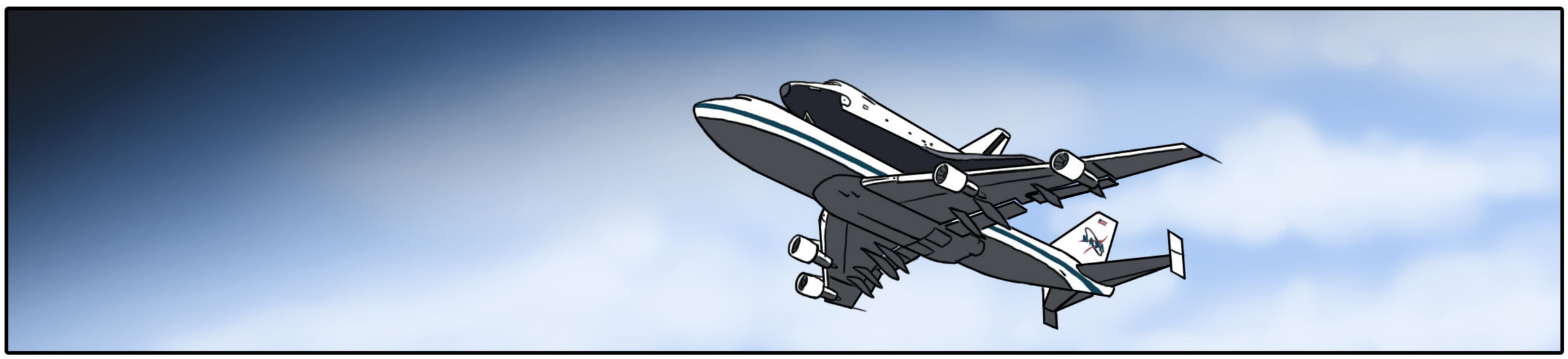
Mission 007: The Forces of Flight
Physical Sciences: Flight and Aerodynamics
6AB, 6SK, 6MB, 6ON, 6NB, 6PEI, 6NFLD 6NWT, 6NU

StarAcer™ ACADEMY

Welcome Stellar Teacher! Let's Grow Some Astronauts.

THE FORCES OF FLIGHT



MISSION CONTROL COMMENTS (TEACHERS CORNER)

CURRICULUM OUTCOMES

Flight	Students will be able to identify two of the forces of flight: thrust and drag.
	Students will be able to recognize that thrust and drag are opposing forces.
	Students can identify the steps in the Scientific Method.
	Students can identify variables in an experiment.

TIME FLOW

A Make a Guess	15 minutes
B Flight Test	minimum 2 x 45 minutes
C The Big Bang - Making Connections	1 x 45 minutes

EXTRA RESOURCES

StarAcers.com has links for your mission!

A scientific report outline in the Common Documents

Student and teacher rubrics

SUGGESTED RESOURCES

- Have book and Internet resources available for student use on different paper airplane designs
- Invite a pilot in to explain principles of flight
  (StarAcers website should be a resource for web links)

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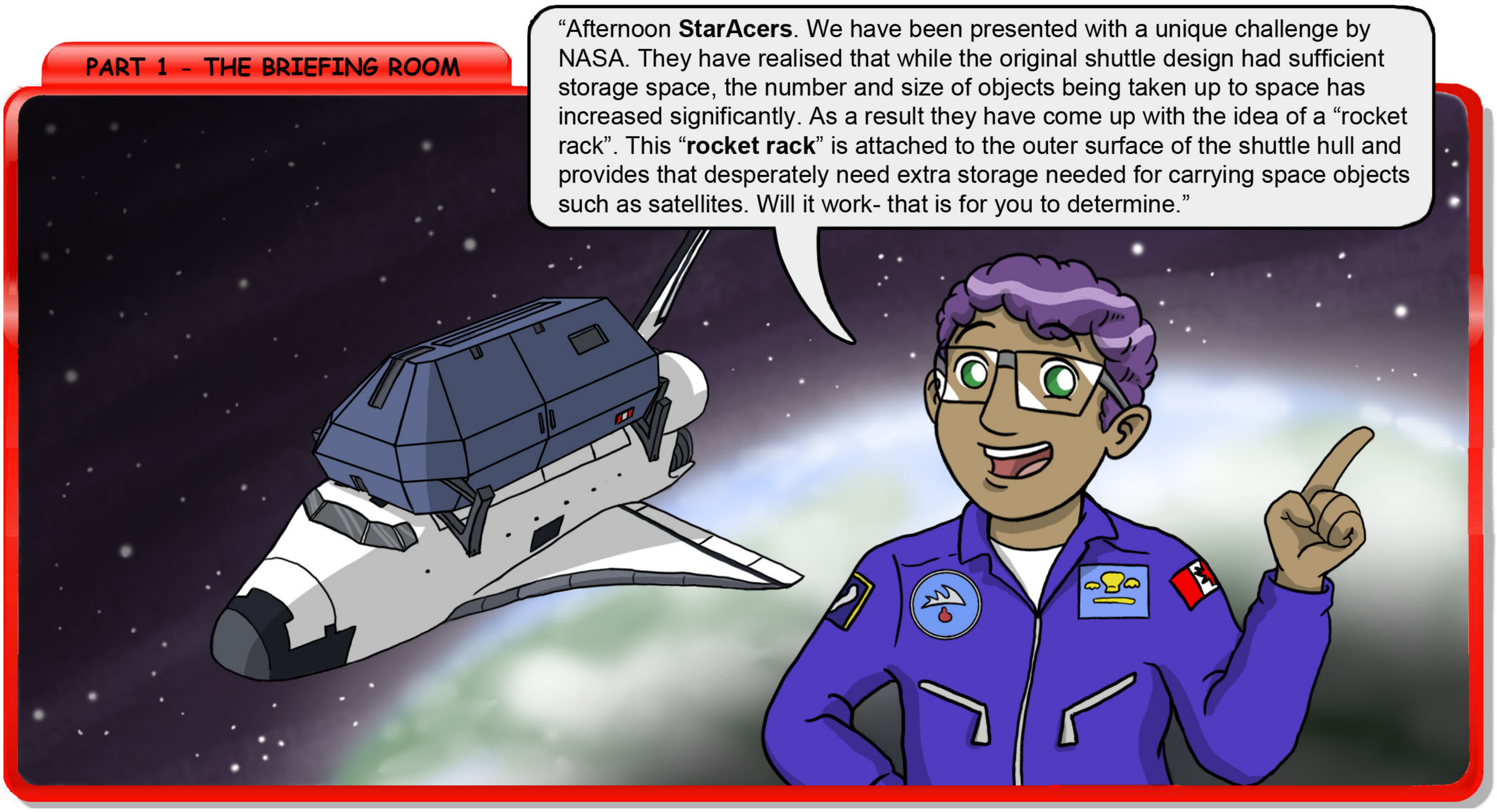
Modern flight and rocketry seem like miraculous feats, and in many ways they are. People have dreamt, explored, written, and even died in the pursuit of human flight. It is something that we take for granted in the age of cheap flights to Mexico and regular shuttle launches. The forces of thrust and drag have challenged flight engineers to come up with the most aerodynamic and efficient modes of flight.

PART 1 - THE BRIEFING ROOM



As up and coming astronauts, it is important for you to understand the relationship between thrust and drag. The following mission will have you build a paper airplane and determine an average flight distance based on throwing the plane 10 times using the same amount of thrust. You will then repeat this process 3 more times using the same amount of thrust, but using t3 different sized bags attached to the back of the plane to represent varying amounts of drag.

PART 2 - THE POCKET GUIDE TO FLIGHT

Vocabulary

- Thrust
- Drag
- Aerodynamics
- Payload
- Scientific Method
- Air Resistance
- Bernoulli's Principle
- Weight

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A. PART 3 - MAKE A GUESS (HYPOTHESIS)

Generate a hypothesis for each of the following questions:

- Does drag affect the plane's flight?
- Can thrust overcome drag?

B. PART 4 - FLIGHT TEST

Get the experiment done by doing the following:

1. Gather materials
   a. Paper (a poster sized cardstock or heavy paper works best)
   b. Bags- 3 sizes (sandwich, grocery, and garbage)
   c. Tape
   d. Measuring Tape/ Meter stick
   e. Scientific Method outline
   f. Pencil
   g. Notepaper
   h. Positive Attitude!

2. Do your trials:
   a. Fold your plane (research your own or use attached design)
   b. Throw your plane
      - Use the same throwing thrust
      - Record distance travelled from start to where it first hits the ground
      - Repeat 9 more times
      - Record data in a chart, and calculate an average distance
   c. With the the small sandwich bag attached open end forward to the back of the plane
      - Use the same throwing thrust as Step B
      - Record distance travelled from start to where it first hits the ground
      - Repeat 9 more times
      - Record data in a chart, and calculate an average distance
   d. With the the grocery bag attached open end forward to the back of the plane
      - Use the same throwing thrust as Step B and C
      - Record distance travelled from start to where it first hits the ground
      - Repeat 9 more times
      - Record data in a chart, and calculate an average distance
   e. With the the garbage bag attached open end forward to the back of the plane
      - Use the same throwing thrust as Step B, C, and D
      - Record distance travelled from start to where it first hits the ground
      - Repeat 9 more time
      - Record data in a chart, and calculate an average distance

3. Record your observations. Make note of any patterns, and draw some conclusions on how drag and thrust are related.

4. Repeat trials c-e from above, but increase the thrust to see if you can get the flight distance to match trial a.

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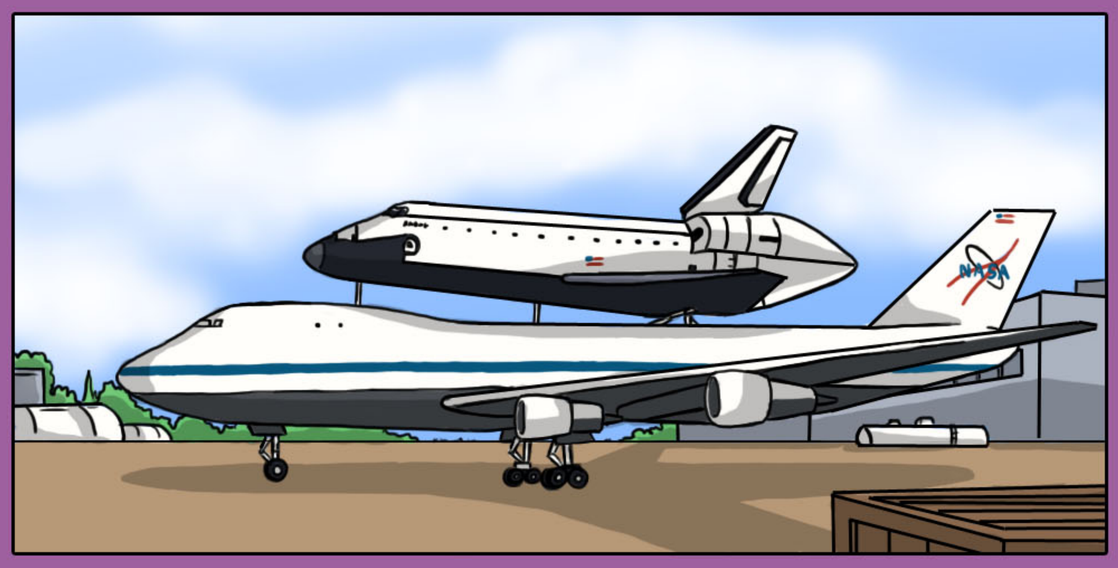
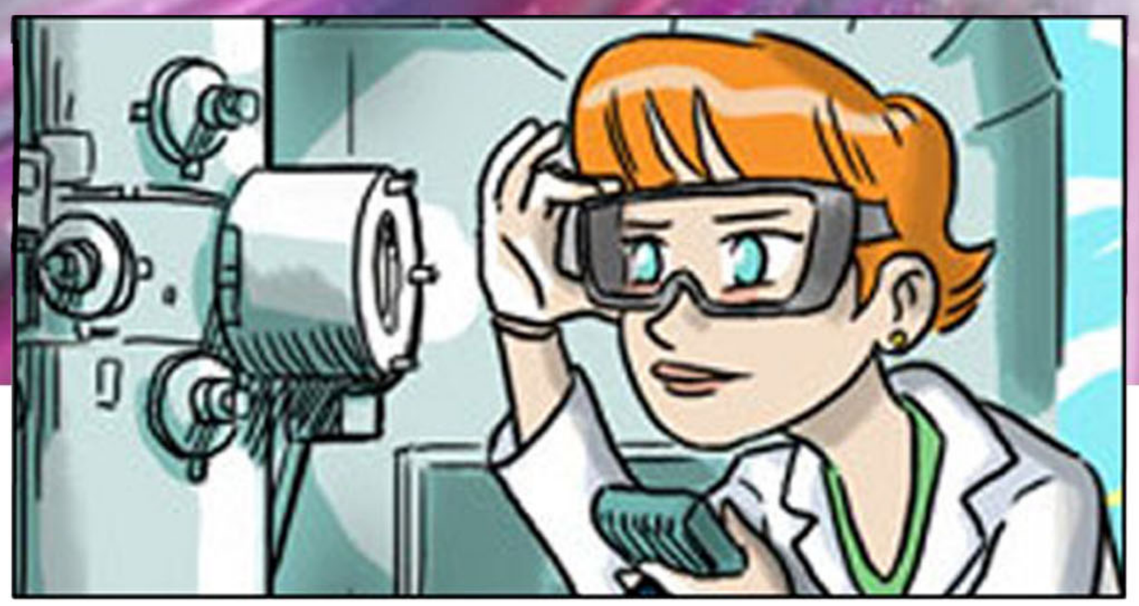
C. THE BIG BANG - MAKING CONNECTIONS

We have a lot of raw data here to process and NASA is anxiously awaiting the results of your test flights. They want to get the "rocket rack" in production.
You need to use the observations and data from your test flights to establish a conclusion which you can use to provide a recommendation on the size, configuration, and effectiveness of the "rocket rack".

Be sure to have a complete report for presentation to NASA.





DO YOU MEASURE UP?

Get a rubric from Mission Control. How do you measure up based on the work that you have just completed in Mission 007?

WANT MORE ADVENTURE?

Want a challenge? Try this:

- How does payload affect flight and thrust need for flight?
- Test different paper airplane designs to reduce drag.

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Record Your Data

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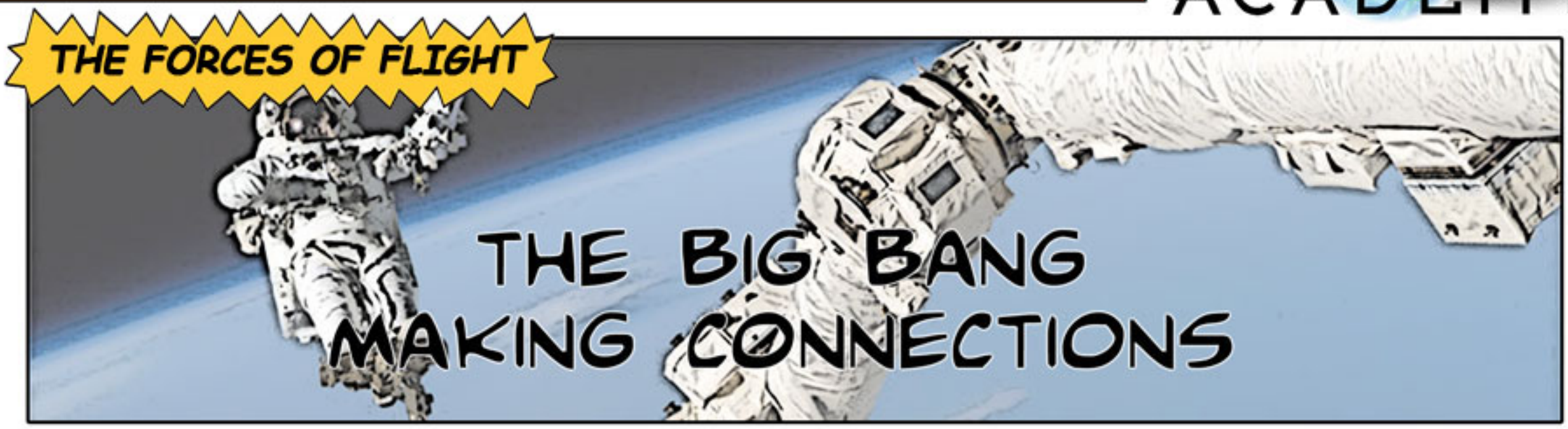

Establish a suitable conclusion based on the data you have collected and prepare a report that you can present to NASA.