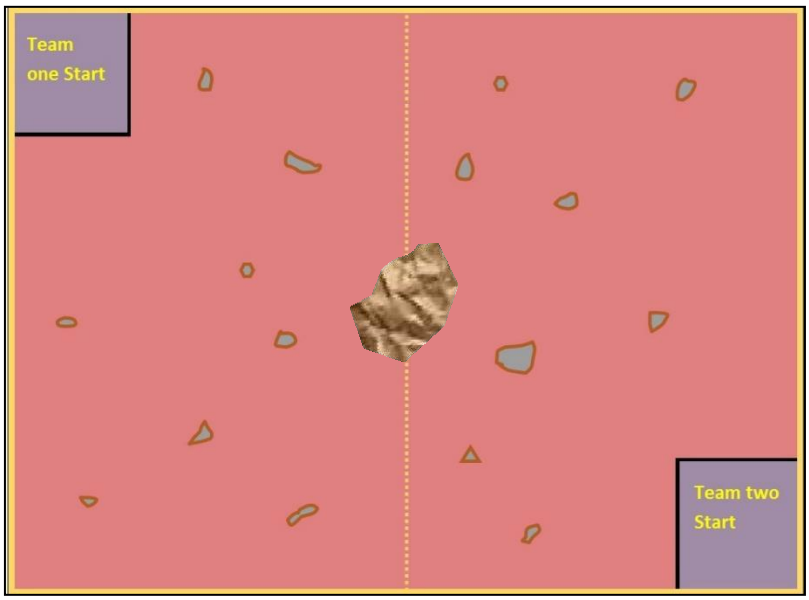
The overall winning team will be determined at the discretion of Headquarters.

Individual activities will be worth:

- 40% - Rock Retrieval and Mineral Identification Mission
- 30% - Rover Rescue and Mineral Identification Mission
- 15% - Final Presentation
- 10% - Budget Reporting & Communication
- 5% - Team Spirit & Professionalism

Rover Competition Arena—"The Mars Yard"

MARS YARD LAYOUT



OLYMPUS MONS SHOWN DIRECT CENTER

The NCAS Mars Yard consists of interlocking foam squares to form a flat Martian surface. Atop the surface are various targets and obstacles of different sizes and shapes. The competition area is bisected down the middle allowing two teams to compete at one time. Teams will be tasked with staying within their half of the competition area, and an out-of-bounds penalty will be assessed upon crossing over to an opponent's side.

Exception: Teams that fall into their opponent's half while attempting to capture Olympus Mons' rock will not be assessed an out-of-bounds penalty. Judges will determine if and when teams may reset their rover.

DO NOT LET ROVER NEAR WHITE OUT OF BOUNDS BORDER

IMPORTANT: Your team's sportsmanship and professionalism should never come into question while you are at NCAS. The course is set up to provide friendly competition as well as share ideas. If your rover does not perform as hoped, do not get discouraged, use what you learned in the next iteration!

Hint: Perhaps your team could adopt and modify a successful technique that another team is using.

Unlike the picture above, your Mars Yard will have a solid blue out-of-bounds border to prevent confusion as to what actually is out of bounds, and what is not.

Out of Bounds Clarification

Rovers must not cross the 3D plane rendered above, or it will be counted as out of bounds. That means **ANY** piece (except the color sensor) of your team's rover that breaks the plane will be assessed the penalty. Rover pieces that incur an out-of-bounds penalty will be penalized thirty seconds.

Judges

The judges are here for you. Their job is to provide fair competition and mediate between disputes, as well as interpret and decide where to rule. The competition judges have the final say. There is no arguing with the judges. There is no instant replay; therefore, the judge's decision is final. Remember your expected behaviors.

Strategy

Remember, this is a competition and a good strategy will do your team well. One particular strategy that has been successful in the past is loading back-up programs onto your team's rover. All too often initial programs can have problems, not working as expected. To ensure the most success, be sure to come with a "Plan B," just in case.

Project Rock Retrieval and Mineral Identification (Competition 1)

This competition consists of building a prototype, testing thoroughly, and completing the Rock Retrieval mission. All costs must be justified, as budget progress reports are due daily. (See *Budget Considerations* for more information.)

GOAL: Traverse the course and gather the rocks and bring them to the extraction area and "identify minerals" in select locations on the course.
RULES:

- All wheels must touch the ground
- Teams may orient their rover in whichever direction they choose upon starting.
- Your rover must be able to move and/or pick up samples
    - Dragging rocks by wires is not allowed
- When the competition starts, hands off! Let the rover run its full program.
- Any object knocked loose or moved inadvertently by the rover will remain in its resting place. At no time during the competition, will there be any modification of the Mars Yard. Only after that team has completed their iteration will the Mars Yard be reset to ensure fair play for all teams.
- When "identifying minerals" the rover must say the name of the mineral found.
- Each team will have a total of **14 minutes** on the simulated Mars surface
    - **2 minutes** to test rover to determine if modifications are needed
    - **2 minutes** to make modifications
    - **10 minutes** to push/carry rocks to extraction area an "identify minerals"

    ***Note:* If a wheel or another part falls off during the 10 minute time period, it remains off – NO REPAIRS!**

AWARDED MONEY:

- **2 Million** – per functioning robotic arm and/or sensor
- **15 Million** – correctly identify mineral
- **10 Million** – small rock
- **20 Million** – medium rock
- **30 Million** – large rock
- **150 Million** – 1 rock on Olympus Mons
  ***Note:* Rocks must be entirely within the Extraction Area* borders to be counted. (*taped off start box)**

PENALTIES:

- **Going out-of-bounds-- Any part of the rover that touches the blue tape (except the color sensor), or enters into the 3D plane of the out-of-bounds area.**

  ***Note:* If a rover goes out-of-bounds, a thirty-second penalty will be enacted. Your rover must wait in the out-of-bounds zone until the full thirty seconds are over. Time will not start until your program has ended.**

Project Rover Rescue and Mineral Identification (Competition 2)

This competition consists of modifying your rover prototype, testing thoroughly, and completing the Rover Rescue mission. You must be working on your final presentation and rover design at the same time, as presentations will occur after this challenge is completed. Include in your daily progress report the justified costs of your rover revisions. (See *Budget Considerations* for more information.)

GOAL: Drive towards the stranded Mars Buggy, secure it, and bring it back to the start area, and "identify minerals" in select areas of the course.
RULES:

- All wheels must touch the ground
- Teams may orient their rover in whichever direction they choose upon starting.
- Your rover must be able to move and/or pick up samples
    - Dragging rover by wires is not allowed
- When the competition starts, hands off! Let the rover run its full program.
- Any object knocked loose or moved inadvertently by the rover will remain in its resting place. At no time during the competition will there be any modification of the Mars Yard. Only after that team has completed their iteration will the Mars Yard be reset to ensure fair play for all teams.
- When "identifying minerals" the rover must say the name of the mineral found.
- Each team will have a total of **14 minutes** on the simulated Mars surface
    - **2 minutes** to test rover to determine if modifications are needed
    - **2 minutes** to make modifications
    - **10 minutes** to retrieve the buggy, secure it, and tow it back to the start.

    ***Note:* If a wheel or another part falls off during the 10 minute time period, it remains off – NO REPAIRS!**

AWARDED MONEY:

- **2 Million** – per functioning robotic arm and/or sensor
- **15 Million** – correctly identify a mineral
- **75 Million** – each Mars Buggy rescued

PENALTIES:

- **Going out of Bounds –** If any part of the rover touches the blue tape (except the color sensor), or enters into the 3D plane of the out of bounds area.

    ***Note:* If a rover goes out-of-bounds, a thirty second penalty will be enacted. Your rover must wait in the out-of-bounds zone until the full thirty seconds are over. Time will not start until your program has ended.**

Final Presentation Scorecard

For each item, please award between 0-2 points.

0 - Item not addressed **1- Moderately Well** **2-Very well**

Name, Logo, Motto, Organization ___High creativity and appeal to consumer ___Company name incorporates team color ___Presents company org. chart **Rover Prototype—Addresses the following components of the rover:** ___Power ___Instrumentation ___Robotic-Mechanical Arm ___Control Program ___Navigation Package ___Communications Package ___Creative Design **Prototype Testing Results** ___Reports on rover challenge outcomes ___Describes modifications made between first and second competition ___Describes challenges faced and lessons learned **Budget Management and Cost Justification** ___Provides high level budget overview ___Provides cost of rover for first competition and additional expenses for second competition ___Provides totals for fines and bonuses ___Provides rationale for spending **NASA Alignment** ____Clearly and accurately aligns to NASA's goals for Moon and Mars Exploration ___Uses Multiple keywords and terms from Moon to Mars	**Public Outreach & Communication Plan** ___Has a clear purpose and key messages ___Multiple strategies for different audiences identified ___Events planned to promote company and mission across multiple platforms and venues **Presentation Style** ___Company appears organized, prepared and or rehearsed ___All team members speak ___Logical flow of topics ___Tells a compelling story ___Team is confident and enthusiastic **Presentation Format** ___Professional color scheme/slide layout ___Images and Text are well-balanced ___Text and images are legible ___Text is mechanically correct (Spelling, grammar, etc.) **___Time Limit** Give a 0 if less than or equal to 5 mins OR if 12+ minutes Give 1 point if between 5 and 7 mins OR if between 10 and 12 Give 2 points if presentation was between 7 and 10.
COLUMN A SUBTOTAL	**COLUMN B SUBTOTAL**

(62 possible points)

TOTAL SCORE (Add Columns A + B) _____

Purchasing/Selling Rover Parts

Each team has the option to sell excess parts from their kits to other teams. The procurement manager/financial officer is responsible for approving all sales and purchases, maintaining all transaction receipts, and obtaining and releasing all parts. All deals must be completed at Headquarters by the Project Manager.

Note: Parts must be returned to their rightful kits at the end of the competition. Your team will be fined if your team fails to do this.

Team Prototype Cost Analysis (Competition 1)

Each part that you use will cost you money. The amount of money for each part is categorized by type of part. Each type is in a different box and will be shown on the following pages. Make sure you multiply the price assigned to the box by the number of parts that you use from that box.

Purchase Order Form on Next Page.

Note: Do not lose any of the parts. You will be fined $500,000 per part for losing parts or if they are found on the floor.

Competition 1 Purchase Order Form

Box	Price Per Part	Number of Parts	Subtotal
A	$1,000,000		
B	$2,500,000		
C	$5,000,000		
D	$3,250,000		
E	$3,250,000		
F	$5,500,000		
G	$3,750,000		
H	$10,000,000		
I	$5,000,000		
J	$3,000,000		
K	$1,500,000		
L	$1,500,000		
M	$5,000,000		
N	$10,000,000		
O	$5,000,000		
P	$2,500,000		
Q	$2,500,000		

Box	Price Per Part	Number of Parts	Subtotal
R	$3,000,000		
S	$1,500,000		
T	$1,500,000		
U	$1,000,000		
V	$15,000,000		
W	$1,000,000		
X	$8,000,000		
Y	$10,000,000		
Z	$2,000,000		
AA	$7,500,000		
BB	$3,000,000		
CC	$5,000,000		
DD	$3,000,000		
EE	$3,000,000		
FF	$1,000,000		
GG	$1,500,000		
HH	$1,000,000		
II	$3,000,000		
JJ	$3,000,000		
KK	$6,000,000		
LL	$3,500,000		
MM	$7,500,000		
NN	$10,000,000		
OO	$5,500,000		

Box	Price Per Part	Number of Parts	Subtotal
PP	$4,000,000		
QQ	$1,000,000		
RR	$4,500,000		
SS	$8,000,000		
TT	$6,000,000		
UU	$2,500,000		
VV	$3,500,000		
WW	$6,500,000		
		Total Amount	

Team Prototype Cost Analysis (Competition 2)

Each part that you use will cost you money. The amount of money for each part is categorized by type of part. Each type is in a different box and will be shown on the following pages. Make sure you multiply the price assigned to the box by the number of parts that you use from that box.

Note (1): Your team only needs to track any additional parts added from Competition 1. You may not subtract the value of any parts removed from the rover.

Note (2): Do not lose any of the parts. You will be fined for losing parts or if they are found on the floor.

Competition 2 Purchase Order Form

Box	Price Per Part	Number of Parts	Subtotal
A	$1,000,000		
B	$2,500,000		
C	$5,000,000		
D	$3,250,000		
E	$3,250,000		
F	$5,500,000		
G	$3,750,000		
H	$10,000,00		
I	$5,000,000		
J	$3,000,000		
K	$1,500,000		
L	$1,500,000		
M	$5,000,000		
N	$10,000,000		
O	$5,000,000		
P	$2,500,000		
Q	$2,500,000		

Box	Price Per Part	Number of Parts	Subtotal
R	$3,000,000		
S	$1,500,000		
T	$1,500,000		
U	$1,000,000		
V	$15,000,000		
W	$1,000,000		
X	$8,000,000		
Y	$10,000,000		
Z	$7,500,000		
AA	$3,000,000		
BB	$3,000,000		
CC	$5,000,000		
DD	$3,000,000		
EE	$3,000,000		
FF	$1,000,000		
GG	$1,500,000		
HH	$1,000,000		
II	$3,000,000		
JJ	$3,000,000		
KK	$6,000,000		
LL	$3,500,000		
MM	$7,500,000		
NN	$10,000,000		
OO	$5,500,000		

Box	Price Per Part	Number of Parts	Subtotal
PP	$4,000,000		
QQ	$1,000,000		
RR	$4,500,000		
SS	$8,000,000		
TT	$6,000,000		
UU	$2,500,000		
VV	$3,500,000		
WW	$6,500,000		
		Total Amount	

Deliverables:

Statement of Work (SOW)

A statement of work (SOW) is a formal document that defines the work activities, timeline, cost, and metrics that will be executed during your work period. It is expected to be no longer than 1 page in length and contain:

- Planned work activities
- Timeline of project
- Estimated pricing of rover for Competition 1
- Desired performance outcomes

The SOW can be submitted to HQ in writing or submitted digitally on a thumb drive. Be sure to get your CEO's approval before submitting.

Progress Report 1

Please turn in to Project Manager before you leave for the day.
Project Manager is responsible for submitting to headquarters.

What has been accomplished? Use a time line.

What still needs to be accomplished for your rover?

Progress Report 2

Please turn in to Project Manager before you leave for the day.
Project Manager is responsible for submitting to headquarters.

What has been accomplished since competition one? Use a time line.

What still needs to be accomplished for your rover before the second competition?

Final Presentation Progress Report

Project Manager is responsible for submitting to headquarters.

What has been accomplished? Use a time line.

What still needs to be accomplished for your final presentation?

Overall Budget Spreadsheet

Please turn in to Project Manager before your final presentation.
Project Manager is responsible for submitting to headquarters.

_____Team

Starting Budget	$600,000,000
Rover Prototype Rock Retrieval and Mineral Identification Cost	
Rover Prototype Rover Rescue and Mineral Identification Delta Cost	
Rock Retrieval and Mineral Identification Award Amount	
Rover Rescue Award and Mineral Identification Award Amount	
Total Bonuses	
Total Fines	

ROVER PARTS & PRICES

A	B	C
 10x Bushing, ½-module, yellow 4239601	 2x Axle with stud, 3-module, dark beige 6031821	 5x Axle, 7-module, gray 4211805
 10x Bushing, 1-module, gray 4211622	 2x Axle with stop, 4-module, dark gray 4560177	 2x Axle, 8-module, black 370726
 60x Connector peg with friction, 2-module, black 4121715	 2x Axle with stop, 8-module, dark gray 4499858	 2x Axle, 9-module, gray 4535768
 10x Connector peg, 2-module, gray 4211807	 10x Axle, 2-module, red 4142865	 2x Axle, 10-module, black 373726
 8x Connector peg with axle, 2-module, beige 4666579	 14x Axle, 3-module, gray 4211815	 2x Axle, 12-module, black 370826
 6x Connector peg, 3-module, beige 4514554	 4x Axle, 4-module, black 370526	 4x Pointer, 3-module, white 4173941
 20x Connector peg with friction/axle, 2-module, blue 4206482	 6x Axle, 5-module, gray 4211639	D  4x T-Beam, 3x3-module, black 4552347
 30x Connector peg with friction, 3-module, blue 4514553	 4x Axle, 6-module, black 370626	
 22x Connector peg with bushing, 3-module, red 4140806		

ROVER PARTS & PRICES

E

4x
Beam with crosshole, 2-module, black
6006140

2x
Beam, 3-module, black
4142822

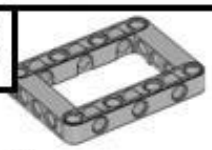
4x
Beam, 3-module, green
6007973

4x
Beam, 3-module, red
4153718

4x
Beam, 3-module, blue
4509376

4x
Beam, 3-module, yellow
4153707

H



3x
Frame, 5x7-module, gray
4539880

1x
Frame, 5x11-module, gray
4540797

F

6x
Angular beam, 4x4-module, white
4509912

4x
Angular beam, 3x7-module, gray
4211624

4x
Angular beam, 4x6-module, black
4112282

4x
Double angular beam, 3x7-module, white
4495412

6x
Angular beam, 2x4-module, red
4141270

2x
Angular beam, 3x5-module, gray
4211713

4x
Angular beam, 3x5-module, white
4585040

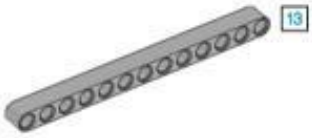
G

4x
Beam, 5-module, gray
4211651

4x
Beam, 7-module, gray
4495930

6x
Beam, 9-module, gray
4211866

4x
Beam, 11-module, gray
4611705



6x
Beam, 13-module, gray
4522934

6x
Beam, 15-module, white
4542578

ROVER PARTS & PRICES

I

4x
Double connector peg, 3-module, gray
4560175

6x
Double connector peg, 3x3-module, gray
4225033

4x
Angular connector peg, 3x3-module, gray
4296059

L

8x
Cross block, 2-module, gray
4211775

8x
Cross block, 3-module, dark gray
4210857

6x
Cross block, 3x2-module, gray
4538007

8x
Double cross block, 3-module, black
4121667

4x
Cross block fork, 2x2-module, black
4162857

J

4x
Cross block, 2x2-module, black
4140430

2x
Cross beam, 2x1-module, red
6008527

2x
Connector peg with handle, 3-module, black
4563044

2x
½ beam, 4-module, black
4142236

4x
½ triangle beam, 5x3-module, gray
6009019

2x
3-spoke angular block, 3x120°, gray
4502595

4x
Tube, 2-module, gray
4526985

6x
Bushing/axle extender, 2-module, red
4513174

K

4x
Angular block 1, 0°, black
4107085

4x
Angular block 2, 180°, black
4107783

2x
Angular block, 6 (90°), black
4107767

4x
Rubber beam with crossholes, 2-module, black
4198367

M

4x
Gear, 8-tooth, dark gray
4514559

2x
Bevel gear, 12-tooth, beige
4565452

4x
Gear, 16-tooth, gray
4640536

4x
Gear, 24-tooth, dark gray
4514558

N

2x
Gear, 40-tooth, gray
4285634

2x
Double bevel gear, 12-tooth, black
4177431

2x
Double bevel gear, 20-tooth, black
4177430

2x
Double bevel gear, 36-tooth, black
4255563

2x
Worm gear, gray
4211510

4x
Gear, 4-tooth, black
4248204

T

2x
Turntable bottom, 28-tooth, gray
4652235

2x
Turntable top, 28-tooth, black
4652236

O

2x
Hub, 43.2x26 mm, gray
4634091

2x
Low profile tire, 56x28 mm, black
6035364

Q

4x
Tire, 30.4x4 mm, black
6028041

4x
Hub, 24x4 mm, dark gray
4587275

R

1x
Steel Ball, silver metalic
6023956

1x
Ball bearing, dark gray
4610380

U

54x
Track, 5x1,5-module, black
6014648

P

4x
Sprocket, 40.7x15 mm, black
4582792

EE

1x
Right curved panel, 5x11-module, black
4543490

1x
Left curved panel, 5x11-module, black
4541326

S

1x
Left curved panel, 3x5-module, black
4566251

1x
Right curved panel, 3x5-module, black
4566249

ROVER PARTS & PRICES

V

1x
EV3 Brick

W

4x
Cable, 25 cm / 10 in.
6024581

X

1x
Color Sensor
6008919

2x
Touch Sensor
6008472

1x
Ultrasonic Sensor
6008924

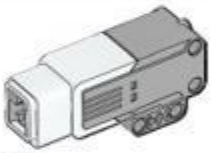
1x
Gyro Sensor
6008916

2x
Large Motor
6009430

Y

2x
Cable, 35 cm / 14 in.
6024583

Z



1x
Medium Motor
6008577

AA

1x
Cable, 50 cm / 20 in.
6024585

BB

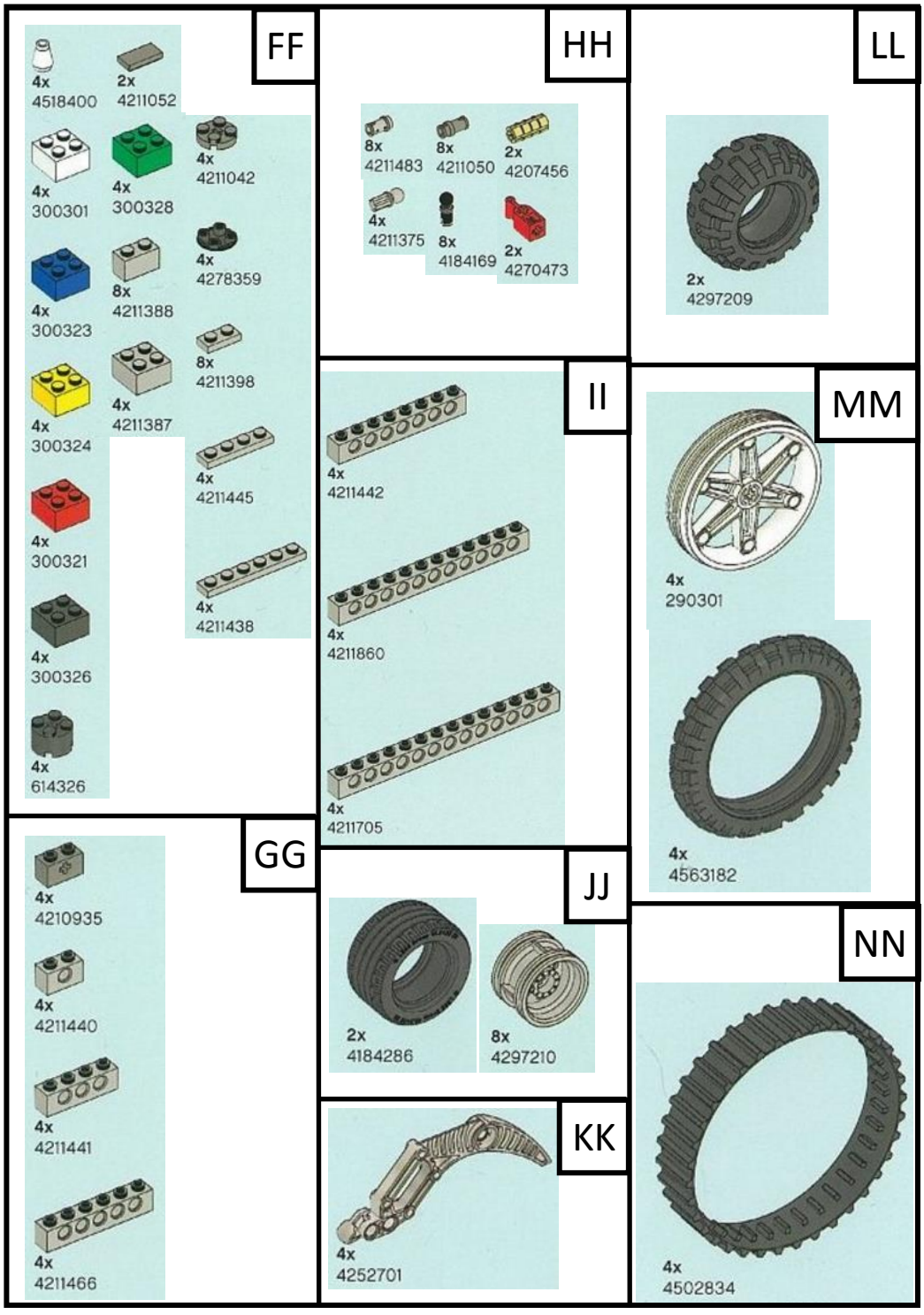
1x
Rechargeable Battery
6012820

CC

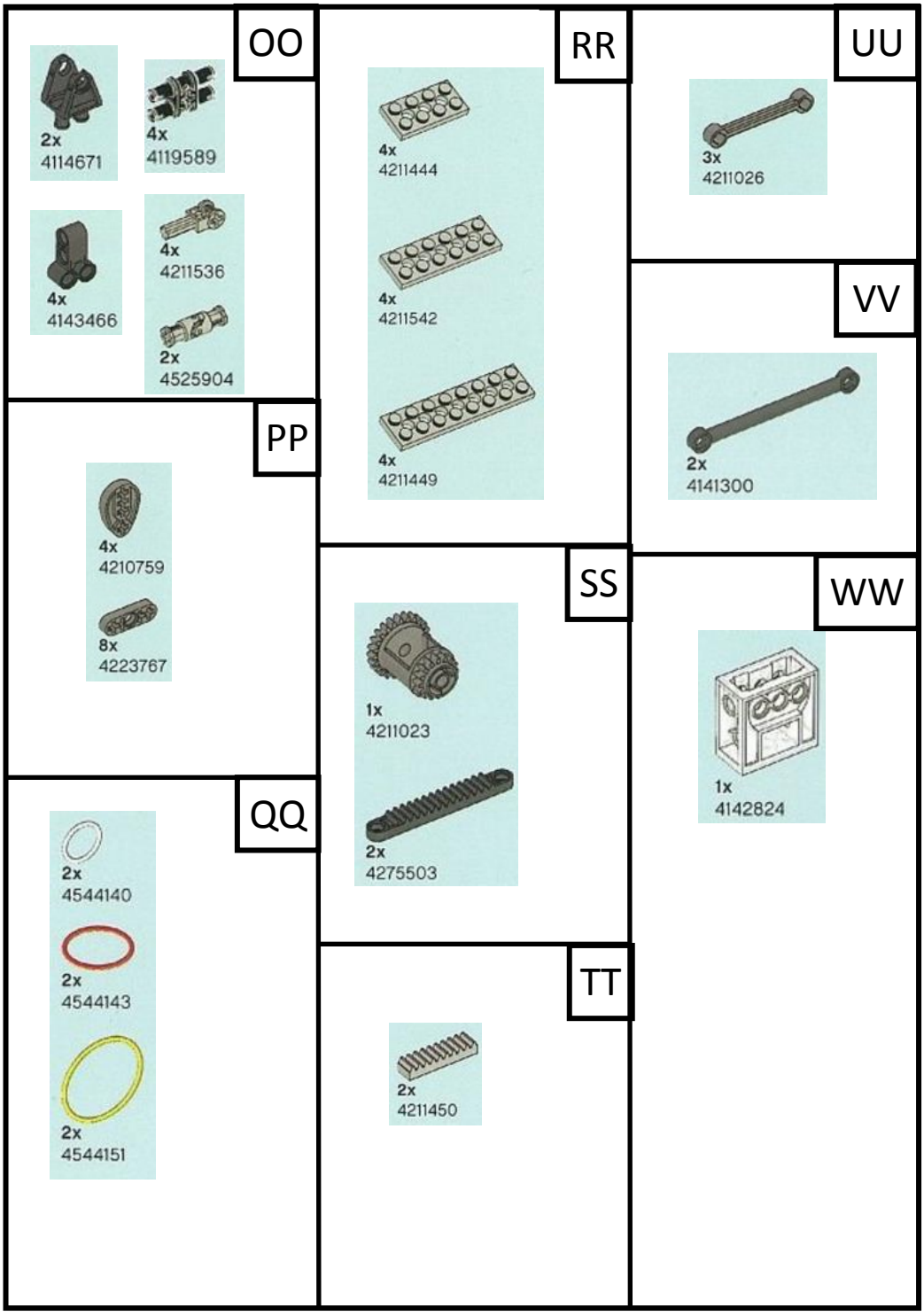
1x
USB Cable
6036901

DD

ROVER PARTS & PRICES



ROVER PARTS & PRICES



EV3 Tutorial

Please visit the following websites for EV3 tutorials:

http://ev3lessons.com/en/(Beginner, Intermediate, and Advanced Lessons)

http://www.lego.com/en-us/mindstorms/learn-to-program

www.youtube.com (search programming EV3 tutorial)

http://why.gr/wp-content/uploads/2015/03/EV3-User-Guide-EN.pdf

Networking: Mentor, Speaker and Judge Biographies

NCAS will introduce you to a wide variety of professionals from diverse backgrounds at many different stages in their careers.

Please take the time to read their biographies before meeting them so you can:

- Ask questions relevant to their experience during presentations
- Use this info as a networking tool for a jumping off point to have a conversation:
    - Find something in common with this person and ask their advice
    - Find something that interests you about this person so you can ask further questions

We encourage you to ask questions and engage in conversations with the people that you will meet at NCAS. Here are some powerful networking questions you can use. (*From http://www.alduncan.net/networking-questions.html*)

1. How did you get involved in…?

   VARIATIONS:
   What made you decide to major in…?
   What made you decide to attend (name of school)?
   What made you decide to go into the___field?

2. What advice would you give me if I wanted to be successful in your line of work (or major)?

   VARIATION: *What advice would you give someone just starting in this profession/major?*

3. What do you love/enjoy most about what you do?

4. What separates you from the competition?

5. What was the strangest or funniest incident you've experienced in your professional career?

6. What do you see as the coming trends in your field?

7. What would make someone the ideal employee for your organization?

Workshop Expectations

Attire

We want you to be comfortable but professional. Dress in layers or bring a fleece or sweater as temperatures will vary greatly.

- **Pants:** A dark wash or "nice" jeans, khakis or slacks permitted. **Not permitted**: *shorts, skirts/dresses, sweat pants, pajama/ spandex/leggings/yoga pants, torn jeans, sagging/revealing pants.*
- **Shirts:** Button down/collared shirts, polo shirts, sweaters, blouses. T-shirts are ok if worn under collared shirt or jacket. **Not permitted**: *tank tops, low-cut tops, shirts with corporate lettering or logos.*
- **Shoes:** Closed-toe shoes - loafers, boots, flats, leather casual, and clean athletic shoes. **Not permitted:** *open-toe shoes, flip-flops, sandals, and slippers.*

Hotel Information

If required to stay at a hotel, you will be assigned a roommate. Use the buddy system and help keep each other on time to all events.

Meals & Snacks

All meals and snacks will be provided. Vegetarian options will be available for those who requested it in their travel information forms. Options will be available for those who indicated allergies or religious observances on their travel information forms. Please contact us ASAP if you did not provide this information in your form.

What to Bring

- Valid government issued photo ID with your legal name such as a driver license or U.S. Passport. This is required for entry to tours. If flying, the name on your e- ticket must match the name on your ID.
- Cell phones, laptops, mobile devices are all permitted. Please bring at your own risk.
- Spending money for the gift shops.
- Comfort items such as refillable water bottle, chewing gum, mints, tissues, lip balm, sun block, umbrella, hand lotion or sanitizer
- Sweater or jacket.

TEAM EXPECTED BEHAVIORS

The NASA values consist of Safety, Teamwork, and Integrity in support of Mission Success. We commit without compromise to embodying our core values in all that we do.

While many organizations and companies have their own core values these serve to improve and reinforce the relationships we have with each other, and to complement those organizational or corporate values.

Be Respectful - Demonstrate consideration or appreciation.

We respect ourselves and each other. We appreciate the creativity and broader perspective of a diverse team. This diversity is vital to our success.

Be Trustworthy - Act with integrity and honor

Our success is built on an environment of trust and ethical behavior. We exhibit sincerity and truthfulness in all actions.

Be Accountable - Be answerable and responsible for your actions

We are personally answerable for fulfilling our individual and team commitments.

Be Open Minded - Be receptive

We seek knowledge that will strengthen our team and ourselves.

Be a Key Player - Think results

We encourage all team members to be engaged contributors and develop solutions.

Mentors - They have lives too!

Please remember they are full time employees with their own deadlines they have to meet. They are volunteering their time to your team and you should keep that in mind if your mentor should miss something during the workshop.

Effective Communication is a crucial ingredient to practicing these behaviors daily.

With effective communication we make these behaviors common practice. Communication is a two-way process that requires us to listen and understand at least as much as we speak.

We openly share information and knowledge, focusing on quality not quantity.

This all seems like common sense to me, why are we undertaking this effort?

- To make life better for all of our employees; to create an environment in which employees feel they can contribute, add value, can disagree openly and without fear, and enjoy working together every day to execute our mission.
- To be the best team we can be.

Safety Summary

Safety is everyone's responsibility Even if you have your own personal vehicle, you are required to use the provided transportation throughout the workshop.

Safety Tips to Remember:

- Report **all** work-related injuries to the NCAS program staff **immediately**.
- Always wear correct personal protective equipment (PPE) if requested to do so (i.e. safety glasses, face protection, hard hats, shoes, gloves, etc.).
- Keep your work areas clean to prevent slips, trips, and fall from spills; fire hazards from paper stacks; and rodent/roach problems from food.

What can I do to prevent injury or harm to others and myself?

- Learn and follow all of the safety rules that are given to you.
- Ask questions if you have doubts concerning a safety condition.
- Never allow yourself or anyone else to work in an unsafe area.
- Follow all warning signs.

What do I do if I see an unsafe act or condition?

- Stop it!
- Fix it yourself (if you can).
- Tell your CEO (mentor) or NCAS program staff.

What do I do in case of a fire alarm?

- There are maps located on the wall that show you where to go.
- Notify your NCAS program staff if you cannot use the stairs to evacuate or need assistance to evacuate. He/She will discuss special evacuation procedures with you.