

Spaceflight is arriving soon: How UTS will bring spaceflight down to Earth.

Abstract

Universal Transport Systems is bringing the cost of spaceflight within reach of individuals and small businesses. Inexpensive spaceflight will open up new opportunities, and greatly increase the human economy. UTS is uniquely positioned to open this new market.

How can spaceflight be made inexpensive and routine?

Current approaches to spaceflight are very expensive, limiting space vehicle access to nations and mega-corporations. This is due to several factors: First, space vehicles are typically government funded national prestige projects. This strongly drives project managers to push the technical envelope as hard as possible. While 1970s technology was sufficiently advanced for human spaceflight, all current launch programs attempt to push bleeding edge technology to its limits. It is simply not as impressive to re-fly something similar to what has come before.

Additionally, most legacy space vehicle manufacturers are paid using cost-plus contracts. If a business's profit is tied to the cost of a project, the business will push to make costs be as large as possible. SpaceX is breaking this paradigm, and showing what can be done when goals are more properly aligned.

Lastly, spaceflight will remain expensive and rare if the vehicles remain dangerous. As long as a spacecraft is too dangerous to operate near the public, range and safety costs will dominate. A 747 carries 200 tons of fuel on board, but is allowed to fly over our most populous cities.

A notable absence in this list is propellant/energy cost. The propellant to fly current spacecraft is a completely insignificant portion of the overall cost. For example, the Falcon 9 vehicle from SpaceX costs about \$62 million for every launch, while the propellant cost for the Falcon 9 is about \$200,000 per launch.

The UTS approach - Technology

UTS tries to use the simplest and most reliable technology available. For example, most spacecraft projects shun solid propellant because it is lower performance. Solid propellant is widely known to be the cheapest and easiest solution to propulsion - in fact projects that run low on money switch to solid boosters in the end, for example the Space Shuttle. As development costs tend to dominate vehicle costs, UTS baselined solid propellant from the start.

UTS also built from the Atlas vehicle family approach of using pressure stabilized vehicles. The Atlas rockets were some of the lightest structures flown, able to lift extremely heavy loads for

their size and weight. As we give up performance by using solid propellant, we can recover it with our impressively lightweight structures.

Slowing our vehicles down in the atmosphere also helps decrease the technology required. By flying slower, the forces on the vehicle are lower and more predictable. The flight control system also has more margin with slower flight. Overall performance is lowered, but at that lower performance level spaceflight can be inexpensive and routine.

The UTS approach - Safety

By keeping the solid propellant outside the engine prior to combustion, the normal issues of solid propellant rockets are avoided. The UTS solid rocket engine is throttleable, stoppable and in flight restartable. This makes the safety level comparable to a typical liquid rocket engine, which typically have the same features.

Having the propellant be solid greatly improves safety compared to liquids however. If the propellant storage area is ruptured, the propellant stays in place. A liquid propellant tank that ruptures almost always results in an explosion. The solid propellant used by UTS is very difficult to light outside the engine - during tests, a blowtorch was held to it for several seconds without ignition. If the propellant does catch on fire, it will quickly extinguish itself. Impact testing showed that hard impacts, even supersonic impacts with enough energy to rip the propellant apart will not ignite it. Even high powered rifle bullets had no adverse effects on the propellant!

Conclusion

UTS has created a simple, safe, and inexpensive approach to spaceflight. We are starting with a simple nanosat launch vehicle to demonstrate the technology, and have plans to create a large manned vehicle after that. That vehicle will change humankind forever, as everyday people head to the stars.