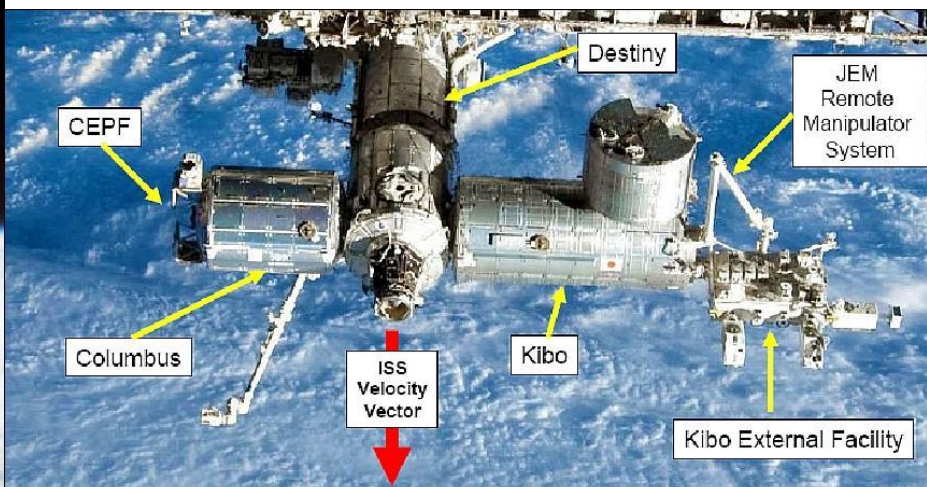
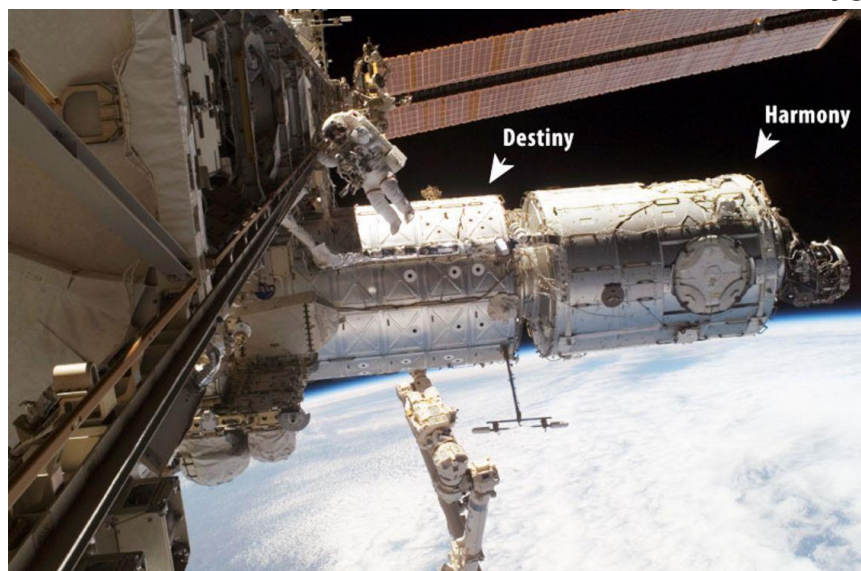




# Destiny Mockup

Glenn Johnson with Stacy Hale

The Destiny module on the International Space Station is also called the US Lab. It is one of the largest modules on the ISS and is responsible for housing and controlling many of the experiments that are done. The Destiny module acts as the central hub for a large portion of the science that happens in space. HUNCH is interested in building a full scale mockup of the Destiny module that could be placed in an airport or similar venue where lots of people would be able to walk through and interact with large touch computer screens of the experiment and system racks. To build one out of the same materials and same structure would not be appropriate. The one on orbit is made so people can float through and work in zero-g. This one will have to be adjusted so many people can walk through. Doorways will need to be built that will allow people in from the side instead of the hatches on ends. The floor will have to support many people at a time instead of experiment racks that the astronauts float over. This Destiny mockup will be more like one of the training mockups used at Johnson Space Center than like what is on orbit.



# Destiny mockup

## Problem:

HUNCH is interested in building a full scale mockup of the Destiny module that could be placed in an airport waiting area

## Objective:

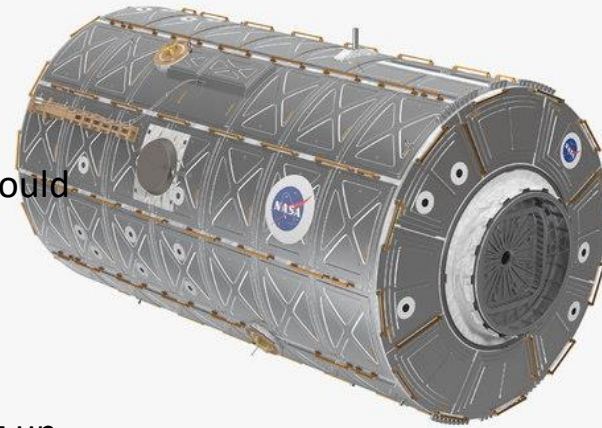
Build a 1 to 33 scale model of a Destiny module to demonstrate how a full sized module would be built and transported from one venue to another.

## Structure

- We are looking for something that is easy to transport on a flat bed trailer, set up and take down.
- How much needs to be made of steel, aluminum, wood?
- Should be modular sections that assemble
- Individual modules may have wheels for moving on concrete floors
- Individual modules could be picked up by fork lift to get it on and off a truck if necessary
- Enter through bay 1 starboard and exit through bay 6 port. Make the endcones so graphics or photos can show the interior of other modules
- Ramps for entry and exit to module
- Will allow for handicapped entrance
- What kind of structure is needed for the floor to support many people walking through? What kind of structure is needed for the walls and ceiling to hold TV screens
- Exterior surface could be inflated or flexible covering with graphics to make it look like the outside of the module.
- We do not want it on a trailer since that would limit the outer dimensions of the mock up to what is legal on the road.

## Interior

- Interior walls and ceilings could be large touch screens to allow interaction with the experiments?
- What kind of TV screens do you recommend?
- How big of doors are needed for handicapped entry?

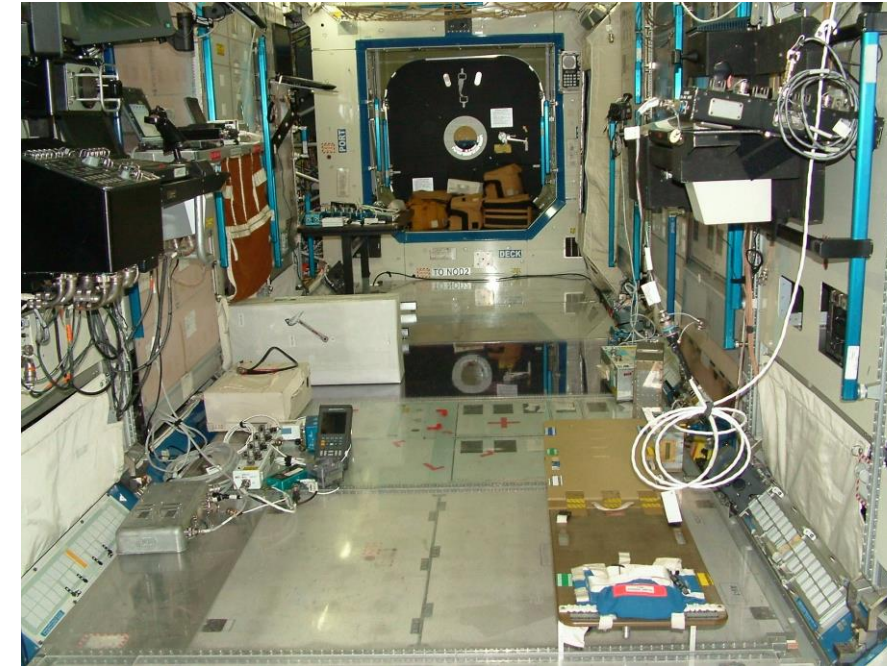


# Destiny trainer in SSMTF

This is what the inside of the Destiny training module looks like at the Space Station Mockup Training Facility (SSMTF) looks like at the Johnson Space Center. On orbit the floor is filled with experiment racks that the astronaut float over. However, in the mockup they have photo facades that allow the astronauts to see what equipment is located there on orbit. Those experiments and racks on the floor on orbit have to be trained outside of the mockup.

On orbit lots of equipment and cables are attached to the walls and ceiling but these would all get in the way when training the astronauts on the ground so the cables and equipment are only installed at specific times of training the crew.

For the general safety of the public walking through the Destiny Mockup you design, it will be pretty clean of cabling so people don't trip or snag as they go through. Some of the cabling may be represented in the pictures.



# U.S. LABORATORY MODULE

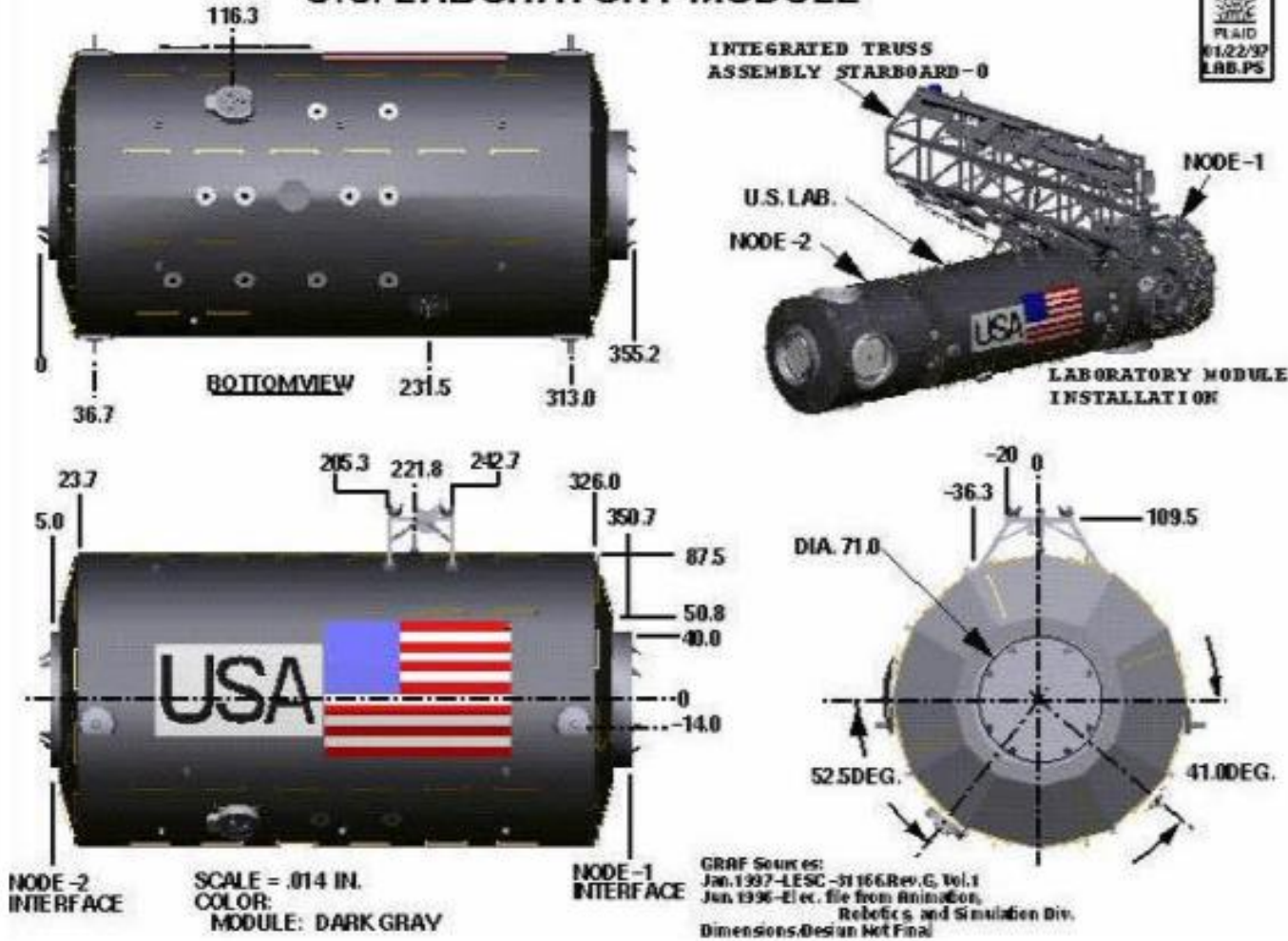
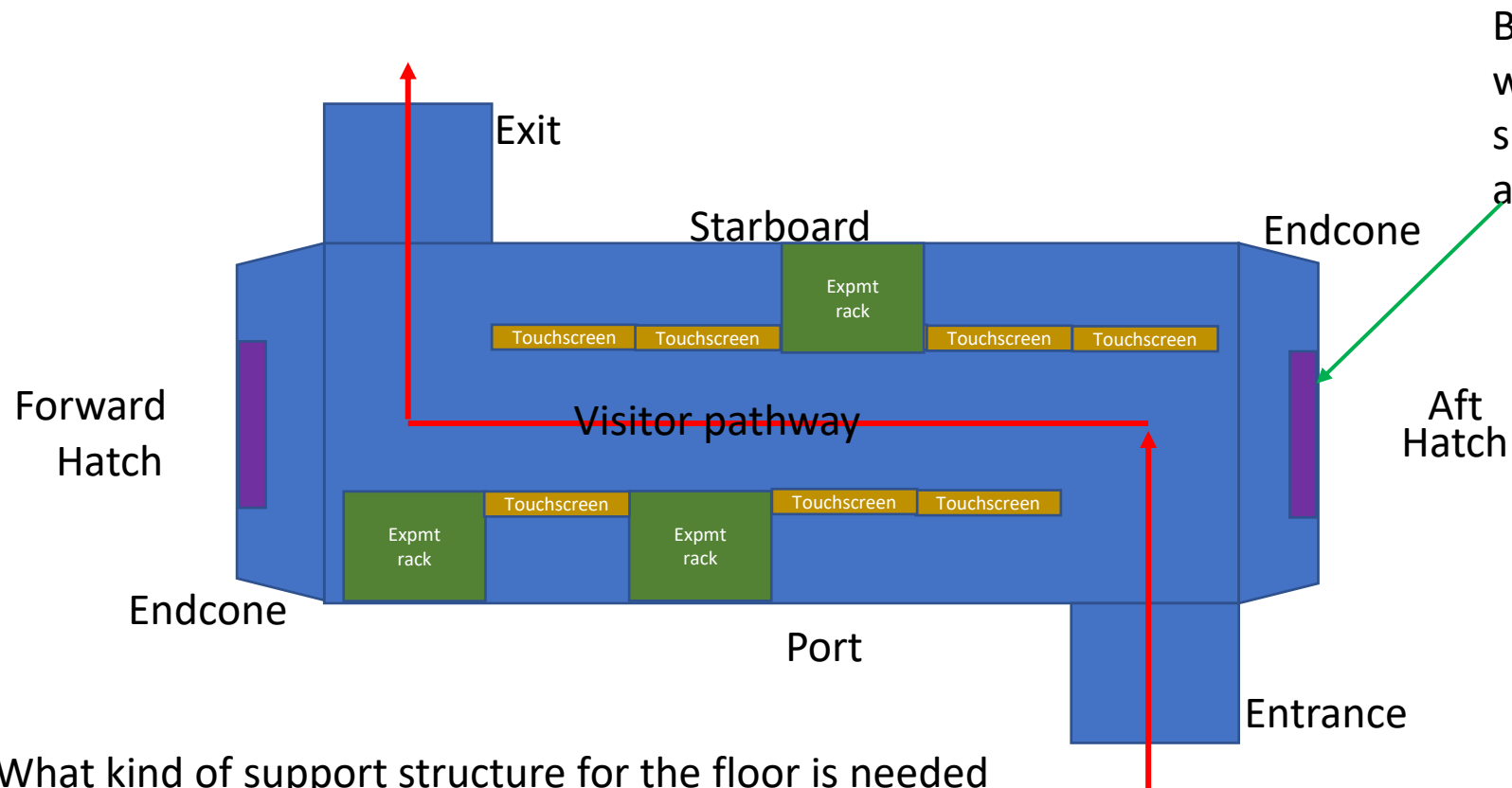


Figure 3.1-1. U.S. Laboratory module ("Destiny") views

- Rack dimensions--73 in (185 cm) tall and 42-in (107 cm) wide, the back is curved so that it matches the curve of the shell.
- The Destiny has a total of 24 racks—
  - 4 racks in a bay—overhead, deck, starboard, port—
  - 6 bays—bay 1 is closest to aft and bay 6 is most forward
- Two end cones forward and aft where the hatches allow for attaching to other modules. Each end cone has approximately 2ft of space where air handling equipment, fire extinguishers and oxygen masks reside.



# Generalized Layout viewed from above



Both hatches could be large screens where visitors can see videos that show the other modules and astronauts working.

The six Overhead racks will all be touch screens showing experiment racks. The six Deck racks will all be large photo facades showing experiment racks.

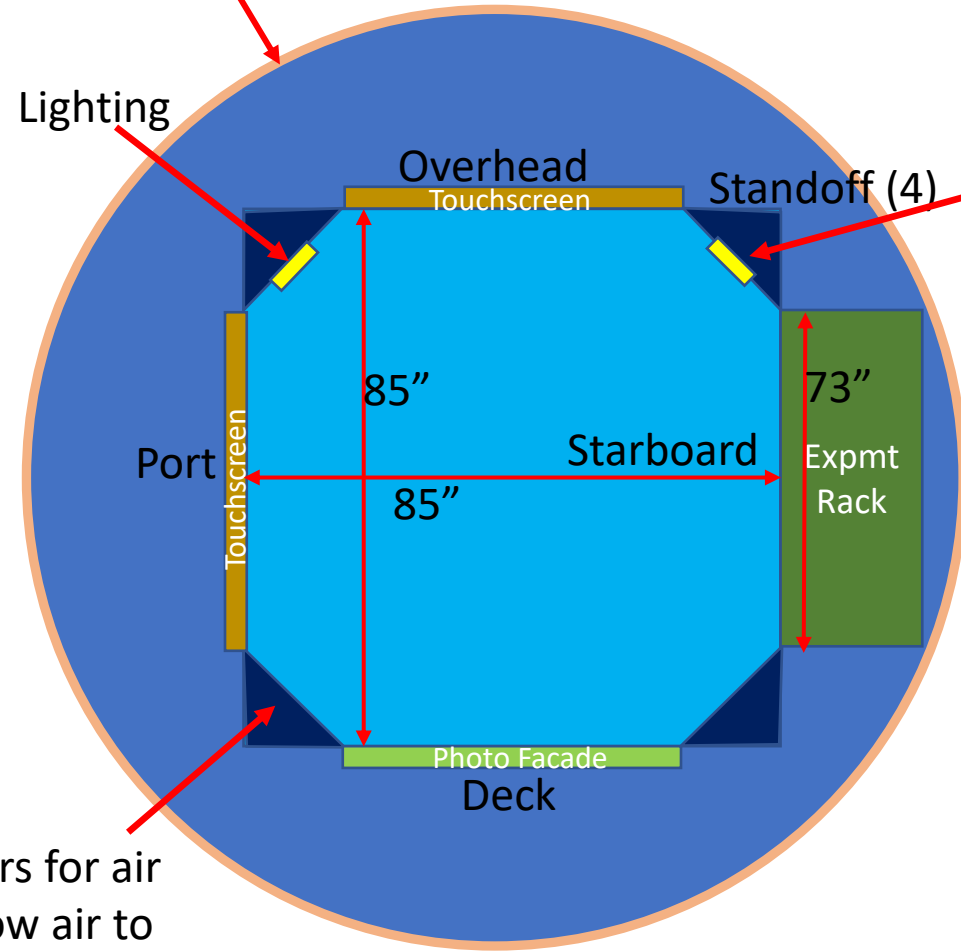
What kind of support structure for the floor is needed to support several people walking through at a time?

Because the Lab is a cylinder, the entrance will be raised and will need stairs and an elevator to allow wheelchair access.

What kind of materials do you want to use for the outside to make it look like the exterior aluminum shielding?

How should the Touchscreens be mounted so they won't fall on people when they are using them?

There will be a maximum height the sections can be for transporting on the roads due to overhead bridges and power lines. What is the height of the flatbed trucks that you transport your pieces on?



Every other light location should be an air vent to blow air into the module.

What kind of structure is needed to hold the people walking through? What kind of materials make the most sense.

We would like the module to look accurate both inside where the people are walking and outside where it will attract people to go inside. Behind the touchscreens and under the floor it will look nothing like the real Destiny Lab. But of course, it needs to be very functional for holding the weight of many people.

Location of inlet air vents with filters for air circulation. Your module could allow air to blow out through the entrance and exit.

# Making a scale model



Scale models are used by architects and engineers to demonstrate their ideas of how the final product will look. These models can be done in cardboard, foam core, clay, 3D printed plastic, balsa wood and any other form that helps convey the ideas. You may also see them with a mix of materials. The more detail that goes into the model, the more problems they have solved and the less they have to explain.



Since the Destiny module is 14.2 feet in diameter and 29 feet long there is no way the mockup could be transported on a freeway or brought into an airport in one piece.

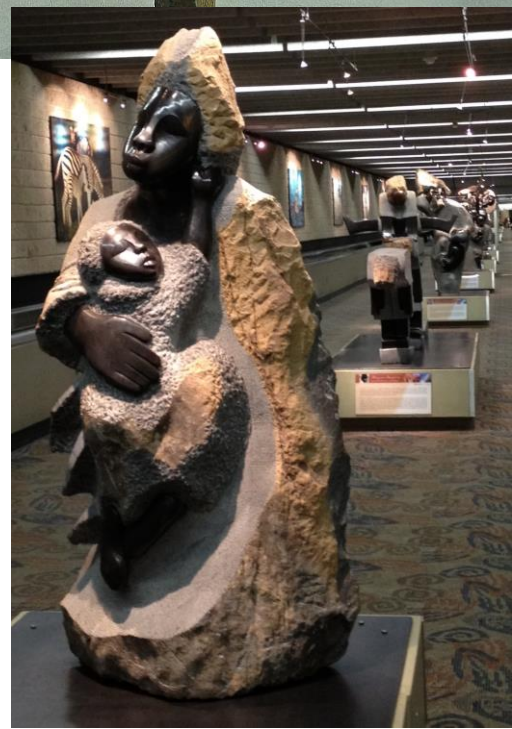
- It will need to be built in components that can be transported as separate pieces and then assembled at the airport location.
- It may have wheels on it or wheels that attach to it for transporting it.
- How big should each piece be?
- How will it be loaded onto the truck that brings it?
- Might the exterior be inflated and the interior solid?



# Airport Displays



If you have been to an airport, you may see a variety of different displays that show what that city is proud of or local artists that are wanting to show their work. Some displays are smaller and others are big enough to walk through. We are looking for a display that will be a full sized mockup that people can interact with as they walk through. One of the most important components is how to build it so it is sturdy enough that many people will be able to walk through it every day. Then it will need to be transported to the airport where it will be installed for several months. Then it will be removed from one airport and taken to another airport. We would like it to be easy to remove from one place and get it to the next location.







This is a NASA display at Hobby Airport in Houston. We would like our Destiny Mockup to be bigger and more interactive.