

# Space Station Identification

Level (Grades K-5)

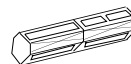
## THEORY/INFORMATION

The space station is a large human-tended spaceship that will orbit 335-460 kilometers (208-285 statute miles) above the Earth. This station is to be used as a permanent laboratory where astronauts live and work. A crew of six will work 90 days, and then another group will come to the station. The first crew will return to Earth. NASA plans four trips each year. The first phase of the space station will be placed in orbit in 1998, and the whole station should be in place and operating in 2003. (See drawing page iv.)

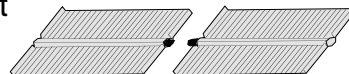
Some of the most important parts of the space station are the **truss**, **photovoltaic arrays**, **laboratory modules**, **nodes**, **habitat module** and **radiators**.

A description of these six parts follows:

- A. A **truss** (trus) is a backbone-like metal structure located on the outside of the station. The **truss** is used to support and connect other parts of the space station.



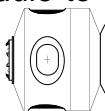
- B. The **photovoltaic arrays** (pho•to•vol•ta•ic ar•ray ) are sets of solar panels grouped together in big sheets. These arrays collect light from the Sun and use it to make electricity to power the equipment and machines on the space station.



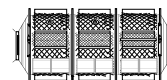
- C. The **laboratory modules** (lab•o•ra•to•ry mod•ules) are filled with most of the equipment used for studying processes, manufacturing materials, and doing experiments. Every day the astronauts will work in these modules.



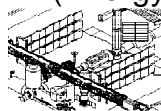
- D. **Nodes** (nodes) attach one module to another, and they are used as passageways so that the astronauts can go from one module to another. The **nodes** are also used for some experiments and for storage.



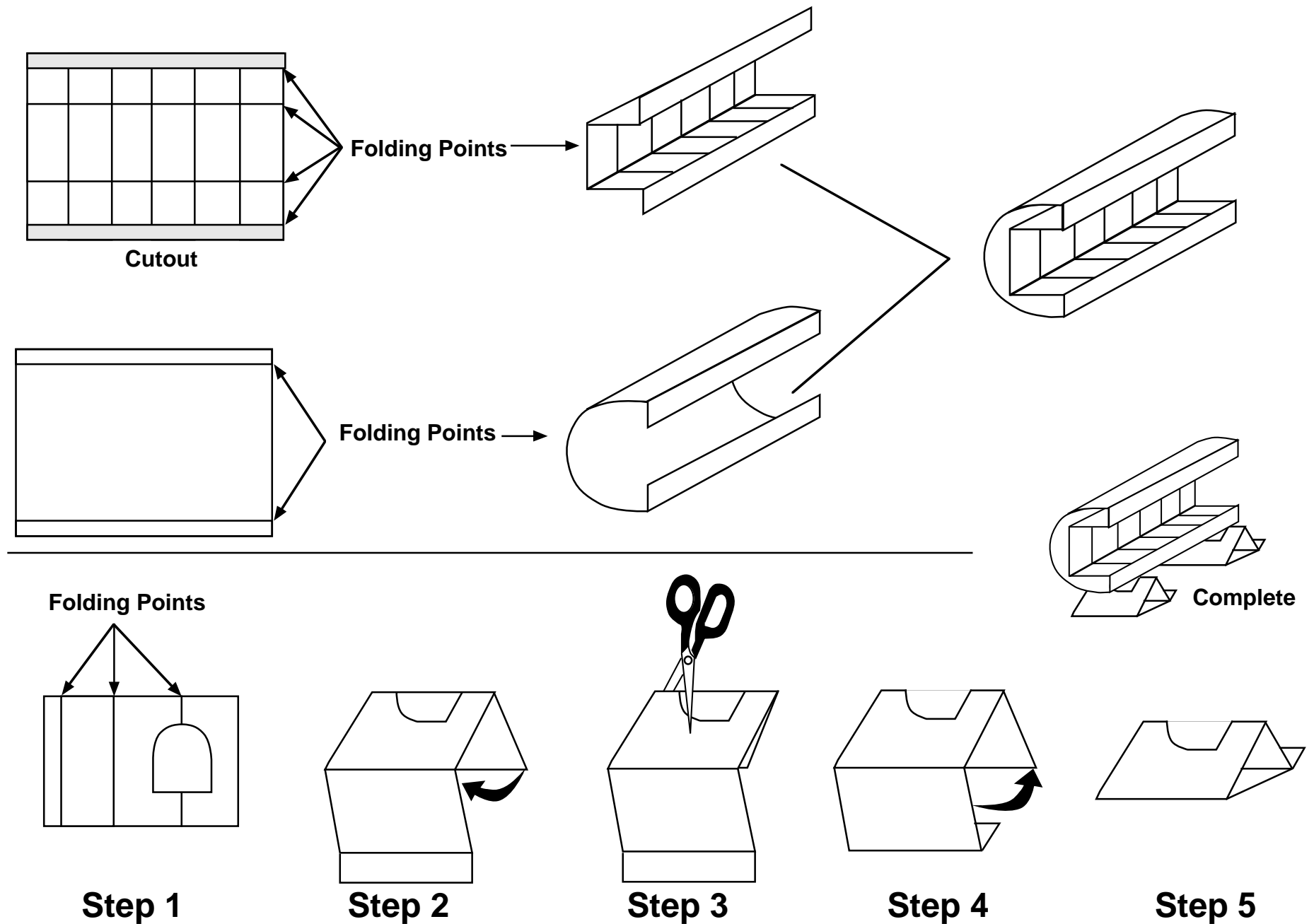
- E. The astronauts will live in the **habitat module** (hab•i•tat mod•ule). They will cook, eat, clean, sleep, bathe, exercise, and relax in this module.



- F. A **radiator** (ra•di•a•tor) removes heat from the space station. Energy in the form of electricity from the photovoltaic arrays is used to perform work in space station. This same energy is converted to heat during this work and must be removed or the space station will become too hot to live in. (Energy in = energy out is an important and fundamental science concept).



# Habitat Module Folding Instructions



## OBJECTIVE

The student will identify six major parts of the space station. He/she will match each of these parts with the function.

## QUESTIONS

What are six major parts of the space station? What does each part do?

## MATERIALS

- 1 Labeled drawing of the space station
- 1 Space Station Vocabulary Match Worksheet
- 1 Pair of scissors
- 1 Pencil
- Crayons (orange, yellow, green, blue, red, black)
- Glue

## PROCEDURES

1. Observe and discuss the labeled drawing of the space station. (See page 3.)
2. Find the Space Station Vocabulary Match Worksheet.
3. Use your scissors to cut out the definitions located at the bottom of the Space Station Match Worksheet.
4. Glue each definition beside the correct word.
5. Use your **crayons** and **color** the parts of the space station.

**Truss** - orange

**Laboratory Module** - red

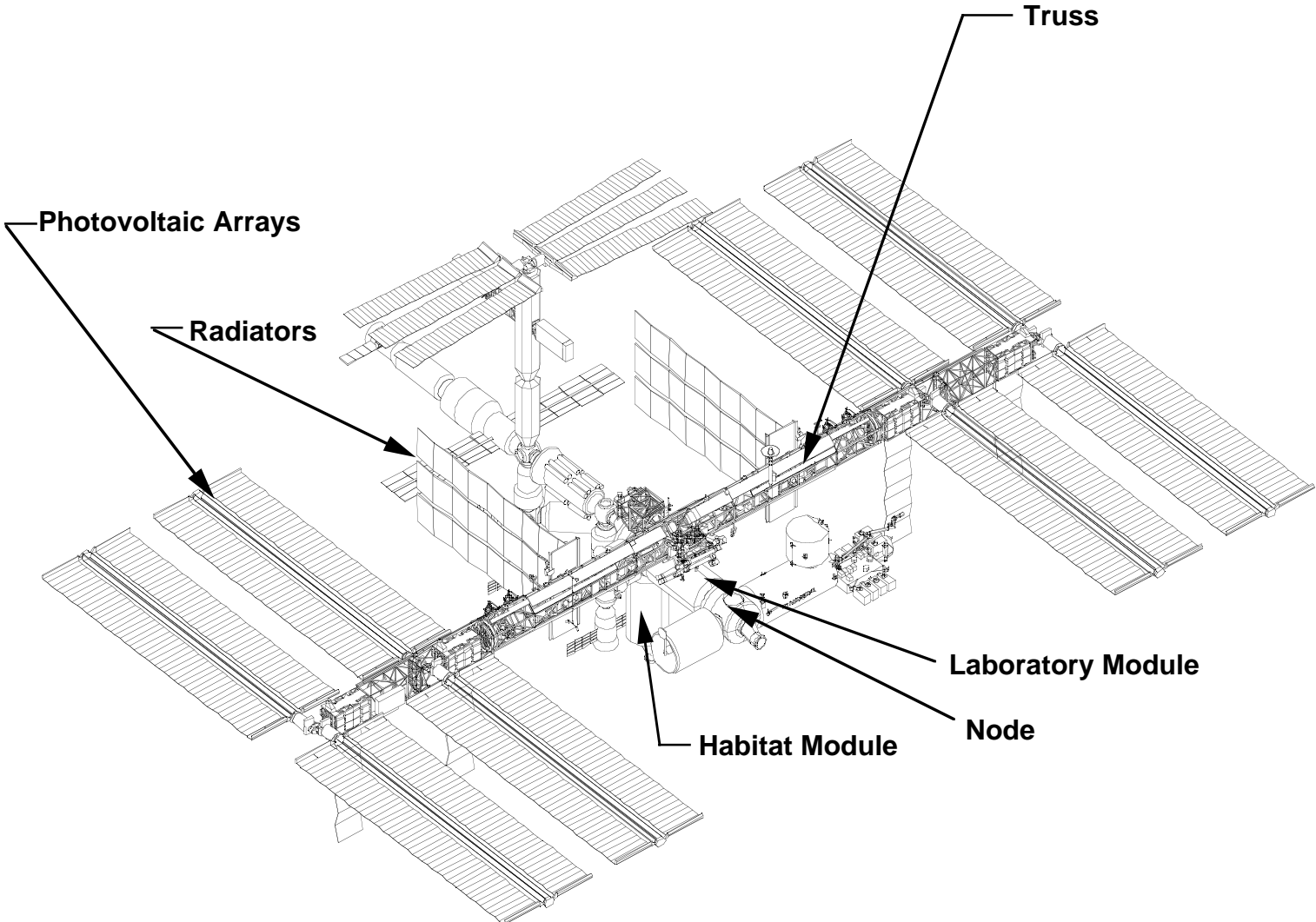
**Solar Arrays** - yellow

**Nodes** - green

**Habitat Module** - blue

**Radiators** - black

# Space Station



# OBSERVATIONS, DATA and CONCLUSIONS

1. What parts of the space station will make electric power to run the machines?
2. What two parts of the space station are used to hold some of the other parts of the station together?
3. Where will the astronauts work?
4. Where will the astronauts live?
5. If you were planning the space station, which part of the station would you put into orbit first? Why?
6. What part removes heat from the Space Station?

# Space Station Vocabulary Match

1. Node -
2. Habitat Module -
3. Truss -
4. Photovoltaic Array -
5. Laboratory Module -
6. Radiators

Definitions: (Cut along the dotted lines and glue them into place)

A. The part of the space station that makes electricity to run the machines and equipment

B. The backbone-like support used to attach many parts of the space station together.

C. The place where the astronauts will eat, sleep, clean, bathe, cook, exercise, and relax.

D. A part of the space station that serves as a passageway from one module to another.

E. The space station crew will spend 8-12 hours each day working here.

F. Removes heat from the space station so it will not be too hot to live in.

# Space Station Habitat and Laboratory Modules

Level (Grades K-5)

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## THEORY/INFORMATION

The space station is a manned spaceship for humans to be used for exploring, studying, manufacturing, and experimenting while on orbit around the Earth. The station is a very complicated machine and it has many parts. Each part of the station is needed to support life or provide an environment for manufacturing and science activities.

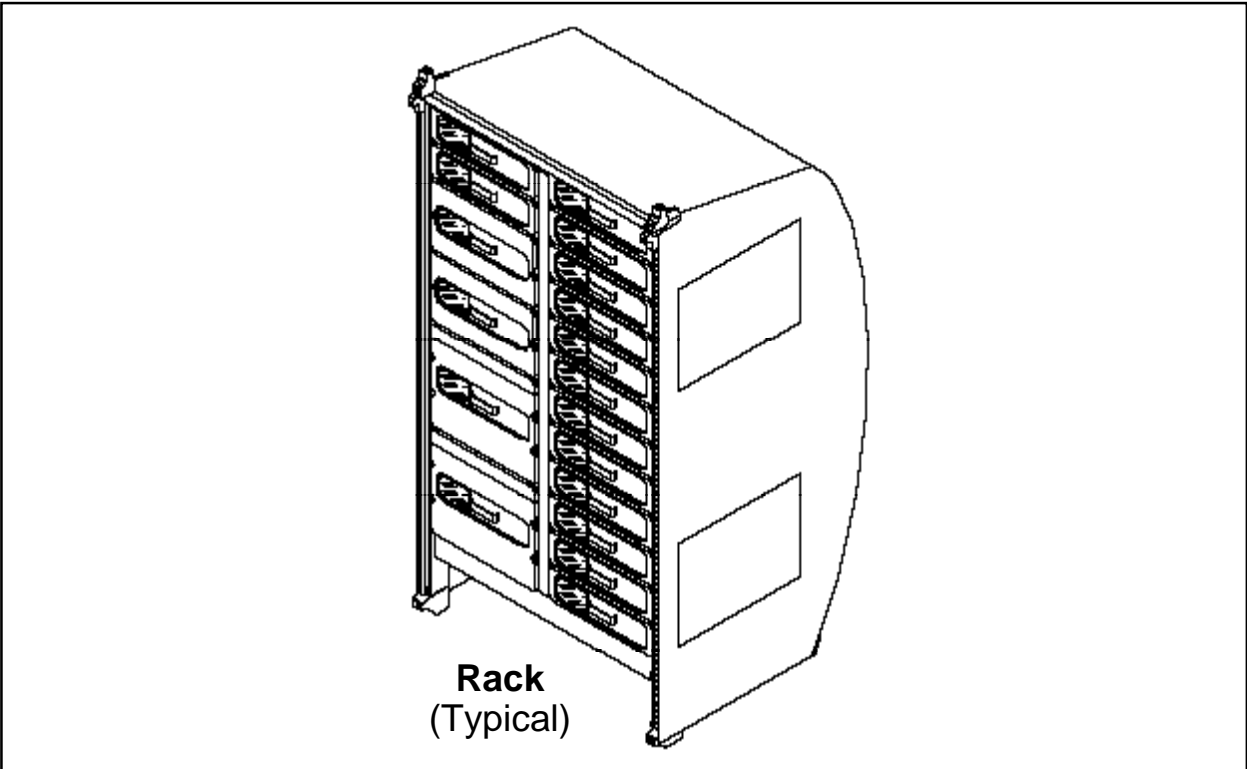
Two very important parts of the station are the habitat and laboratory modules. Both modules are made so that racks can be taken out and moved or replaced. Racks are refrigerator-size reinforced cabinets used for storage or to attach equipment. The racks used in the U.S. Space Program are all the same size, 203.2 x 106.68 x 76.2 centimeters (80 x 42 x 30 inches). Each rack has a flat front surface, but the back is curved to fit into the cylinder-shape of the habitat and laboratory modules. There is a small space between the back of each rack and the circular outside wall of each module. This empty area is used to run the electric cables and fluid lines needed to operate the equipment attached to the racks. (See illustration on page 8.)

On orbit in the space station, there is no "up" or "down" because everything is weightless and floats. In order to work with each other and communicate with the scientists on Earth, the astronauts need a way to think and talk about "up" or "down" so the habitat and laboratory modules are designed to look like rooms on Earth. When not in use the inside of both the modules is a long box shaped area with four flat wall-like surfaces. The line of racks in two of the surfaces are marked to look like walls. Other racks are stored in areas made to look like the floor and ceiling. Lights and air vents are arranged around the top or ceiling. More return air vents are arranged around the floor of the modules. The walls of the modules are pale gray, and the handles are navy. The circular ends of the laboratory module are trimmed in royal blue, and the ends of the habitat module are trimmed in burgundy. The colors are used to mark the exits.

After the space station crew arrives, the supplies and equipment are unpacked from the racks, and then the modules are ready to use for working and living. The racks in the laboratory module will be changed when they are empty or when a manufacturing or science activity is finished. Some of the racks in the habitat module will be changed but others may only be cleaned and resupplied.

During the regular 90-day tour of duty, the crew of the space station will live in the habitat module. Scientists and engineers plan for the astronauts to cook, eat, wash dishes, clean, sleep, bathe, exercise, and relax in this module. The cooking and eating area is the galley. The racks in the galley have an oven and a way to dispose of trash.

Farther along the wall opposite the eating area is a restroom with a toilet and beside it is a shower. Other racks hold the clothing and dishes. To sleep, the astronauts attach their sleeping restraints to hooks on the front of the racks so they will not float around while they sleep.



## OBJECTIVE

The student will assemble a model of the habitat module of the space station. The student will also plan and assemble his/her own laboratory module.

## QUESTIONS

What does the habitat module look like? Where are all the racks located? How would you arrange your own laboratory module?

## MATERIALS

- 1 Space station habitat module paper model. (8 sheets)
- 1 Pair of sharp scissors
- Crayons
- 1 Set laboratory module rack drawings
- 1 Bottle of rubber cement, glue, or transparent tape.  
(Hint: It is best to use rubber cement.)



# PROCEDURES

## Procedure A: Assemble the Habitat Module Model

1. Color the interior of the space station. Use the color key on the drawings of the habitat and laboratory modules.
2. After coloring, cut out each part of the space station habitat module model.
3. Fold the parts of the model and glue them together. (Hint: It is best to use rubber cement.) Follow the instructions on each part of the model.
4. Fold the display stand for the habitat module. Tape or glue the tabs into place.

## Procedure B: Assemble Your Own Laboratory Module. (Optional)

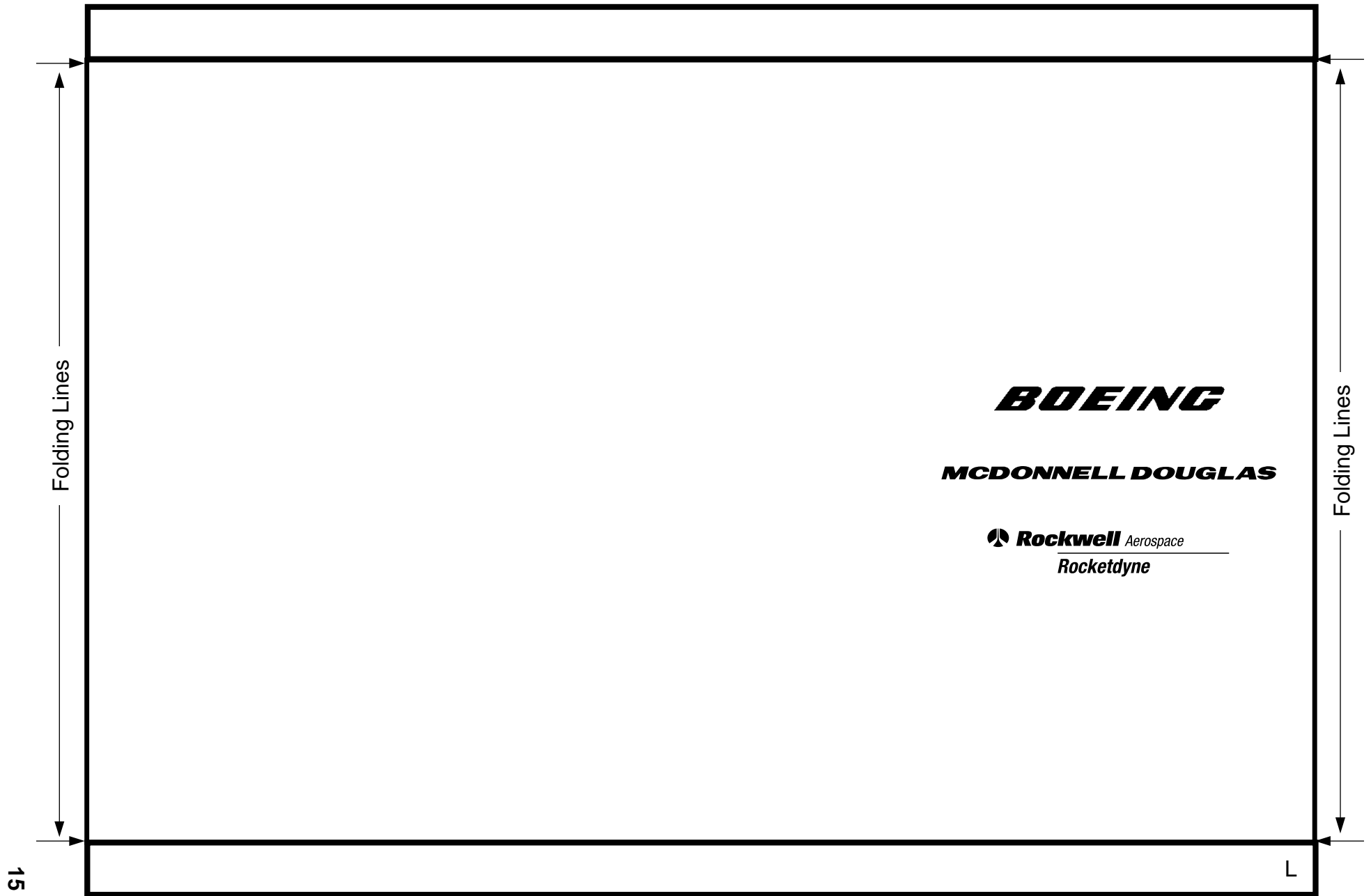
1. Plan your own laboratory module.
2. Color the laboratory racks.
3. Use your scissors and cut out the racks.
4. Put a small amount of rubber cement on the back of the paper rack.
5. Follow your own laboratory module plan. Glue the fronts of the laboratory racks over those on the model of the habitat module.

# OBSERVATIONS, DATA AND CONCLUSIONS

1. Observe the habitat and laboratory modules. What is the shape of the outside of these modules?
2. What is the shape of the inside of the two modules?

3. Count the racks in the habitat module model. How many racks are in this paper model? Do you think there are more racks in the real space station habitat module?
4. Where is the galley located?
5. Where are the toilet and shower?
6. As you probably noticed, there is no furniture in the habitat module. If pieces of furniture were sent to the space station and placed in the habitat module, what would happen to them?
7. The astronauts will sleep in the habitat module. There are no beds. Where will they sleep during the 90 days that they will be on the space station?
8. If you are an astronaut on the space station, you will work in the laboratory module 8-12 hours each day. You will sleep 8 hours each day in the habitat module and exercise 2 hours. How will you spend the two hours of free time each day?
9. (Optional) After you have planned and completed your own laboratory module, explain your plan.

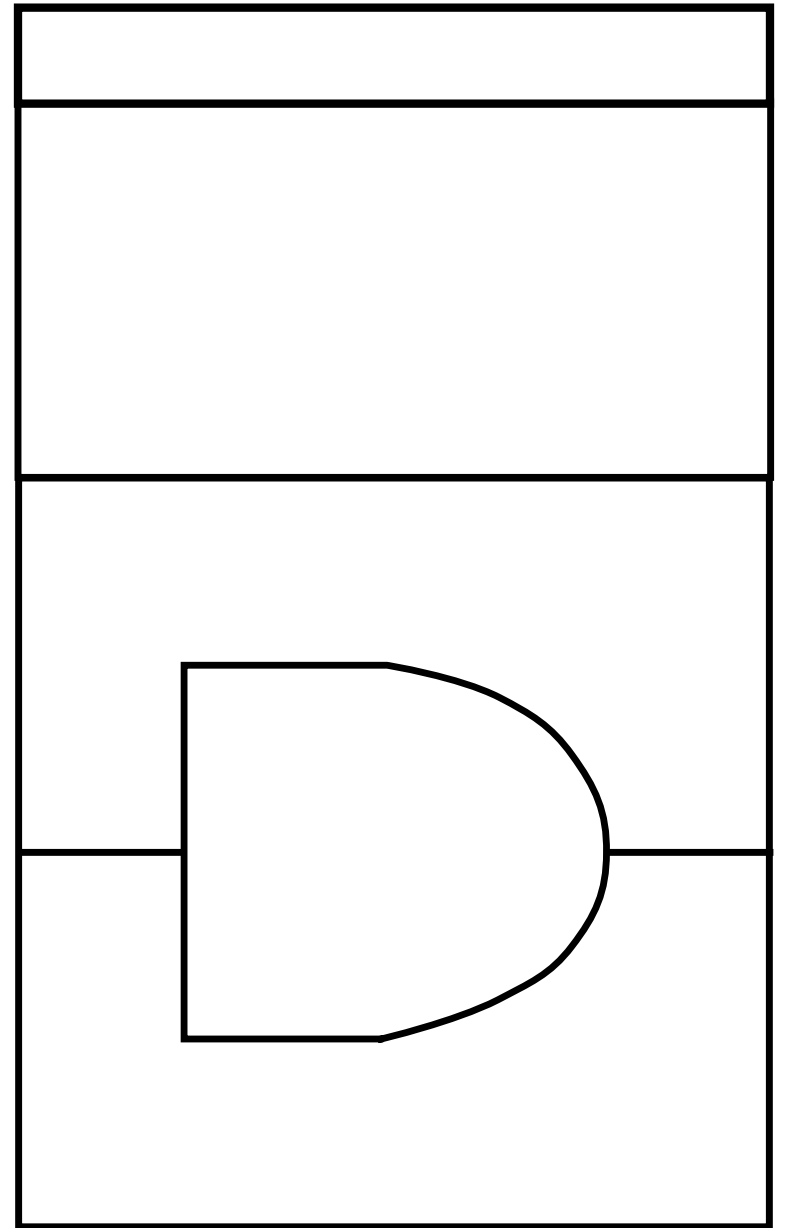
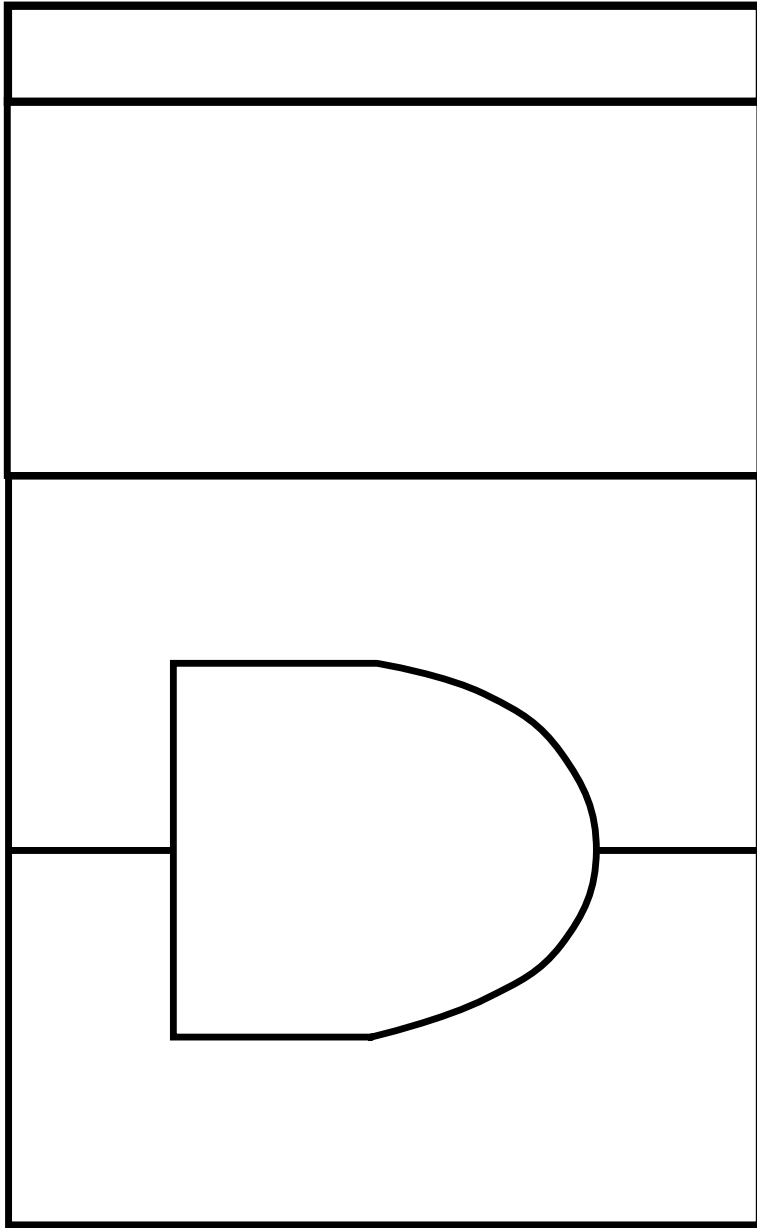
# Hab (Left Side)



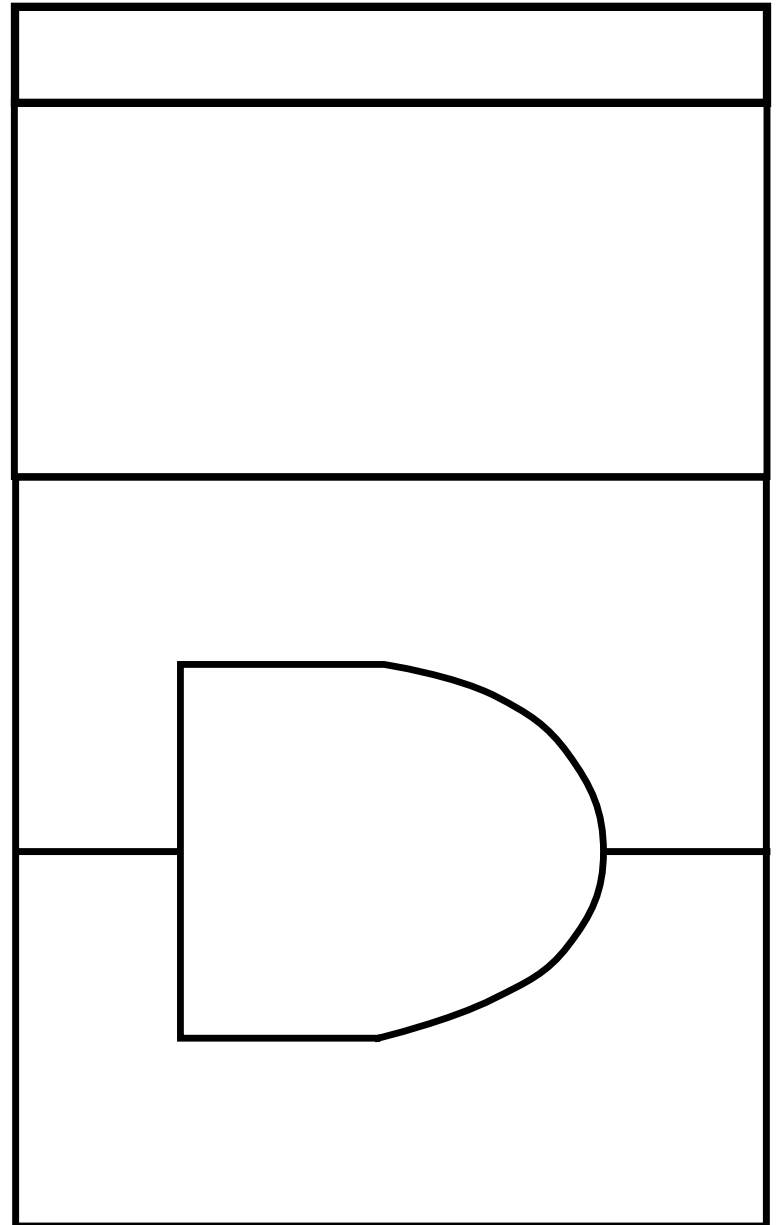
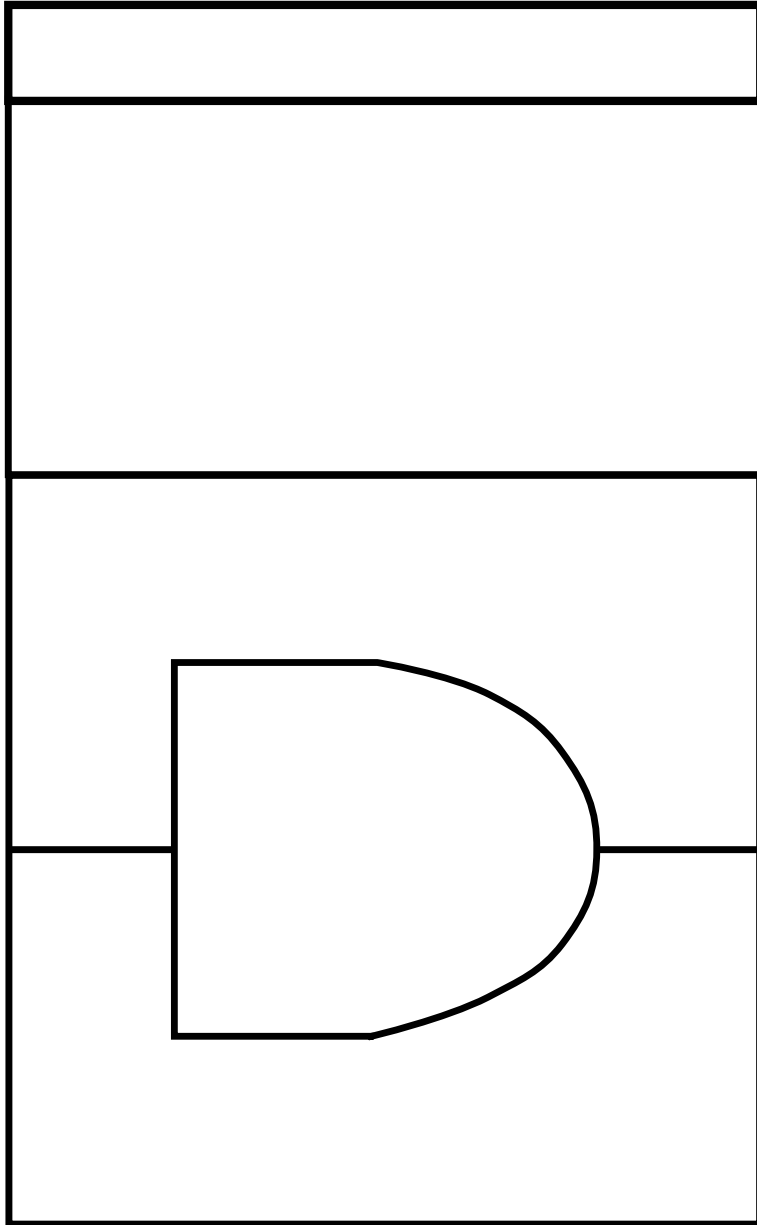
# Hab (Right Side)



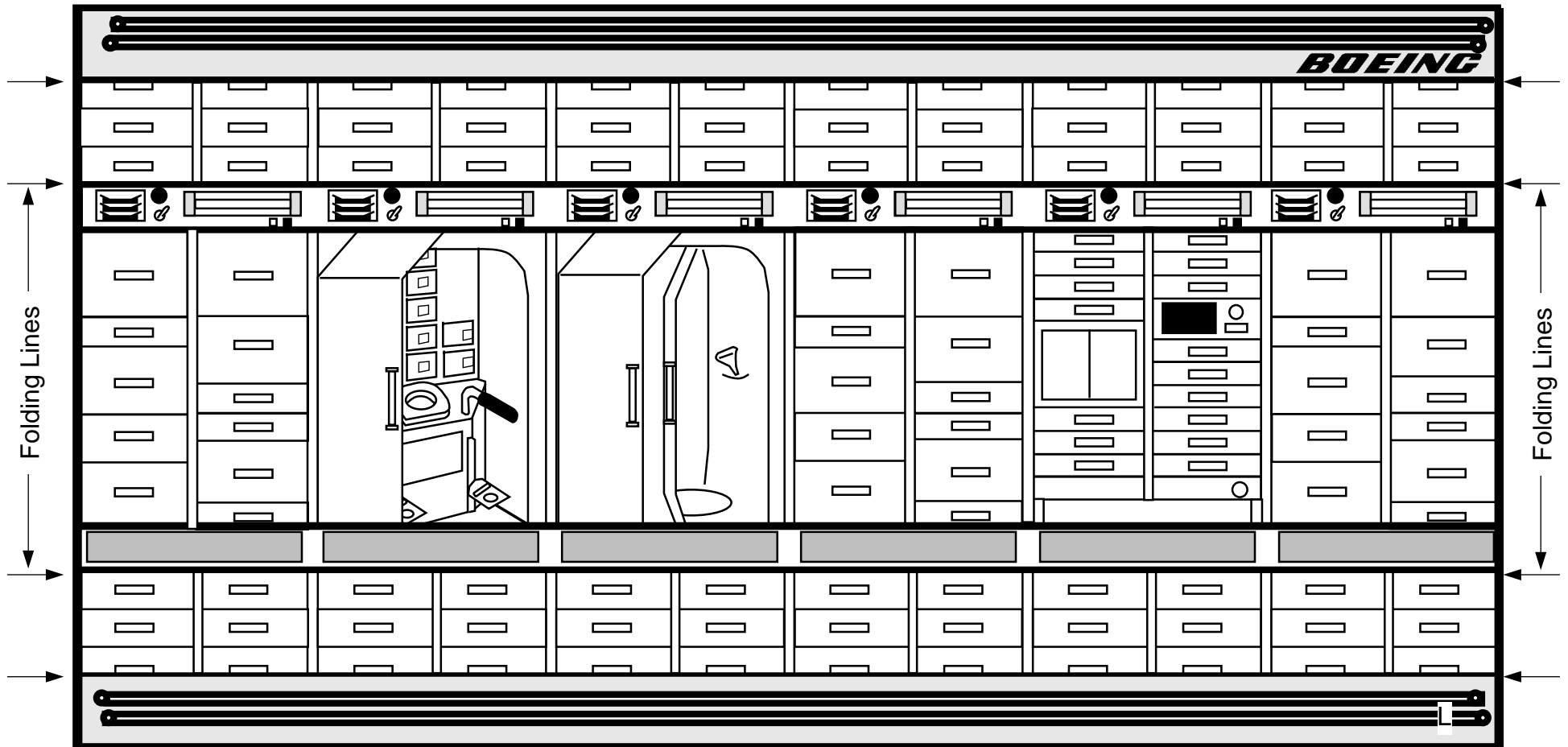
# Module Stands



# Module Stands



# Space Station Habitat Module (Left Side)



Racks (Light Gray)

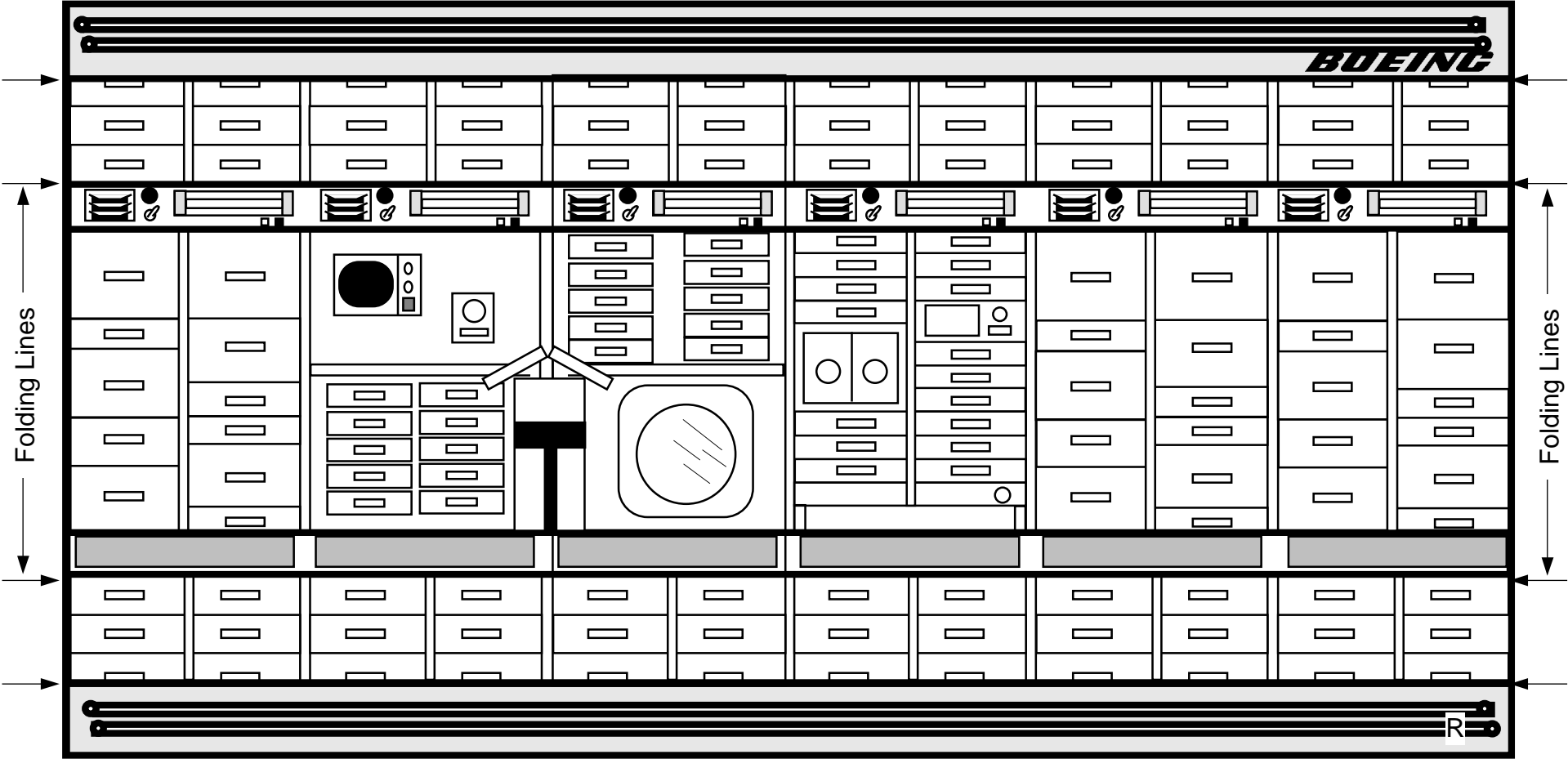


Handles (Navy Blue)

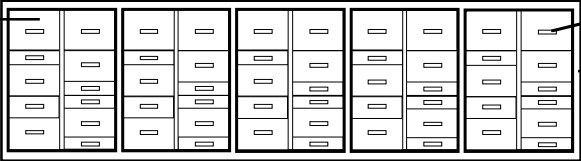
Trim (Burgundy)  
Vents (Burgundy)

Color Key for Hab

# Space Station Habitat Module (Right Side)



Racks (Light Gray)



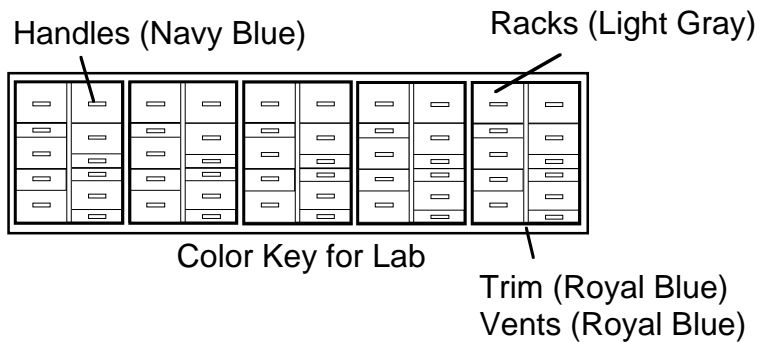
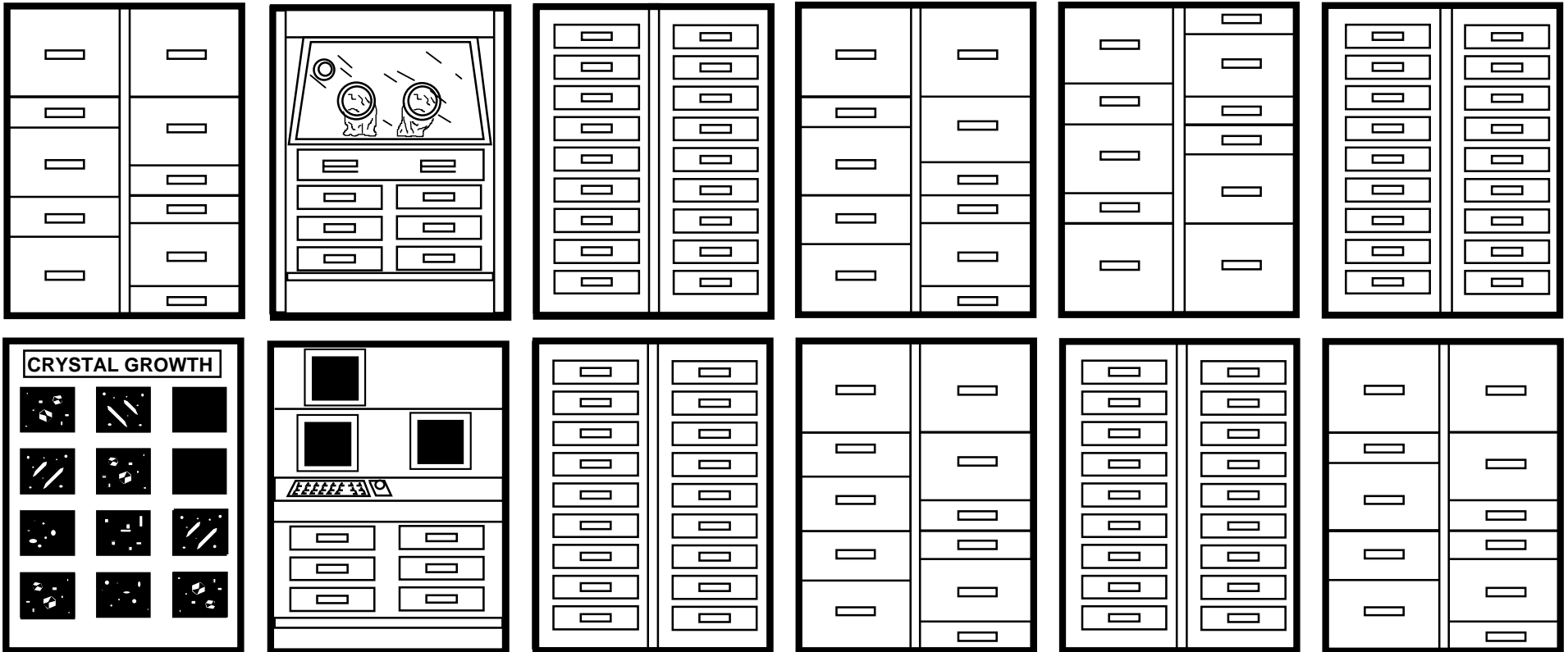
Handles (Navy Blue)

Trim (Burgundy)  
Vents (Burgundy)

Color Key for Hab



# Laboratory Module Rack Fronts



**Optional Idea:** A full size space station model. Place the rack front drawings in an opaque projector or make a viewgraph and place it on a projector. Project the rack illustrations onto bulletin board paper and copy the enlarged racks. Attach these paper rack fronts to large, cardboard refrigerator boxes and assemble a full size space station module. You may draw other racks on large white plastic and place one on the floor and drape another over the top of the boxes.