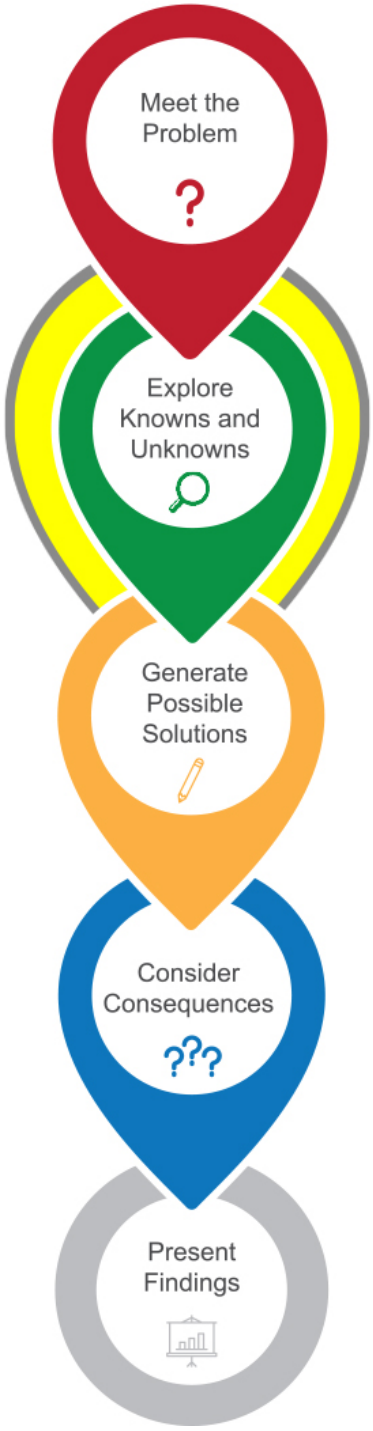
PHASE II

Part 1: Explore Knowns and Unknowns/Baseline Testing of Tool

Astronaut Charles M. Duke Jr., Apollo 16 lunar module pilot, has a sample bag in his hand, and a lunar surface rake leans against the large boulder. Credits: NASA



In Part 1 of Phase II, your team will continue to explore knowns and unknowns as you test your team's tool and collect data related to its performance. While conducting the test, you will be wearing simulated spacesuit gloves from a previous NASA/team activity. You will not be permitted to recover or pick-up samples directly with your hands; only the tool can be used (while you are wearing the spacesuit gloves). Be sure to review the testing procedure and the Tool Feedback Form (TFF) carefully prior to conducting your testing. Attention to detail and recording of data during testing in Part 1 will provide valuable information that will help you to generate possible solutions in Part 2.

Good luck!

Phase II - Part 1: Explore Knowns and Unknowns/Baseline Testing of Tool

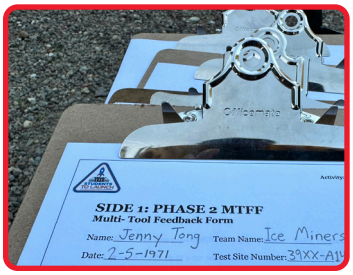
TOOL BASELINE TESTING PROCEDURES

STEP 1: Go with your team to your assigned testing site, that will include a simulated Moon surface with lunar rock and lunar **regolith**. Take all four tool components and four copies of the Phase II TFF with you. (A Mission Director may have already brought over your TFFs. Ask questions if needed for clarification.)

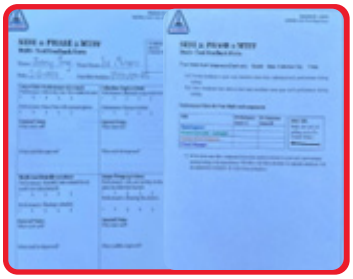
STEP 2: Determine who will be timing your tests with the stopwatch. If it is students and not a Mission Director, each student will take a turn timing another student. Use this time to learn how to use the stopwatch. If needed, ask a Mission Director for help.

STEP 3: Place all your team's tool components in the marked tool component stage area of the test site. Check with a Mission Director to make sure your test site has been prepared and cleared for testing.

STEP 4: Place your TFF in the provided clipboard if this was not done by a Mission Director. Fill out the test evaluator section in pencil (NAME, TEAM NAME, DATE, TEST SITE NUMBER).



STEP 5: Pre-read both sides of your TFF to prepare for what you are expected to report on after your test session. Then discuss with your team any questions you may have.

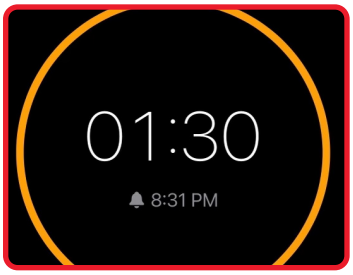


STEP 6: Each member will have a 1 minute 30 seconds time frame to collect as many simulated lunar rocks and the least amount of the simulated lunar regolith as possible by raking, scooping, and picking up with the tongs with the spacesuit gloves on.

Phase II - Part 1: Explore Knowns and Unknowns/Baseline Testing of Tool

STEP 7: Collect as many lunar rock specimens as possible using the tool attachments and place them in the collection bucket. All the tools in the kit must be used during the testing time. Remember, do not use the gloves to directly pick up the samples.

STEP 8: After 1 minute and 30 seconds the timer should say "Stop!" Stop collecting rocks. Any rocks that have not been placed in the collection bucket should be placed back into the test site.



STEP 9: When the first team member is finished, they should count the number of rocks collected with the tool and record the number on their TFF.

STEP 10: Repeat the testing process for the remaining three team members. When testing is completed, each student should complete Side 1 only of the Tool Feedback Form (TFF) about their testing trial. Good luck! Happy Testing.

Great job completing initial testing of the Tool!

Now it is time for your team to share their observations and data in a Stand-up presentation.

A. Group members should stand in a circle.
B. The maker of the tool component (lunar rake, collection cup handle, or lunar tongs) should refer to the notes on the TFF and speak for 1 minute about its performance to their team members.
C. Each team member should then share their feedback about the tool component (refer to notes on TFF) with the maker of the component (lunar rake, collection cup, handle, or lunar tongs). The maker should record the feedback on SIDE 2 of their TFF.

Steps A-C should be repeated for the remaining team members until everyone has SIDE 1 and SIDE 2 of their TFFs completed.

SIDE 1: PHASE II Tool Feedback Form (TFF)

NUMBER OF ROCKS COLLECTED:

Student Name: _____ **Team Name:** _____

Date: _____ **Test Site Number:** _____

Lunar Rake (5 is best)

A. Performance: Efficiently find rocks hidden in sand.

1 2 3 4 5

B. Performance: Ease of use with spacesuit gloves.

1 2 3 4 5

General Notes

What went well?

What could be improved?

Collection Cup (5 is best)

A. Performance: Efficiently scoop rocks into bucket.

1 2 3 4 5

B. Performance: Placing in bucket.

1 2 3 4 5

General Notes

What went well?

What could be improved?

Tool Handle (5 is best)

A. Performance: Stability and connection to tool attachments.

1 2 3 4 5

B. Performance: Placing in bucket.

1 2 3 4 5

General Notes

What went well?

What could be improved?

Lunar Tongs (5 is best)

A. Performance: Grip and pickup rocks and place in collection bucket.

1 2 3 4 5

B. Performance: Clearing fine debris.

1 2 3 4 5

General Notes

What went well?

What could be improved?

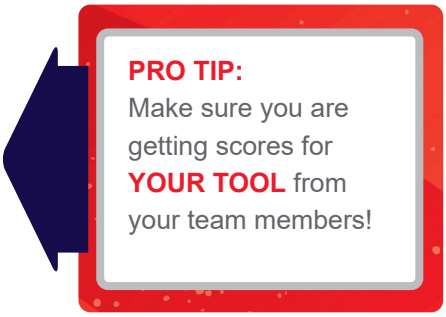
SIDE 2: Phase II Tool Feedback Form (TFF)

Your Tool Component (Circle one): Handle Rake Collection Cup Tongs

A. Provide feedback to your team members about their individual tool's performance during testing.
B. Collect feedback from each of your team members about your tool's performance during testing.

Performance Data for Your Tool component.

Role	Performance Score: A	Performance Score: B
Tools Engineer		
Mission Specialist - Geologist		
Human Factors Engineer		
Project Manager		



C. Write down any other comments from team members related to your tool's performance during testing in the space below. **YOU WILL USE THESE NOTES TO CREATE A DESIGN FOR AN IMPROVED VERSION OF YOUR TOOL IN PART 2!**

PHASE II

Part 2: Generate Possible Solutions/Tool Redesign

Congratulations on completing your first round of testing with your initial prototypes. In Part 2 of Phase II, you will Generate Possible Solutions. Each team member will redesign their Tool component using the data recorded on the TFF from testing and your team's stand-up discussion. The original maker of each tool will be responsible for rebuilding the part for round two of testing. To facilitate the redesign and rebuild step, we have supplied some of the basic building components so that you can focus more time on the part that needs customization/changing. You will have until the end of Phase II to complete your tool's redesign. Work efficiently – time is tight.

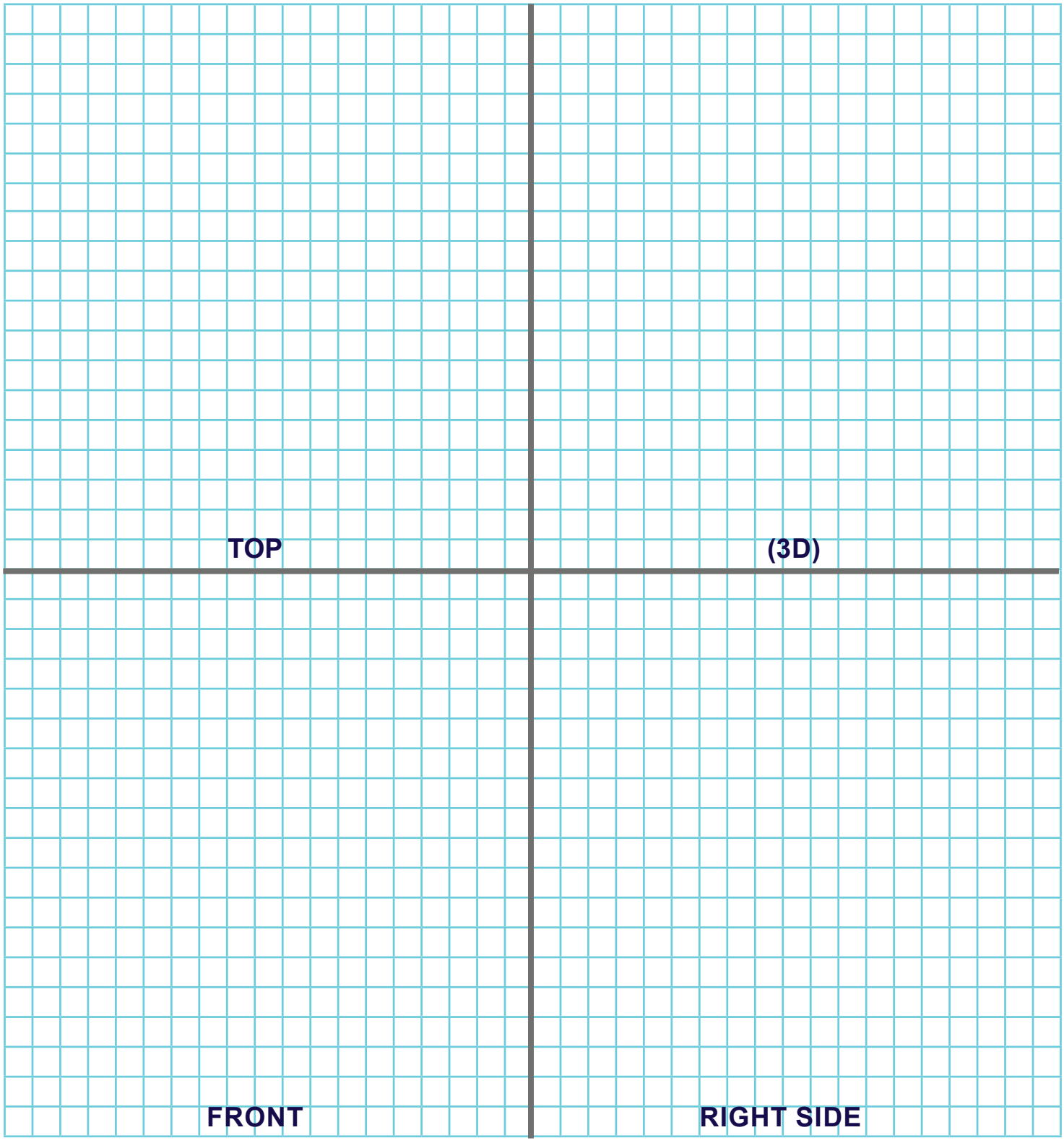
Tool Component Redesign Instructions

STEP 1: Discuss with your team: What materials will be needed for each component's redesign? This will ensure that there are enough materials to complete your modifications. Write down what materials and tools you will need; then work with a Mission Director on securing those items for your rebuild.

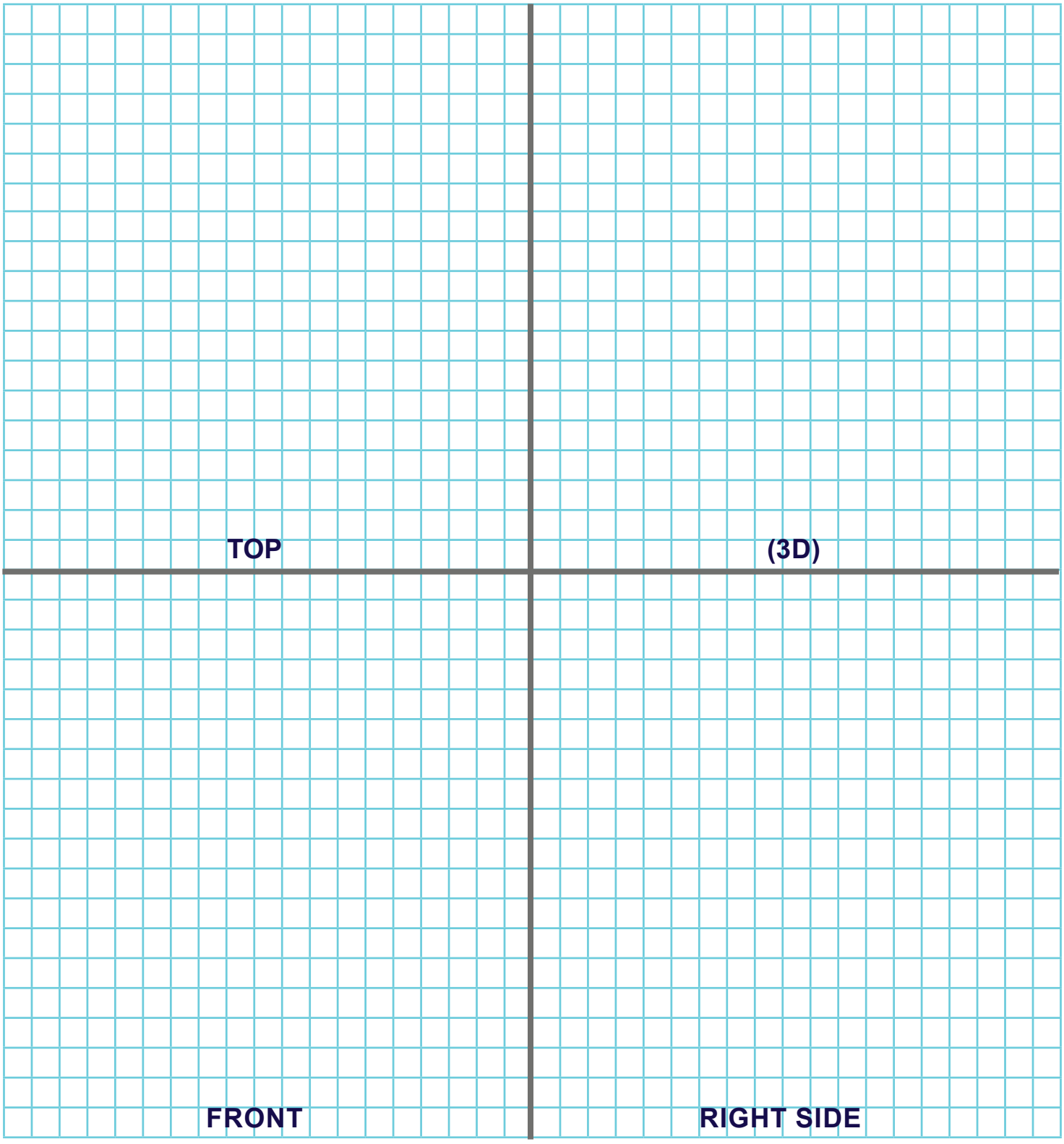
STEP 2: Complete a brainstorm sketch on the Tool Redesign Sketch Sheet on the following page. Use the 3D-view plus orthographic format. That's a top view, front view, and right-side view of the tool. In the upper right corner, do your best to draw a 3-D sketch of your redesign.

STEP 3: Use the materials in your team's supply bin and other items requested from a Mission Director to create your redesign. As time gets close to the end you may find yourself working faster to make sure your project is completed on time. SLOW DOWN, BE SAFE, FOCUS ON QUALITY!

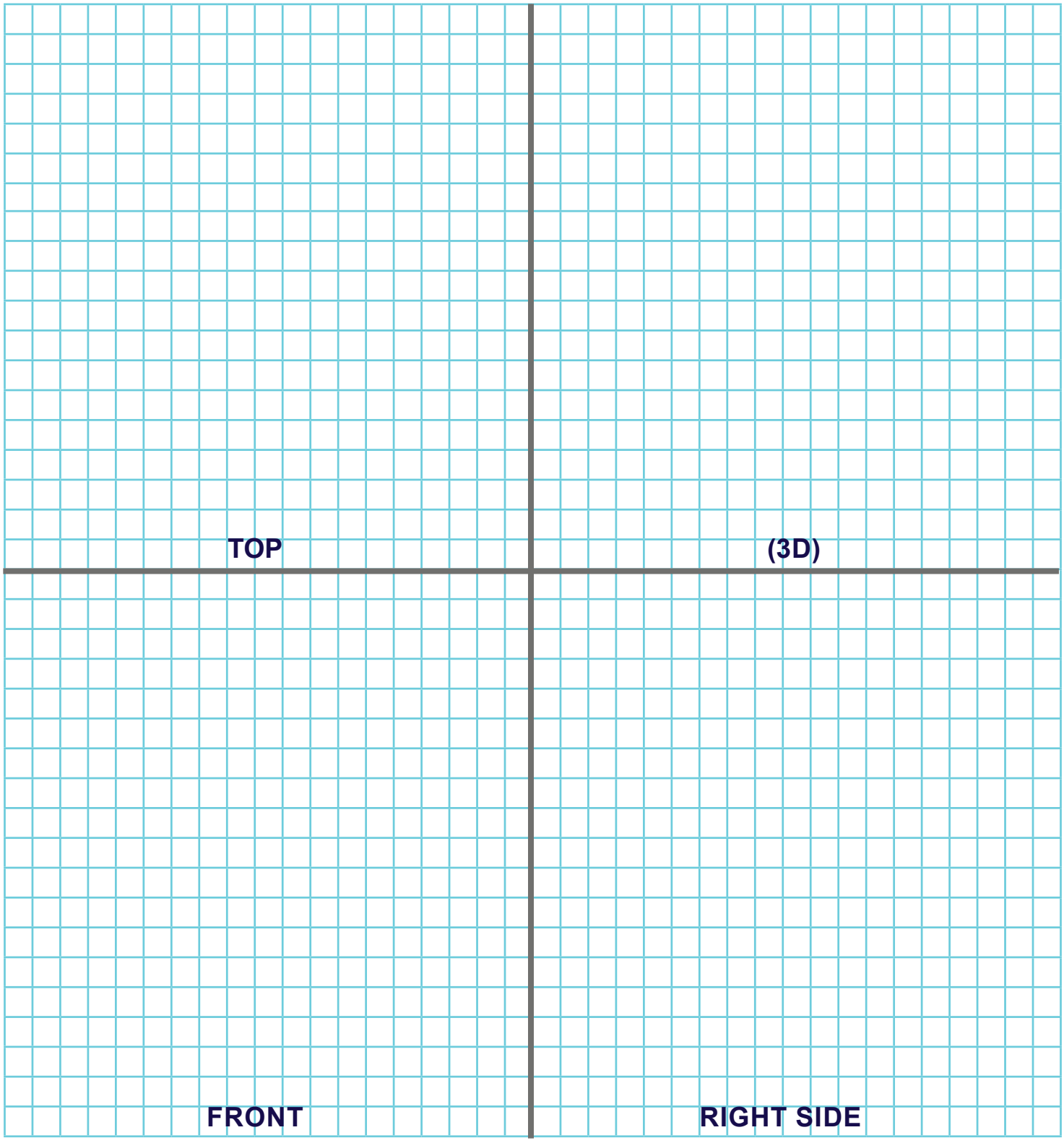
Sketch Sheet: Tools Engineer



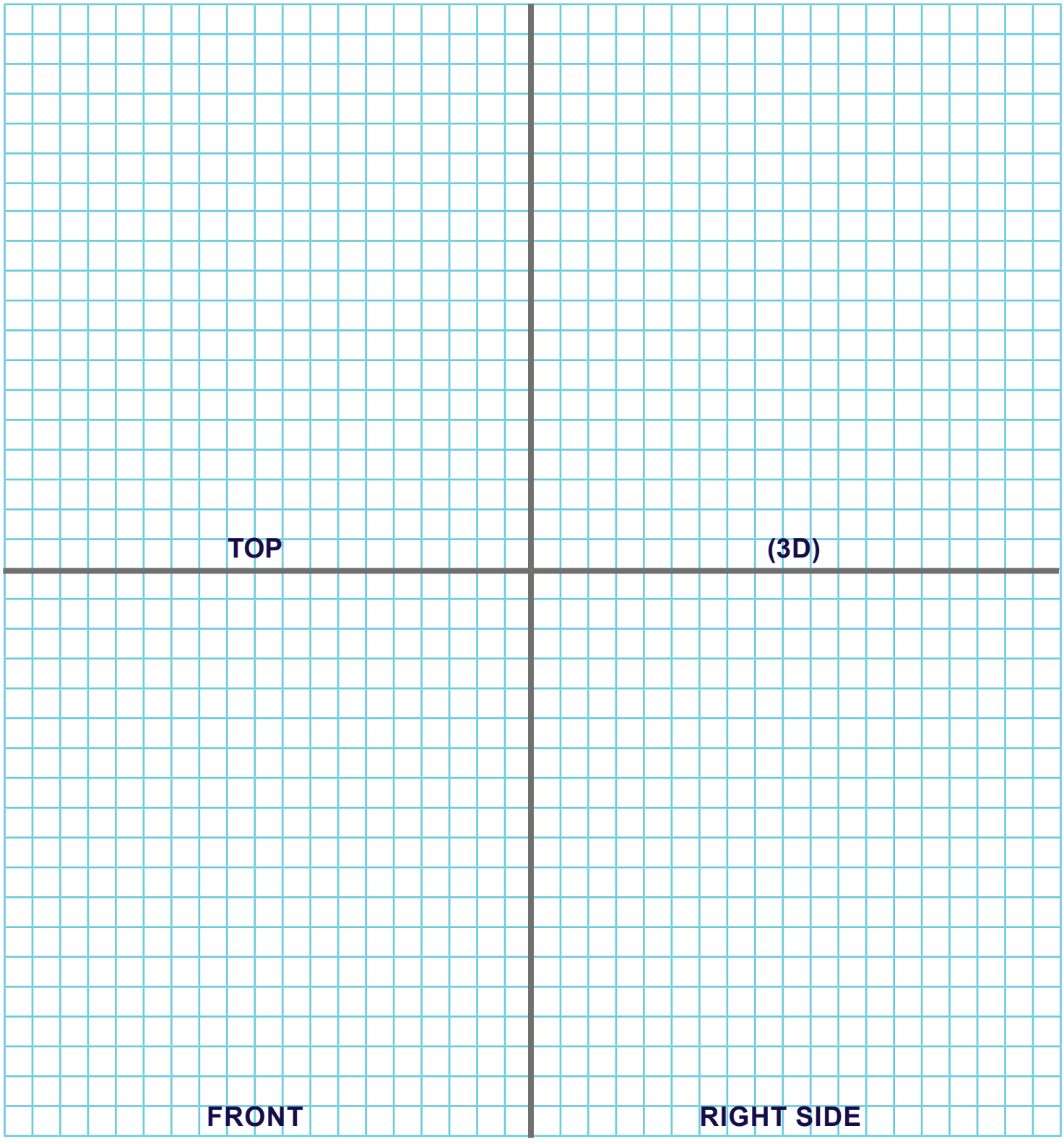
Sketch Sheet: Mission Specialist - Geologist



Sketch Sheet: Human Factors Engineer



Sketch Sheet: Project Manager



Blue Sticker

Phase II Baseline Test: Tools Engineer

- Complete testing of your tool
- Provide tool feedback to your team in a stand-up presentation
- Complete TFF Side 1
- Complete TFF Side 2 focusing on lunar rake feedback
- Redesign and rebuild your tool

Blue Sticker

Phase II Baseline Test: Mission Specialist - Geologist

- Complete testing of your tool
- Provide tool feedback to your team in a stand-up presentation
- Complete TFF Side 1
- Complete TFF Side 2 focusing on collection cup feedback
- Redesign and rebuild your tool

Blue Sticker

Phase II Baseline Test: Human Factors Engineer

- Complete testing of your tool
- Provide tool feedback to your team in a stand-up presentation
- Complete TFF Side 1
- Complete TFF Side 2 focusing on handle feedback
- Redesign and rebuild your tool

Red Sticker

Phase II Baseline Test: Project Manager

- Complete testing of your tool and provide tool feedback to your team in stand-up presentation
- Complete TFF Side 1 & Side 2 focusing on lunar tongs feedback
- Check and approve team tasks. Apply blue sticker to this sheet as team members complete their tasks.
- Contact Mission Director when each phase component is complete to get red sticker
- Redesign and rebuild your tool