

Industry Outreach and Relationship Potential for Space Habitats

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Industry, Facilities and research (Collaboration, Access)

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Requirements to make successful team collaborations:

- Regular teleconferences and sharing of ideas and results
- Sharing of test equipment as needed (traveling to other sites)
- Think outside the box, do not just have only one field of engineers/scientists work on the project, consult other in different relevant areas you are surrounded by in academia.
- Partner with Industry leaders that are dedicated to continuous improvement.
- Utilize industry connections that your research team may have.

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- **Suggestions for resources of funding and partners, Approaches to make national and international collaborations, and Industry needs from academia**
- **The companies that have maintained success delivering advanced, high value products have done so through lean six sigma manufacturing ideology.**

(Lean six sigma ideology involves identifying and eliminating waste, improving quality, continuous improvement, and problem solving utilizing capital investment to achieve this.)
- **These companies are in competition with each other and other nations, and under constant pressure from the government to lean out their processes and personnel.**

(An example of this is U.S. Government leaning on Lockheed Martin to cut the cost of the most expensive weapon in world history; the F-35. Lockheed created the goal of saving \$5 Billion and they are on track to do so.)

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- **Companies that utilize continuous improvement have seen their stock continue to climb. And they are all willing to invest in projects that will result in novel achievements, just like with their kaizen events.**
(Kaizen events involve bringing together a group of individuals, some directly involved with the problem, and some from other disciplines to work together to solve a problem utilizing lean six sigma ideology.)
- **There is pressure from the government and these companies to excel and achieve groundbreaking solutions**

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The some prominent companies (who all practice lean six sigma) are:

- Lockheed Martin
- General Dynamics
- Boeing
- Northrop Grumman
- Textron
- Raytheon
- United Technologies
- And Others



<https://www.nasa.gov/press-release/nasa-selects-eight-projects-for-2016-x-hab-academic-innovation-challenge-0>

- In 2012 NASA gave grants to 4 Universities to work on this habitat
- In 2015 NASA gave grants to 8 Universities to work on this habitat

These companies are all open to continuous improvement which includes funding scientists and engineers in academia to solve problems

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- **NASA's goal of lunar outpost, Mars Exploration, and asteroid mining.**

Japan, China, European Union, Russia and India have joined in the efforts for Lunar and Martian exploration.

Canadian Space Agency could be another potential partner in space habitat research

Funding: NASA, Air Force, DOD,
National Space Grant Foundation
National Science Foundation
National Academy of Engineering/Sciences
Other options for funding include:
European Space Agency
India's Department of Science Technology
Canada's NSERC and SSHRC
Japan's JAXA, JST and JSPS
Mexico's CONACYT
Chinese Government



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Industry Needs from Academia

- Many industries/companies understand that investing in projects and continuous improvement yields success; they have experienced it.
- Successful companies regularly hold Kaizen events where the goal is to solve some specific problem. They will bring in a range of people with different backgrounds and fresh pairs of eyes to work together to solve the problem. Some of my graduate students have participated in a number of these in their companies and the outcomes have always been successful.
- The universities need to sell to these companies that having all completely fresh eyes to look at a project will be even more beneficial.

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- For universities, with all of this academic knowledge; if you don't use it, you lose it. And many research groups at the Universities these days have used it every day, and find new ways to utilize fundamental concepts every day.
- It is beneficial to companies to get a project into the academic realm where there are subject matter experts in every discipline all around you. Generally, a lot of work done in industry is based on previous work done or work being done in parallel.
- Alternatively, funding a University to focus on a project will have subject matter experts utilizing fundamental concepts and research to solve the problem



THANK YOU

