Galley Table

Design School: Cypress Woods

Build Schools: Cypress Woods H.S. Texas, Clear Creek H.S. Texas, Cypress Springs H.S. Texas

Teachers: Mike Bennett, Bill Gibbs

Mentors: Stacy Hale, George Kessler, Roy Bellard, Mike Cabiran, Alli Westover, Marcie Dickson, Glenn Johnson

NASA Engineers: Bruce Blazine, Don Pettit, Tom Marshburn

CMC engineers: Michael Morgan, Martin Fraske, Steve Schaff, Laura Dillon, Tim Gadd, Amit Patel, Jon Reyna, Remesh Patel, Coke Kepler, Ashley Estes, Rudy Gabiola,

Tim Kopra, Jeff Williams, and Tim Peak installed the Galley Table into Node 1 of the International Space Station.

Problem:

One of the many agreements NASA had with the other international partners was that NASA would provide a table that all astronauts and cosmonauts could eat from in the US side of the International Space Station. Although designing and building a table sounded easy, the forces that could be put on the table (kicks and pushes) and the locations available makes the design complicated and potentially expensive to design and build. HUNCH was asked to take up the task.

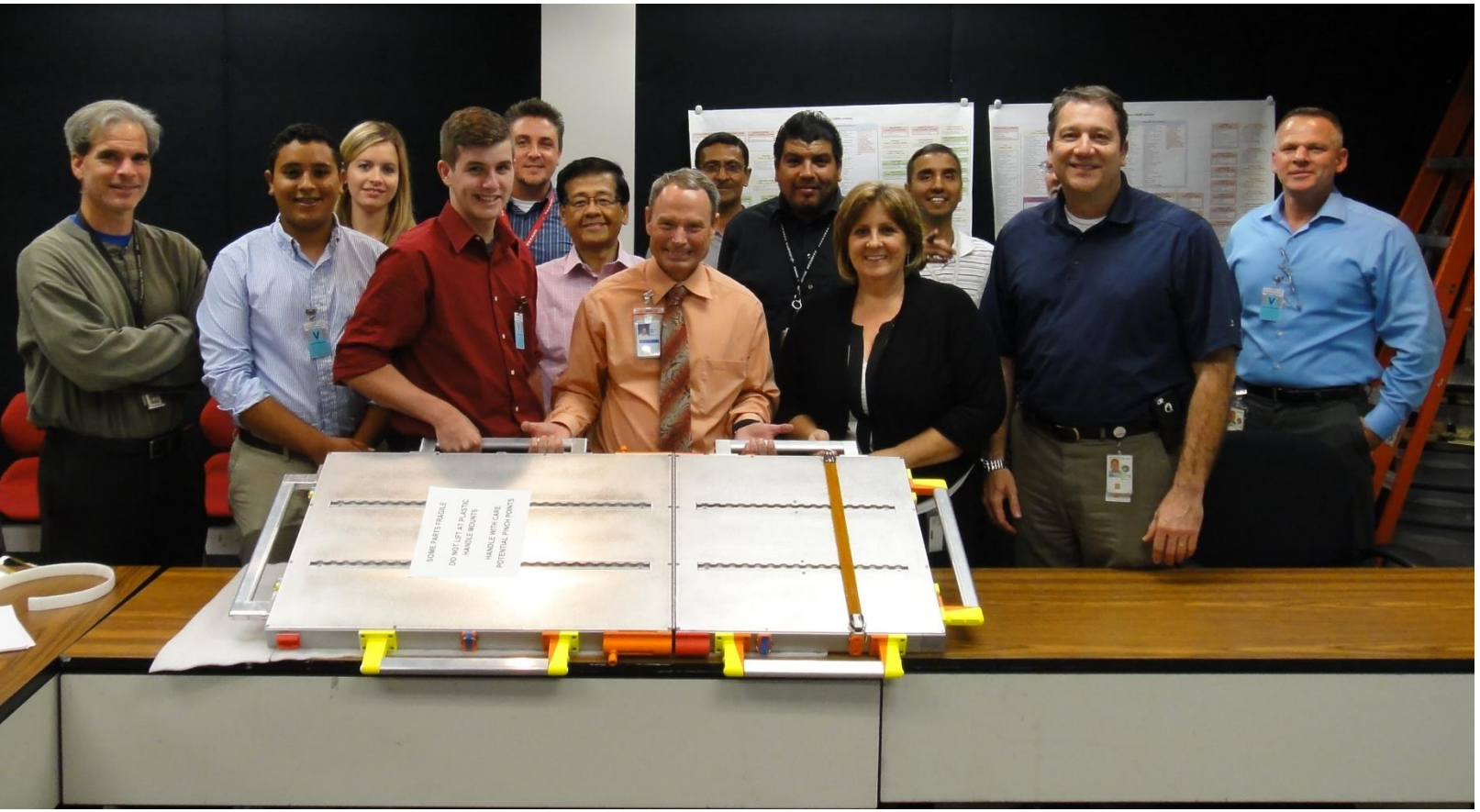
Designing and Prototyping

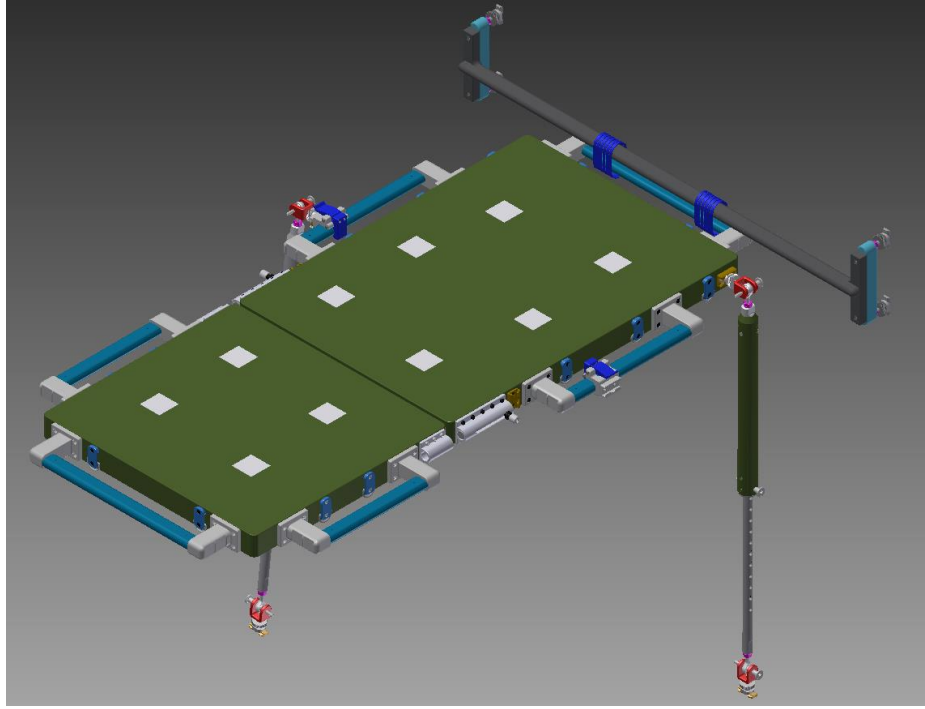
Jay Isabell, Ian Kapp, Kieffer Christ, Robert Lipham

The Galley Table was a multi year design and build project that included many students, engineers, mentors and astronauts all sharing ideas and working together. The project began through a partnership with Lockheed Martin Cargo Mission Contract on March 3, 2014. This project was sponsored through the OB Vehicle Integration office, and through CR/SSCN 13394.

Initial drawings and concept ideas were developed at Cy Woods High school under the direction of Mike Bennett. Students then presented their ideas based on some initial design requirements at the Preliminary Design Review on April 24, 2014. The review served to tweak some of their initial ideas, improve on the requirements set before the HUNCH team, and to include the integration of materials, safety and structures groups to obtain a satisfactory Class I Flight Hardware. The Cy-Woods team developed not only ideas and concepts for the Galley Table, but also for the attachment Galley Table Bracket and the Galley Table Struts to attach to both the ZSR(Zero G Soft Rack) and RSR (Resupply Stowage Rack) panels. Throughout the process, the students would develop rapid prototype parts through use of their 3D printer to share with structures and safety as design ideas would change.

The Critical Design Review took place on June 26, 2014. This review made sure that all of the materials were being manufactured appropriately, stress analysis were complete, and safety was in agreement with the processes of manufacture.

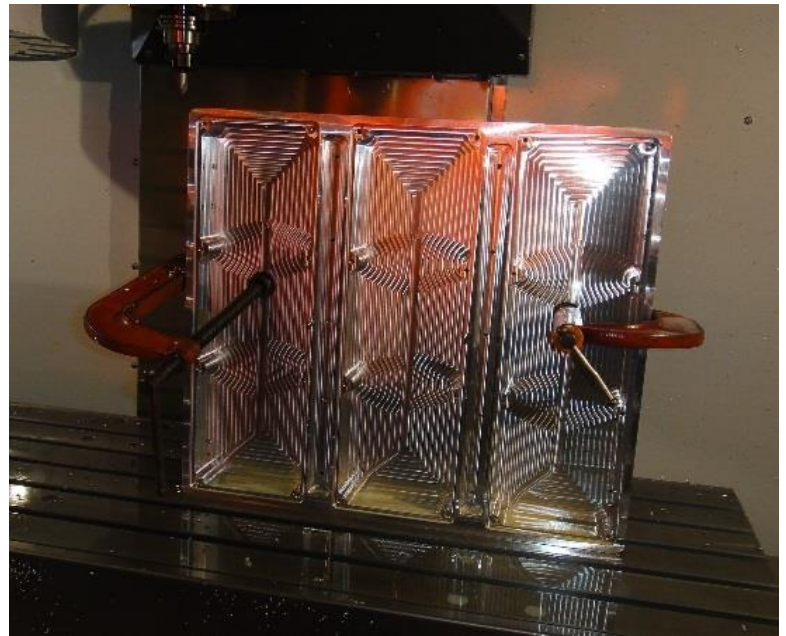




Students, Engineers, Mentors show off the prototype after presenting the full idea of the Galley Table at the Critical Design Review.

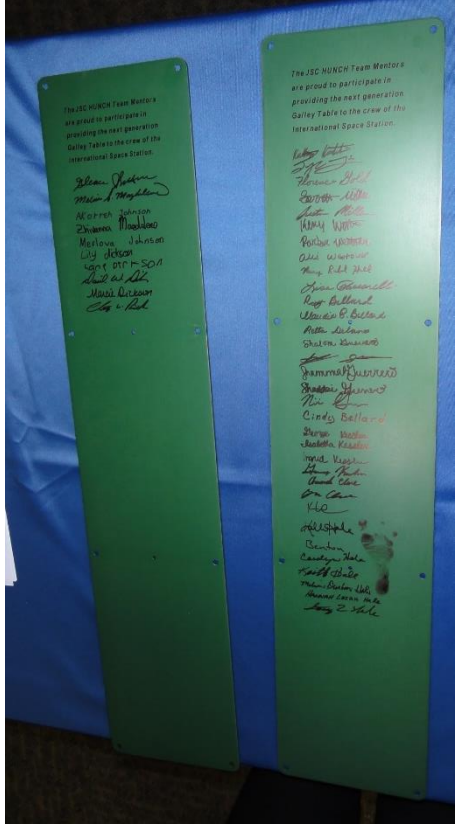
The Build

Once designs were complete and the detailed drawings describing each part were complete, the machining classes at Clear Creek, Cy- Woods, and Cy - Springs began the manufacturing process. These schools started turning aluminum sheets, blocks and rods into high precision milled components. Over many months, the classes dedicated many hours to careful 3D modeling, CNC programming, and precision machining setups and fixturing, as the parts were milled from the raw material of aluminum and stainless steel.



Inspection and Assembly

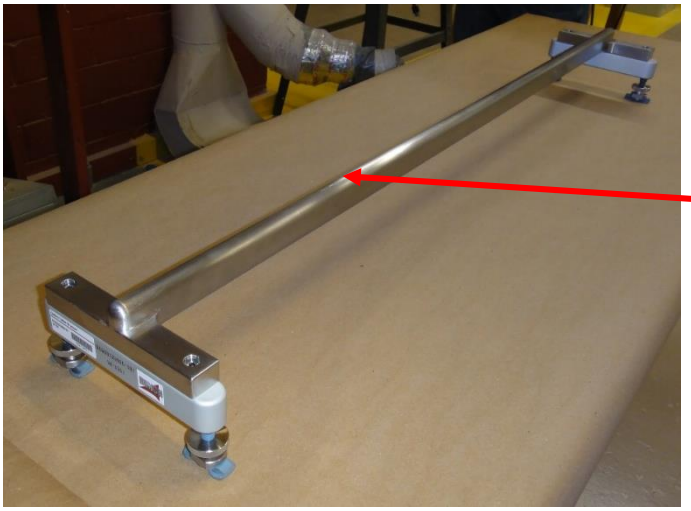
After machined parts were complete, they went through a de-burring processes and inspected to ensure accuracy and quality. Quality paperwork was filled out to certify compliance and to ensure that the parts could be declared flight ready. All parts were sent to Turn Key Coatings for anodizing and passivated to give the desired color, provide a hard surface coating and ensure that corrosion would not occur after assembly.



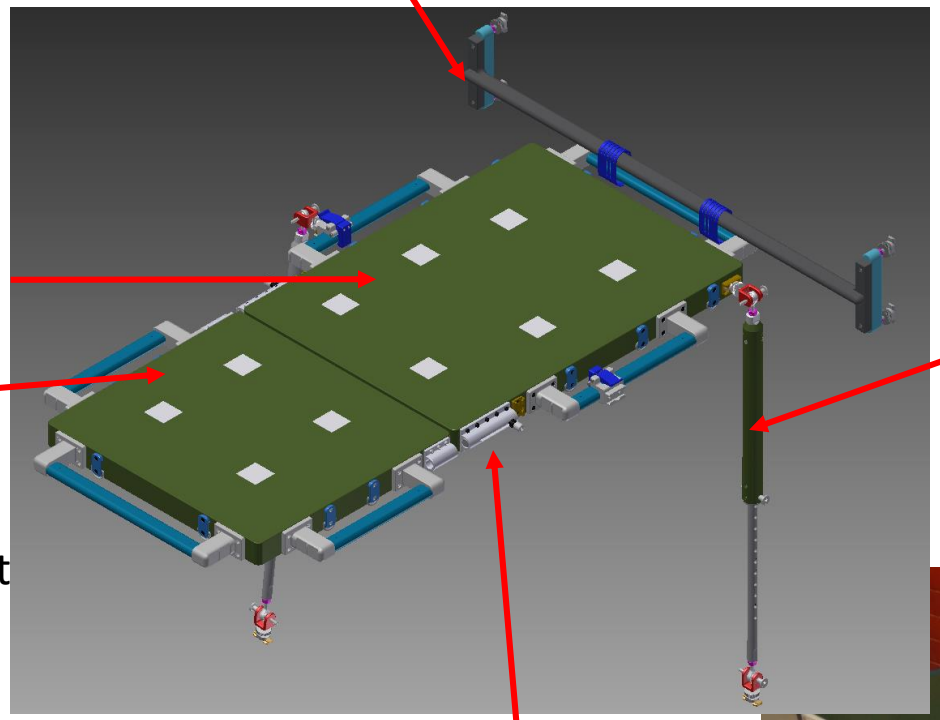
Students, teachers, engineers and mentors were allowed to sign the underside of panels before assembly.

When all parts were considered flight ready, the assembly began at Clear Creek High School. The HUNCH Galley Table was turned over to CMC for delivery on August 11, 2015. Once at CMC, the table was processed for flight including getting it packed in a soft stowage bag. The stowed Galley Table was delivered to Orbital on January 25, 2016. The Galley table successfully launched on March 23, 2016

Galley Table Features



Galley Table Bracket is a sturdier handrail for holding the table to the wall



Large Leaf

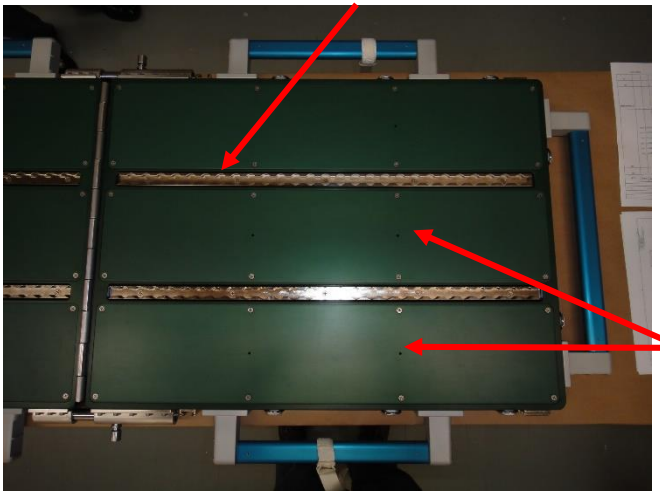
Small leaf

Galley Table Struts support and rigidizes table

Top side of the table is the smooth cleanable eating surface

The underside is the work surface

Seat track for attaching equipment for repairs



Holes for PiP pin attachment

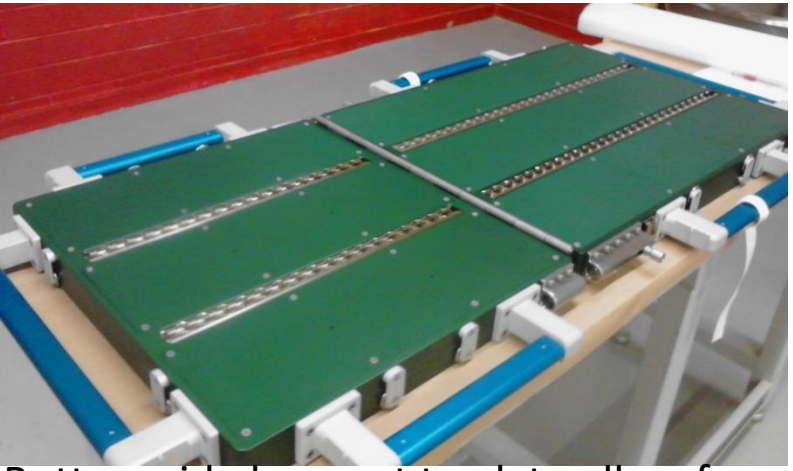
Latch for holding small leaf open

D-rings for holding bungees

Notches on handrails to aid in holding bungees

Inspection

Astronaut Shannon Walker and engineer Bruce Blazine inspect the top side of the table that is a smooth surface for eating and easy cleaning.



Bottom side has seat track to allow for strapping down equipment if a work surface is needed.

The Galley Table Bracket is a specially designed handrail to handle the large forces that would occur if the table were kicked or ran into when fully extended.

Galley Table Struts were designed to help rigidize the table's motions.

Launch to ISS

- The Galley Table was launched on the Orbital 6 rocket to the International Space Station (ISS). The Galley Table was installed not long after docking.

Installed by Expedition 47

https://www.youtube.com/watch?v=NV-i_1OHrZA

Thanksgiving dinner 2016

(Left to right) Oleg Novitskiy , Sergey Tyzhikov , Andrei Borisenko, Thomas Pesquet , Shane Kimbrough, Peggy Whitson

Eating dinner in zero-g is less like sitting down at the table and more like being at a cocktail party where you have a place to set your food while you float around and talk. The Galley Table was designed to handle holding food for six people when folded out. Expedition 51 had Thanksgiving dinner around the Galley Table. Peggy Whitson was one of the astronauts providing inputs on the table while in development.

A day in the life of the Galley Table (zoom in to satisfy your curiosity)

Astronauts add tape, Velcro, clips and bungees to the table to hold their utensils and food in place. If any of these restraints gets dirty or stops working, they can be thrown away and replaced.

Galley Table Trainer delivered to Johnson Space Center

In the process of building the Galley Table and its equipment for the ISS, there were parts made as practice that had small defects like scratches or little dings. These slightly damaged or just extra parts were turned into the Galley Table Trainer and delivered to the Space Vehicle Mockup Facility. Where it is used for training the crews, answering engineering questions, being aware of its capabilities, volumetric representation. The work put into this table is just as important as the one that flew to the ISS for different reasons. This table is seen by many engineers and developers and stands as an example of what a table for the ISS looks today. The ideas students and engineers put into this table will help people decide what a table will look like for future space vehicles. The good ideas in this table may become good ideas for the next generation.

Thanks and Congratulations

- The NASA HUNCH mentors along with the ISS Program Office Staff want to express their gratitude to the hard working teachers and students involved as well as the engineers at CMC and NASA engineers who helped all along the way. Their hard work and determination allowed the development and fabrication of the Galley Table, Galley Table bracket and Galley Table Struts to become a reality. We expect the Galley Table will continue to serve the astronauts for the duration of the ISS and the design will serve as a sample HUNCH engineering for many years into the future.