MoonBaseTwo - a design concept for an inflatable surface habitat

Andreas Vogler¹, Arturo Vittori²

¹Architecture+Vision, Hohenstaufenstrasse 10, 80801 Munich, Germany
²Architecture+Vision, Via del Piano 20, 01020 Bomarzo (VT), Italy
+49-173-3570833, andreas@architectureandvision.com

Abstract. Long-duration Human Spaceflight requires a reasonable amount habitable volume, which opposes the reality of rocket launch diameters. Thus, ever since the beginning of spaceflight, the idea of inflatable habitats has been the most obvious. Most of Werner von Braun’s Collier Designs from 1953 were inflatable. Goodyear proposed a rubber space station in the 1960ies. However, the makeshift rush, which created Skylab as the first American Space Station didn’t allow the development of new material technology need to built safe inflatable habitats. It was not until the development in material technology, especially fibres in the 1990ies, when inflatable space habitats seem to make more sense than ever. NASA proofed how far the technology can be push by their seminal, unfortunately abandoned, inflatable habitat TransHab. For surface habitats, if for Moon or Mars, inflatables offer many benefits, but also pose some specific problems. The transportation configuration needs to be very compact. The deployment has to be automatical and should allow to setup the habitat to be fully operational when the crew arrives. Here are many mechanical, logistical and organisational problems to be addressed. The form-generation and the functional planning for cylindrical, toroidal and spherical shapes need to be addressed. Concepts for radiation protection by locally collected regolith need to be developed. Redundancy in the skin and control methods need to be addressed. Concepts for designed spaces for group work and necessary individual privacy without solid wall need to be studied.

This paper will present a design proposal for an inflatable moon habitat by Architecture+Vision. The design is based on the currently discussed Ares V fairing size and lifting capabilities. Prepacked as an aluminium module with existing docking facilities, the hard shell module opens after landing and builds the mechanically stiffened floor. Above a dome shaped habitat inflates. Regolith bags will be filled outside to provide a reasonable radiation protection.

The concept is proposing and architectural and human factor driven approach to a future MoonBase.

FIGURE 1. Artist’s impression of the inflatable MoonBaseTwo. (Copyright: Architecture+Vision, background image: courtesy of NASA.)
REFERENCES


PRINCIPAL AUTHOR'S BIO (~50 WORDS)

Andreas Vogler, Architecture+Vision, partner

Andreas Vogler, Swiss Architect, born in Basel 1964. Vogler studied Art History and Literature and worked as an interior architect before he attended architecture school at Swiss Federal Institute of Technology, graduating in 1994. He worked with architects Richard Horden and Christoph Ingenhoven from 1995 to 1996. From 1996 to 2002 he was assistant professor at the institute of Prof. Richard Horden at the University of Technology in Munich. He was a leading force combining teaching with research and actual buildings. Several small student projects have been realized. In 1998 Vogler initiated and led a design semesters for aerospace architecture, where student planned for the International Space Station and a Human Mars Mission. All students were able to perform parabolic test flights at NASA Johnson Space Center. During the time at the University Vogler also submitted several prize-winning competitions. In 2003 he founded the company ‘Architecture and Vision’ with his Italian partner Arturo Vittori. The office concentrating on innovative concepts in architecture and technology transfer from Aerospace. A study for a mobile embassy for Switzerland as well as for inflatable tents for the European Space Agency have been performed. The firm built a prototype of the tent named ‘Desert Seal’, in collaboration with ESA and Italian company Aero Sekur. The prototype first exhibited at The Museum of Modern Art (MOMA) in New York City, recently became part of the prestigious MoMA collection. Vogler was visiting professor at the Royal Academy of Fine Arts School of Architecture in Copenhagen researching in prefabricated houses and is currently collaborating with TU Delft in the ‘Concept House’ research programme. He is lecturing and teaching on an international basis and recently had commitments in Switzerland, Denmark, Hong Kong and Italy. He has been organising scientific conferences and is currently working on a study for a Space Simulator. He is member of the Bavarian Architects Chamber, the ‘Deutscher Werkbund’ and the American Institute of Aeronautics and Astronautics (AIAA).

‘By leaving our planet since the last 40 years we learned more about it, than in the4000 years before’ - Andreas Vogler.

Arturo Vittori, Architecture+Vision, partner

Architect Arturo Vittori was born in Viterbo (Italy) in 1971. Vittori studied Fine Arts and received a Master's Degree in Architecture from the University of Florence and a Thesis Degree in Aerospace Architecture. After graduating in 1996, Vittori relocated to Paris to work with renowned Architecture practices such as Santiago Calatrava and Jean Nouvel. From 2000 to 2002 Vittori worked for Airbus as Manager Cabin Design, working on cabin interiors for various Airlines including the first A380 Jetliner, a future addition to Singapore Airline in 2007. In 2002 Vittori joined London based Architectural firm Future Systems to worked along side artist Anish Kapoor for a Subway Station project in Naples, Italy. In 2005 he joined Francis Design as a yacht designer and stylist. In 2002, Vittori co-founded ‘Architecture+Vision’ (AV) with Swiss Architect Andreas Vogler. The firm’s practice focuses on generating innovative concepts in architecture and industrial design and applying advanced technologies and concepts from the aerospace sector to terrestrial projects. The firm recently performed studies for inflatable structures for the European Space Agency (ESA). The firm built a prototype of the tent named ‘Desert Seal’, in collaboration with ESA and Italian company AeroSekur. The prototype first exhibited at The Museum of Modern Art (MoMA) in New York City and has now become a part of the museum's permanent collection. The work produced by the practice has been recently exhibited in different international Museum such us the MSI, (Museum of Science and Industry) in Chicago, ‘Lille3000’ in Lille, France and at the Landesmuseum für Technik und Arbeit in Germany and soon at the Centre Pompidou in Paris. AV’s projects have been published internationally. Vittori is a member of the Italian Architects Chamber, the ‘Ordine degli Architetti, Provincia di Viterbo’ and the American Institute of Aeronautics and Astronautics (AIAA). He has participated in prize winning architectural competitions. He is currently working on research projects with humanitarian goals.

“Nature is an inexhaustible source of inspiration, are we smart enough to learn its lesson?” - Arturo Vittori