



University of Colorado
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Sensitivity of Private Space Station Profitability to Market Demand and Use of Space Resources



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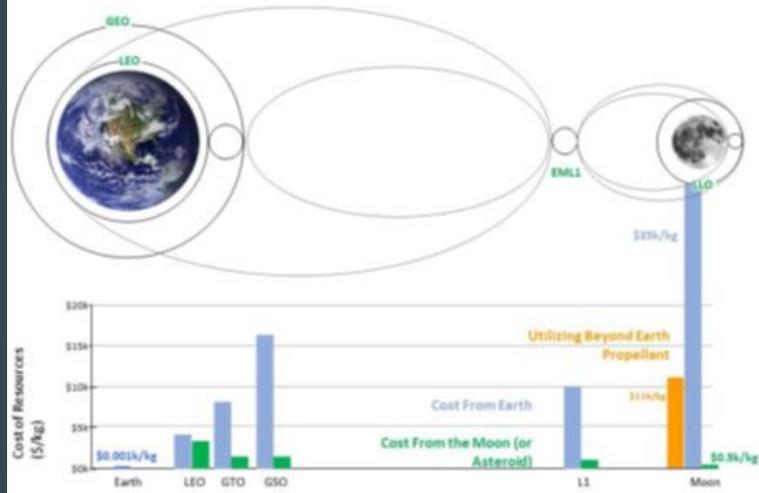
Space Resources Roundtable June 11-14, 2019

The big picture

- How much demand does it take to make a private space station profitable?
- Can space resources increase profitability?



Source: NASA, n.d., "International Space Station."

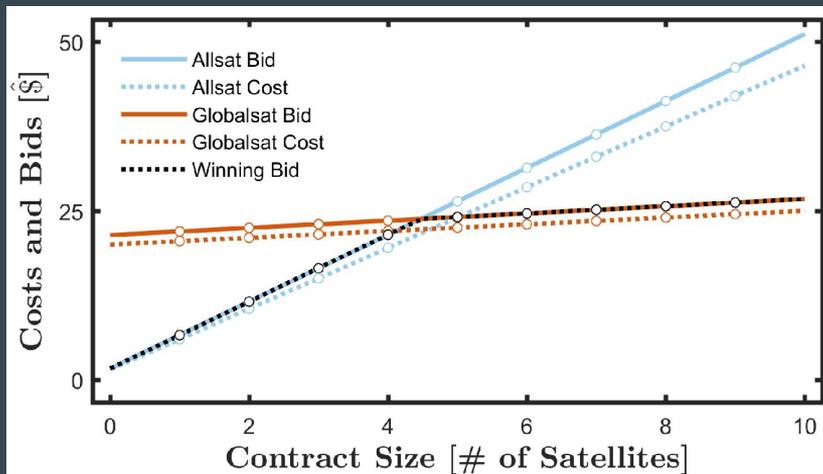


Who is CENKI?

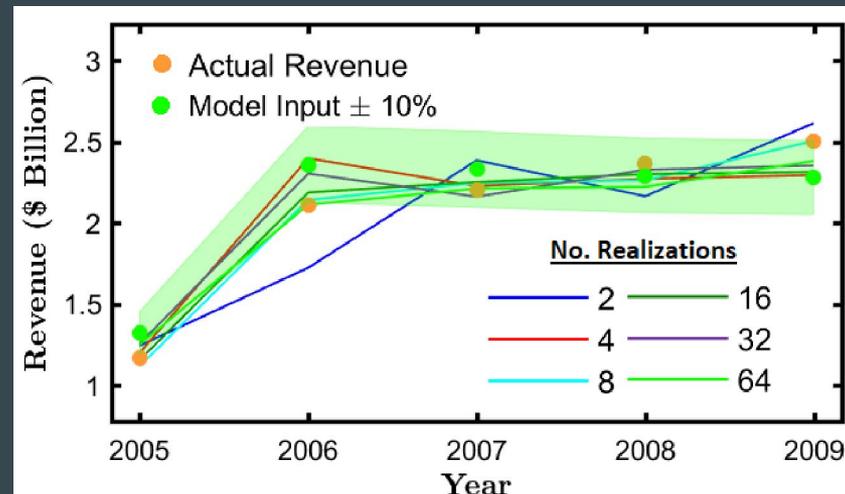


- CENKI: The Committee on Expansion iNto Key space Industries
- We developed the Space Economic Simulator (SES)

Verified:

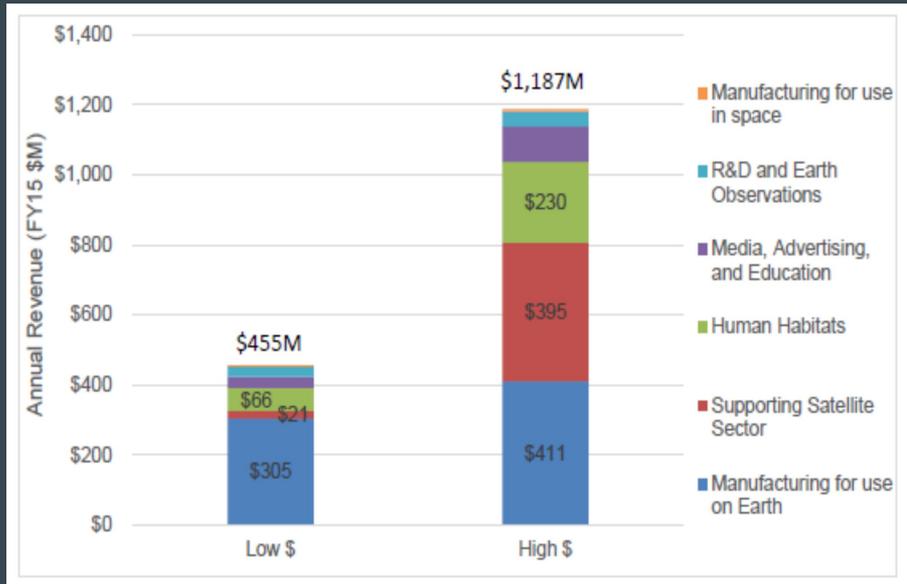


Validated:





STPI report on private space stations



Cost	Revenue	Low	High
		Low Revenue \$455 M High Cost \$2,250 M Annual Loss = -\$1,795 M	High Revenue \$1,187 M High Cost \$2,250 M Annual Loss = -\$1,063 M
High	Low	Low Revenue \$455 M Low Cost \$463 M Annual Loss = -\$8 M	High Revenue \$1,187 M Low Cost \$463 M Annual Profit = +\$724 M

Estimated Annualized Cost and Revenue Estimates for a Private Space Station

Our study: Modeling

- Total cost scales with demand
- Assumptions:
 - 1 fixed operator + additional operator for every 3rd tourist
 - Fixed durations for each crew type, spread annually
 - 50% of human needs come from space resources
- Uncertainties:
 - 0 - 30% industry discount (uniform)
 - Operational expenses: Mean = \$400M and $\sigma = \$200M$

Our study: Results



Profits in millions of dollars

$N_{tx} N_g$	12	24	48	96
0	-\$420	-\$443	-\$355	-\$464
1	-\$435	-\$458	-\$370	-\$479
3	-\$587	-\$610	-\$360	-\$469
6	-\$592	-\$615	-\$527	-\$639
9	-\$758	-\$782	-\$697	-\$808
12	-\$763	-\$787	-\$702	-\$813
15	-\$930	-\$955	-\$870	-\$983

Baseline

$N_{tx} N_g$	12	24	48	96
0	-\$154	-\$72	\$91	\$411
1	-\$159	-\$77	\$86	\$406
3	-\$258	-\$176	\$96	\$416
6	-\$253	-\$171	-\$9	\$310
9	-\$357	-\$276	-\$114	\$205
12	-\$352	-\$271	-\$109	\$210
15	-\$456	-\$375	-\$214	\$104

50% Reduction in Launch Costs and 25% Cost advantage using space resources

Profits per σ

$N_{tx} N_g$	12	24	48	96
0	-7.06	-4.47	-1.99	-1.38
1	-7.32	-4.62	-2.07	-1.42
3	-7.40	-5.13	-2.02	-1.39
6	-7.46	-5.17	-2.66	-1.79
9	-7.65	-5.64	-3.20	-2.15
12	-7.70	-5.67	-3.22	-2.16
15	-7.82	-6.02	-3.66	-2.48

Baseline

$N_{tx} N_g$	12	24	48	96
0	-2.59	-0.73	0.51	1.22
1	-2.68	-0.78	0.48	1.20
3	-3.25	-1.48	0.54	1.23
6	-3.19	-1.44	-0.04	0.87
9	-3.60	-1.99	-0.52	0.54
12	-3.55	-1.95	-0.50	0.56
15	-3.84	-2.36	-0.90	0.26

50% Reduction in Launch Costs and 25% Cost advantage using space resources

Visit cenki.space to learn more!



THANK YOU!

