

Space, the final frontier

Text by Jetro

Pictures by NASA/Bill Ingalls and LEGO® Systems A/S

This year marks the 50th anniversary of human travel in space. It has also been 30 years since the most complex space ship used so far – the Space Shuttle – was taken into service. LEGO® has followed the conquest of space closely from the very beginning. As early as 1964 LEGO launched a Space Rocket (801) and the LEGOLAND Space theme, which ran from 1973 to 1976, featured a rocket base and two moon landing scenes. It took until 1990 before LEGO produced the first model of the Space Shuttle (1682) but since then it has appeared many times and in a variety of sizes. The latest LEGO model of the Space Shuttle has a special added value though: it has actually flown into space on mission STS-134, the final flight for Space Shuttle “Endeavour”.

It is not the first time LEGO goes into space. Already in 1999, a LEGO MINDSTORMS model of the Canada space arm was sent up on a Space Shuttle mission with then astronaut Dan Barry. In 2001, another MINDSTORMS model went up as part of the Ultimate Builders Challenge in Germany, Switzerland, and Austria. Also, two astronaut minifigures “hitched a ride” with the Mars rovers Spirit and Opportunity that arrived at the red planet in 2004 [box]. To be completely true, another model of the LEGO Space Shuttle has been in space before, on

mission STS-133, but this time both the LEGO Space Shuttle and a number of other LEGO sets have made it all the way to the International Space Station (ISS) to run a number of experiments, a fact has received ample media coverage, and it will be the first time a LEGO set is built in space.

So how did the LEGO Space Shuttle make it into space, and what will be its mission there? To answer these and other questions we need to go back to the end of 2010.

The LEGO Space Race

November 2, 2010 - Kennedy Space Center. In view of the enormous countdown clock for the launch of Space Shuttle Discovery on mission STS-133, astronaut Leland Melvin, NASA's associate administrator for Education, and Stephan Turnipseed, President of LEGO Education, announced a partnership aim of promoting STEM (Science, Technology, Engineering and Mathematics).

The next day, and again some weeks later, two “Build The Future in Space” events were held at Kennedy Space Center,



LEGO Build the Future Activity.
Photo by NASA/Bill Ingalls

as a warming-up activity. *"It is based on a concept we have created in Community Engagement and Communication called Build the Change"* says Andrew Arnold (CED PR and Communications Manager at TLG). *"It gives kids the opportunity to build the change that they want to see. Typically, we give children a specific challenge from their daily lives and get them to build a solution. We've used it to suggest solutions for new schools, parks, and just recently to get children in Billund to contribute their ideas to how we can develop the town."* In this case children were encouraged to build what they thought a space city would look like.

But that was only the start of the project. The shuttles that went on mission STS-133 were small builds that came from an existing LEGO® Education set. However, the LEGO Space Shuttle that accompanied mission STS-134 was a newly designed model. [1]



Daire McCabe, a LEGO designer who worked on some of the models that went into space, comments: *"During the design process, we tried to stay completely faithful to the real life Space Shuttle by including features like the opening cargo bay, the Canadian Arm and the big engines at the rear of the shuttle. We even created a new element especially for the wings, in order to recreate the shape of the real Space Shuttle as closely as possible."* The model is about 18cm long and is made up of some 60 bricks. It gives a whole new meaning to the term "flying brick" which is popularly used to describe the real Space Shuttle as it returns to earth as a very heavy unpowered glider.

"The main goal we wanted to achieve was to teach kids about living and working in space, and inspire a new generation of astronauts, scientists and engineers. This is how we came up with the idea of including facts about real life spacecraft on the boxes and creating a series of models which we could send to space aboard a real Space Shuttle"

His favourite set in the range is the 3368 Space Center: *"It carries on the heritage of a long line of great LEGO Space themes, keeping some of the classic icons that have come to define LEGO Space, while adding some new, unique touches to bring it up to date."* The set has a large number of cool play functions such as the elevator, refuelling pipe, a large countdown clock and a mission control center, complete with a classic red telephone! It also includes both a male and a female minifig and the top of the big rocket can hold either a satellite or launch one of the astronauts into space. [2]

Experiments and activities

During the STS-133 mission NASA organised a Tweet-up event, allowing a select group of people to interact directly with the crew on board the Discovery. At this same event, Daire McCabe gave a presentation showing some of the sets that would accompany Endeavour on its final mission and explaining some of the concepts behind sending LEGO into space. The largest model that has been prepared is a reproduction of the ISS itself. Building it on earth turned out to be more complicated than expected. The real structure takes up roughly the size of a football (soccer) field, and weighs about 450 tons. The LEGO replica is almost impossible to build on earth. It requires as many as 5 people to hold different parts of it to avoid it coming apart. In space however, in microgravity conditions, no such complications exist. Even so, the set is so big it has been packaged in two separate containers for assembly in the ISS.

Other constructions that have been sent to the ISS include reproductions of parts of the interior of the Space Station and a number of scientific projects that will highlight the differences between how objects behave on earth and in the micro-gravity of space. In total 30 different LEGO sets and experiments have been taken to the ISS and 3 more will follow, likely early in 2012.

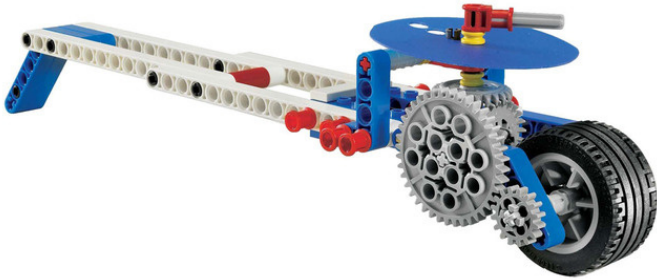
It may seem like something trivial, but conditions aboard the ISS need to be perfectly controlled and micro-gravity adds complications that do not exist in other environments. To this end she also participated in the design of the system to avoid any small pieces from floating off into the ISS. In addition to simplifying the construction process (instead of having over 60 small bricks to assemble, the pieces have been pre-built and glued together several larger chunks) special polymer building bags, also called glove-boxes (or 'containment systems' in the NASA jargon) have been designed in order to build inside a transparent bag.

But there is more to this than just building a LEGO set in space for the first time. As NASA puts it in its research summary [3]: *"The construction process and activities with the sets demonstrate the challenges faced when building things in the microgravity environment of space."* One factor is speed. What may seem a simple task in normal gravity on Earth can take considerably longer in the micro-gravity environment of space. Overcoming the clutch power of a LEGO brick may sound trivial to you, but in micro-gravity you cannot use your own weight to overcome that force. There are also other ways in which micro-gravity affects how things work. In addition to the LEGO City Space sets, a number of experiments built by LEGO Education will be tested to show those differences. The building process will be filmed and posted on the LEGO space.com website. This footage will serve as part of an educational package that LEGO is preparing for the classroom and which will include worksheets for the students who will observe how things work in space and then duplicate the experiments in the classroom to see the differences.

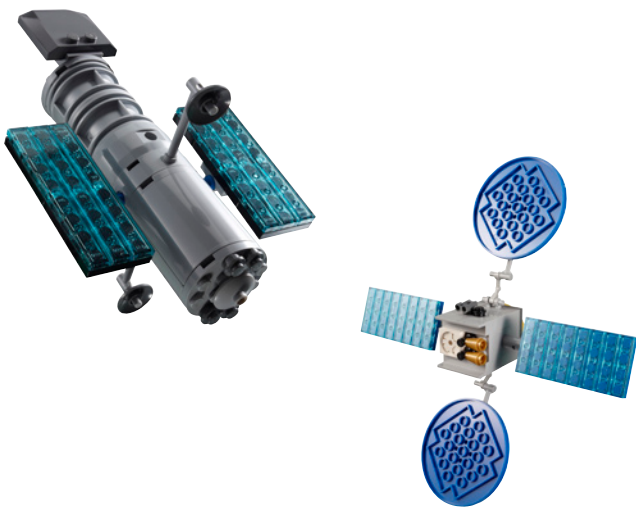
In the words of Leland Melvin, NASA's associate administrator for education, *"These projects not only foster creativity but also instil in the young builders a real sense of the engineering and design principles that NASA uses every day. Fun learning activities like these can help inspire kids to become the next generation of explorers."*

Take dimensions. How big is the Space Shuttle? Well, the cargo bay of the shuttle could hold a standard American

School bus. And since the objective of these exercises is to visually demonstrate things, a scale model of just such a bus has been built that can fit nicely inside the cargo bay of the LEGO® Space Shuttle. Space may be vast, but the living and working space aboard the ISS most certainly isn't. Again, to make these dimensions more real to students, the astronauts aboard the ISS will be using a Trundle Wheel to measure some of the dimensions on board the Space Station, so students on Earth can replicate those measurements and see exactly how 'spacious' things are up there.



Other experiments are less technical, but still involve getting students to think about the challenges and opportunities of space. A set of six different types of satellites has been sent up. Satellites perform many everyday tasks we have come to rely on, like providing data for weather forecasts, GPS localization, or TV and phone signal carriers.

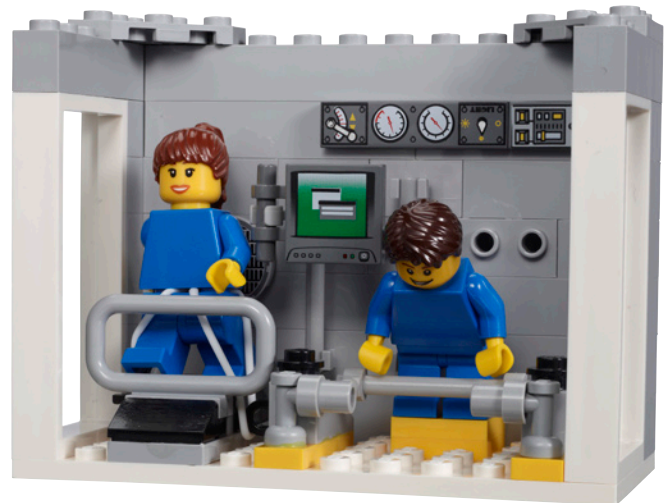


Scale models of ISS living quarters have also been prepared to give an even better understanding of what life is like aboard the space station.

It took some time for the project to take off, first of all literally. STS-134 was delayed several times and so the program could not start when originally planned. But although it was delayed it was not cancelled and the first wave of sets is now in space and the astronauts who will be doing the experiments have been chosen as announced on the blog of LEGOspace.com [3]. On the same website the activities and videos will be published ... in due time.

LEGO has made it into space... once again!! and this time it is ready to get more out of it than ever, but the interest LEGO

takes in space doesn't finish here nor is this project in any way 'complete' yet. So keep an eye on the LEGOspace.com website to see what's new and we'll make sure to give you an update in HBM as well when the time is ready.



[1] The LEGO Space Shuttle that went into space on mission STS 134 has been made available as a LEGO set 3367 and is part of the LEGO City Space range. In addition to the shuttle it consists of a Moon Buggy (3365), a Satellite Launch Pad (3366) and a Space Center (3368).

[2] a full interview with Dair McCabe was published in DMAG, some extracts of which have been used in this article.

[3] www.nasa.gov/pdf/538352main_sts134_presskit_508.pdf

[4] Ron Garan, Mike Fossum, Dan Burbank and Don Pettit have been selected for this task and their bios can be accessed through links on the legospace.com website blog.

Thanks to: Andrew Arnold from TLG
Tormod Askildsen for the LEGO Discovery information.
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LEGO® DISCOVERY

It is not the first time LEGO® includes facts about space with its products. In 2003 LEGO launched the LEGO Discovery series which resulted from collaboration between LEGO and the “Red Rover goes to Mars” project [1] of the Planetary Society [2] which in turn worked together with NASA. For the products of this theme, TLG established a direct relationship to NASA HQ and the Jet Propulsion Laboratory (JPL) [3] and also with Boeing regarding the Delta 2 lift rocket. Similar to the LEGOSpace.com initiative the objective was to stimulate children and young people’s interest in space exploration. To this end LEGO chose some of the models that would appeal most to the imagination of its audience, including the ISS, two mars rovers, the moon landing and the Space Shuttle. Inside the instruction booklet of each set significant details of each of these structures were included.

As part of the project, TLG and the Planetary Society teamed up to run a contest to name the two mars rovers. The competition was won by a 9 year old girl from Arizona in the US. She had proposed the names “Spirit” and “Opportunity”. As a token of this collaboration, representations” of three LEGO bricks and a LEGO Minifigure are attached to the rovers wit magnets and these are now on Mars!

[1] http://www.planetary.org/programs/projects/red_rover_goes_to_mars/

[2] <http://www.planetary.org/home/>

[3] <http://www.jpl.nasa.gov/>

