The Lurio Report

(See <www.thelurioreport.com> for Subscription Prices and Information)

Private Competence Shown, Public Policy Battles

Vol. 5, No. 10, June 25, 2010

==========

Winner of the 2009 Space Frontier Foundation Award for NewSpace Journalism!

"There is so much new material out in the ether of space reporting that it is refreshing to receive a distinct and realistic assessment of events and themes in the industry. In those regards the Lurio Report nails it every time....an indispensable read."
-- Will Whitehorn, President, Virgin Galactic

"In the ever shifting landscape of the New Space market place, the Lurio Report shines out like a beacon of clarity with its focus on the big picture and on the detailed facts alike."
-- Christopher Stott, Chairman & C.E.O., ManSat LLC, <www.spaceisle.com>

==========

Contents:

NewSpace 2010 Conference, July 23-25

Quick Updates:

Armadillo Aerospace...
Joins the In-Air Restart Club
Flies Autonomous Landing Tests
Adds Ben Brockert of Masten
Bigelow Aerospace and ULA Join CSF, Counter Commercial Myths
CRuSR's Path Becoming Less Uncertain?
Moving Teachers In Space (TIS) to AST?
National Space Policy at Loggerheads?
Rick Homans Retakes Reins as Spaceport America Director
'Shameless Plug' to Rick Homans
Ikaros Solar Sail Fully Deployed!

Dear Acquaintances,

- New Space Competence: XCOR's Partnership with ULA -

Demonstrating Competence - A Building Wave
Aims and Details of the Collaboration
Working Together, the Supplier Shortage and New Space Market Credibility

- New Space Competence: The Aftermath of Falcon 9's First Test -

Flight Notes
Changing COTS Test Flight Plans
Additions to the SpaceX Manifest, Large and Small
Correcting Misinformation
SpaceX, Dragon, and Beyond

- Conclusion: XCOR, SpaceX and A New Space "Phase Change" -

==========

NewSpace 2010 Conference, July 23-25: The annual conference held by the Space Frontier Foundation will take place at the Domain Hotel in Sunnyvale, California, at the center of Silicon Valley and near the NASA Ames Research Center (<http://spacefrontier.org/>). For some 20 years the Foundation's members and Advocates have been the chief actors assailing old ideas and assumptions in quest of a "NewSpace" Era.

With the suddenly ramped-up "mainstream" attention, a new and often far more intense phase of the battle has been joined. Hear from and meet those in the front lines of both the private and public fronts.

I expect to be attending.

Tip: **Get your *_hotel_* reservations in ASAP - it's filling up at the special rate.** (Dr. David Livingston of The Space Show® interviewed Conference Chair Ryan McLinko on June 23 and you can hear the broadcast at <http://www.thespaceshow.com/detail.asp?q=1384>.)

==========

Quick Updates:

Armadillo Aerospace... :
Joins the In-Air Restart Club - It took very little time for Armadillo Aerospace to match Masten's May 26th achievement of an in-air shutdown and restart of a vertical takeoff and landing vehicle's engine. On June 5th they few one of their 'module' rockets to 2000 ft, popped open a drogue chute to get a stable condition (engine pointed down) and relit the engine (<http://www.youtube.com/watch?v=HRFSwA0UL9s&feature=player_embedded>). The engine will have to be off for much longer periods as peak altitude increases. Phil Eaton of Armadillo told me that while the vehicle that crashed a while ago (Vol. 5, No. 6, April 30) due to insufficient thrust vector authority at minimal throttle on descent had become uncontrollable at a drop rate of 45m/sec, this time the drogue allowed recovery from a peak descent rate of 50m/sec.

Eaton mentioned that a variety of tests were upcoming, and on June 23rd Clark Lindsey noted a posting from Carmack about a flight the day before, absent the shutdown but testing a control vane. The drogue wasn't supposed to open at all this time, but the software automatically disconnects it on engine shutdown. Pressure behind the disconnect device then caused the parachute to be ejected from its canister. More interesting are Carmack's comments on modifications and strategy for higher altitude flights using the drogue (check Clark's posting at <http://www.hobbyspace.com/nucleus/index.php?itemid=21539#c>; the original Carmack notes are at a members-only forum.)

***Flies Autonomous Landing Tests* - In a later communication Eaton noted that on the 23rd Armadillo few two missions on the highly rebuilt "Pixel." It carried an ALHAT (Autonomous Landing and Hazard Avoidance Technology) test system for future lunar or other missions for a NASA/Draper Labs project** (<http://alhat.jpl.nasa.gov/>). He comments that, "... [Draper was] extremely pleased with the performance of their system on the rocket, and they along with NASA were also very pleased with the Armadillo Guidance and Control system. Of course there is a significant amount of wobble at the end of the flight, but that is all slosh in the tanks."

Adds Ben Brockert of Masten - At the International Space Development Conference (ISDC) in late spring Carmack had noted that the development of the entrepreneurial rocket industry had created a reservoir of talent that he'd probably be exploiting. By June 11th, Clark reported that Ben Brockert of Masten had decided to join Armadillo. Ben was instrumental in development and operations for the Masten vehicles that won Lunar Lander Challenge prizes.

He will find both similarities at his new company (hmm ... they both mainly use isopropyl alcohol/LOX engines) and differences (Armadillo's engine is film cooled, Masten's is regeneratively cooled). Oh, and then there's that whole corporate culture thing - though I suspect it's not all that different....

Ben's reason for leaving Masten had much to do with "the remoteness and isolation of Mojave." But he was given a going-away dinner by a couple of major persons from XCOR, which just shows the collegiality which is also present at the desert Spaceport.

Bigelow Aerospace and ULA Join CSF, Counter Commercial Myths: On June 16th it was announced that Bigelow Aerospace, developer of expandable space station modules, had become an Executive Member of the Commercial Spaceflight Federation, the "CSF" (<http://www.commercialspaceflight.org/?p=1257>).

Less than a week later similar notice came concerning the United Launch Alliance (ULA), builder of the proven Atlas V and Delta IV rockets that could lift commercial human spacecraft to orbit for Bigelow as well as for NASA (<http://www.commercialspaceflight.org/?p=1270>). (The latter resonates with the discussion in the main section of this report of ULA's work with XCOR Aerospace.)

Jeff Greason, President of XCOR, was one of the earliest people to push for what became the CSF. He pointed out that with the 'fishbowl' of attention confronting the new commercial players, it was urgent that the industry begin working formally together on common issues at the earliest possible date.

Proximately, the addition of Bigelow and ULA to the CSF has made it a stronger voice fighting for a "commercial crew" program against the avalanche of hypocritical Hill opposition. That opposition is _*at best*_ based on delusional, "magical negative thinking."

Bob Bigelow addressed this in the June 16th release as follows [all emphases mine],

"... SpaceX's Falcon 9 rocket and Dragon capsule were developed at a cost dramatically below that of traditional cost-plus programs – this should be a wakeup call that it's time for a new way of doing business. ***We are becoming a member of the Commercial Spaceflight Federation at this time to join with like-minded organizations, who want to see America be able to compete again in the global space launch marketplace, and push back against the pernicious misconceptions that are being perpetuated to harm the Administration's commercial crew initiative.***

"Specifically, I'm appalled by the condemnation of commercial crew as being somehow less safe than government programs, and the refrain that commercial companies need to prove they can deliver cargo before they deliver crew... [in view of systems such as the Atlas V that have] an extensive record of flawless operations."

Bigelow also commented about the CST-100 capsule being developed at Boeing with Bigelow Aerospace's technical aid, recently helped by their NASA CCDev (Commercial Crew

Development) award of $18 million, see Vol. 5, No. 2 (February 5). He asserted that it, "... will represent the safest, most reliable, and most cost-effective spacecraft ever to fly... [built by] the company that constructed the ISS itself..."

CRuSR's Path Becoming Less Uncertain?: A project of low cost but high importance for the next few years is CRuSR, the "Commercial Re-usable Suborbital Research Program" (see Vol. 5, No. 3, March 8). NASA would purchase payload flight opportunities on the new reusable suborbitals, demonstrating and using their unique capabilities for fast, repeatable access to space and to gain information in a spectrum of scientific and engineering areas. This would also aid in the creation of standardized payload procedures for the new vehicles. **Fundamentally, CRuSR could represent an "Air Mail Act" for the suborbitals.**

Proposed funding starting in 2011 is $15 million/year for five years.

Using the smaller 2010 funding, NASA has just issued a "Request for Quotation" (RFQ) for flight services under CRuSR (<http://prod.nais.nasa.gov/cgi-bin/eps/synopsis.cgi?acqid=141780>). As indicated by the fast response date (by July 9th) for the RFQ, there could soon be low altitude 'pathfinder' flights - perhaps by Armadillo, Masten or Blue Origin.

Some time ago I was distressed to hear that the future of CRuSR might be undermined by the contorted maneuverings within the Agency about the overall budget. **While nothing is certain, recent indicators are far more encouraging, and one hopes that CRuSR is soon solidly established for coming years.**

Moving Teachers In Space (TIS) to AST?: In my June 1st issue I noted the proposed funding authorization for, "The Jean Hixson National Teachers in Space Act," providing matching funds to train and pay for classroom teachers to fly in suborbital vehicles. That draft Act assumed that the program would be under the supervision of NASA.

However, TIS project head Ed Wright tells me that it recently became clear that there was a great deal of interest in the project at the Office of Commercial Space Transportation (FAA/AST). There was also much greater concern at NASA about taking on this new program than was earlier evident.

So in the latest draft of the Act, the program and its primary funding is under the FAA's Associate Administrator for AST. NASA's role would be, "provid[ing] support to qualified Teachers in Space organizations for the development of astronaut-teacher training programs...through the NASA Innovative Partnerships Program."

National Space Policy at Loggerheads?: I dedicated a whole section of Vol. 5, No. 8 (June 1) to what I called "Revolution and Resistance," regarding the FY 2011 budget proposals. My focus there was on internal NASA resistance, but that battle may be only a sideshow to the ferocious conflict involving Gen. Bolden, the Congress and the existing Constellation contractors. The pitch of that clash has seemed to climb higher each week.

Or in shorthand, all sides have "gone nuclear."

From my perspective, Mr. Bolden and the Administration have made significant and costly concessions to the pork-masters on the Hill. But space activist Ed Wright commented after a recent visit there that the perspective of many Congressional aides is, "'There's no leadership over at NASA... no one there is willing to compromise at all.' The Orion rescue vehicle, heavy-lift research, etc. don't count as compromises, of course -- 'compromise' is defined to mean getting everything they want [back, back]."

Something of a dismal consensus opinion has bubbled in various places. This holds that as far as the eye can see - i.e. through the fall election, a 'continuing resolution' budget, and for an undefinable period beyond - we might end up with only the following basic elements of a "policy":

-- Constellation dead (and from my view, good riddance);

-- A shuttle derived heavy lifter program, vastly expensive and only useful as pork;
-- Most or all of the Administration's proposed projects for sustainable human exploration wiped out;
-- Thanks to the successful Falcon 9 first flight, a grudging, very slowly paced program nominally aiming at commercial crew transport. The lunatic explanation is that it would take years for the private sector to reach NASA standards for human safety; the reality is that consciously and not, that's in effect a cover for insisting upon the same levels of cost, a 'standing army' and associated pork.

Call the above prognostication the ironic flip side of my optimism below about growing recognition of the high competence demonstrated daily by the New Space industry. **The Commercial Space Federation has joined the battle as energetically as possible - as only partly indicated by earlier items here. We should all add our voices and abilities as we can.**

Rick Homans Retakes Reins as Spaceport America Director: As discussed previously (Vol. 5, No. 7, May 17), Spaceport America director Steve Landeene had to depart in April under unfortunate circumstances after overseeing the facility's evolution from a set of plans to rapidly progressing facts on the ground. (See these early June photos from the site, <http://www.spaceportamerica.com/construction/construction-status.html>; a "hard-hat tour" is also available.)

On June 15th Governor Richardson's office announced that Rick Homans would be Landeene's replacement, taking the full-time reins as Executive Director of the New Mexico Spaceport Authority (NMSA), <http://www.governor.state.nm.us/press.php?id=1620>. Homans had most recently been the state's Secretary of Taxation and Revenue. He was the first leader of the NMSA from 2005-7, most of that time also serving as Secretary of Economic Development. His work with Richardson was instrumental in bringing the Spaceport project to the state (e.g., <http://www.spaceportamerica.com/news/press-releases/81-richardson-announces-100mill.html>). As the Governor noted in the June 15th release, Homans is coming back to the project just as the facility transitions from its major construction phase to being an operating facility.

To everyone who has and is contributing to this accomplishment I wish all the best.

'Shameless Plug' to Rick Homans - I flag FYI a project that has had significant contact with the NMSA in your absence from the Authority. This is the StarPort Cafe space simulation center developed by MindSpace Multimedia, which includes such luminaries as Douglas Trumbull and Dan Curry (Vol. 4, No. 2, February 1, 2009). **Recently it has made significant progress. Please Contact David Beaver at david@starportcafe.com.**

Ikaros Solar Sail Fully Deployed!: Following up on an item in Vol. 5, No. 8 (June 1) on solar sail technology, congratulations to the Japan Aerospace Exploration Agency (JAXA) on the June 10th completed deployment of their "IKAROS" sail. Cameras confirmed the sail's extension, while power was measured coming from affixed sections of thin film solar cells (<http://www.jaxa.jp/press/2010/06/20100611_ikaros_e.html>). The diagrams there also show a feature that I'd never seen proposed before; liquid crystal arrays with controllable reflectivity for adjusting the sail's attitude (i.e. angle to the sun) and thus trajectory. 'Traditional' designs envisioned using small, tilting sections of sail material mounted on the ends of the support booms for this purpose.

On June 15th, JAXA released two tiny cameras from the central "spool" of the craft that. as they receded away. relayed back photos of the entire sail. This posting from the Planetary Society includes an "animation" sequence of 32 frames those cameras (<http://www.planetary.org/blog/article/00002552/>).

Dear Acquaintances,

- New Space Competence: XCOR's Partnership with ULA -

Demonstrating Competence - A Building Wave

Why not catch one 'big wave' demonstration of New Space competence to help propel the announcement of another? Coincidence or no, just a few days after the successful first test flight of Falcon 9, XCOR and the United Launch Alliance (ULA) issued a press release on their collaboration over the past several months. **This is aimed at possible application of XCOR's groundbreaking piston-pump technology to the new cryogenic upper stage propulsion systems planned by ULA** (<http://www.xcor.com/press-releases/2010/10-06-08_ULA_and_XCOR_announce_successful_hydrogen_pumping_tests.html>).

Back at Space Access 2010 (SA'10), Jeff Greason alluded to tests of pumping liquid hydrogen (LH2) using an XCOR piston pump. From that it wasn't hard to deduce (hinted at in Vol. 5, No. 6, April 30, 2010) that they were working with ULA on a successor to that company's current upper stage engines. But I was asked not to say this publicly at the time.

The June 8th press release stated in part that [all emphases mine],

"...After XCOR performed risk reduction and demonstration projects in 2009 that validated high performance cryogenic (liquid oxygen and liquid nitrogen) piston pump operations, ULA asked XCOR if the pump technology could be extended to liquid hydrogen. ***Implementing rapid prototyping techniques and working on a fixed price basis, XCOR developed a single piston work-horse test article and test bench, and then successfully tested the pump with hydrogen in less than four months.*** *Based on this success, ULA and XCOR have begun the next phase of the project to further mature the technology.*

"... the tests... demonstrated successive rounds of pumping liquid hydrogen at conditions relevant to a flight type multi-cylinder pump. ***Possible applications include pump-fed liquid hydrogen rocket engines for upper stages, on-orbit propellant transfer operations, and other cryogenic fluid management applications. A unique capability demonstrated during the tests was the ability to pump through cavitation events*** *when liquid hydrogen returned to partial gaseous form, a sign of robustness of the design to handle anomalous events that would cause other high performance pump schemes to cease operations.*

"[Quoting a ULA official,] 'XCOR has demonstrated the beginnings of an important technology development path that ***has the promise to significantly improve the competitiveness of future ULA launch vehicles.'"***

Aims and Details of the Collaboration

For more about the two companies' work I contacted Bernard Kutter, manager of advanced programs for ULA. He previously helped clarify some of the discussion at the SA'10 Propellant Depots Panel, including details of the proposed CRYOTE test of zero-g cryogenic transfer and management (see again the April 30th issue of this year).

The paper at <http://www.ulalaunch.com/site/docs/publications/ULA-Innovation-March-2010.pdf> indicates that ULA's ultimate aim is an "Advanced Common Evolved Stage" ('ACES') to replace both the Centaur (used with the Atlas V) and the Delta Cryogenic Second Stage ('DCSS') Each of these uses an updated version of the venerable RL-10 LH2/LOX engine, the RL-10A-3-2 for the Centaur, the RL-10B-2 for the DCSS.

Two major products of present ULA propulsion/fluids work would be part of ACES, and either alone or both together could be adapted to the present Centaur or DCSS. One is a low cost, cryogenic engine in the 25,000 lb thrust range to replace the RL-10s. The other is the Integrated Vehicle Fluids (IVF) system. The latter eliminates all but the main propulsion fluids for all stage functions, cutting out helium presently used for initial propellant pressurization, some purges and valve actuation functions. It would also enable replacing present maneuvering jets (for the Reaction Control System, RCS) that use hydrazine with ones using gaseous hydrogen and oxygen.

Eliminating extra gases and fluids not only simplifies the vehicle and allows significant dry mass reductions but opens the door for individual adapted stages to fully refuel from LH2/LOX storage depots and carry out a series of missions over an extended period.

Development of the IVF and the large, lower cost engine is paced by several technological readiness milestones as well as by cost. Both the large engine and the new RCS thrusters could end up using XCOR's piston pumps. **Kutter said that XCOR had passed, "with flying colors" the effort to adapt these for LH2, already greatly increasing their readiness rating.** As has been previously discussed here, the main factor in adapting such pumps for cryogenic fluids involves replacing materials rather than design changes. This was so in transitioning from using only a kerosene fuel pump on XCOR's X-Racer engine (<http://www.xcor.com/products/engines/4K14_LOX-kerosene_rocket_engine.html>) to the Lynx's main engines (XR-5K18s) that also have a piston pump replacing helium pressurization of LOX. Tests of that cryogen pump started out cautiously, using nitrogen, then transitioned to LOX as confidence grew.

Analogously, the much lower temperature LH2 required other materials changes in the pump, and ULA used their experience with that operating regime to assist the adaptation. **Kutter made clear that in the development of the new engines XCOR would be a full partner.** As company COO Andrew Nelson said, XCOR is a general rocket propulsion supplier, and in the case of the ULA engines they would provide as much of the engine and as much expertise as can be useful.

Kutter's hope is that the new large engine will be flight-ready in 2015 and that it could fly sometime in 2016.

Working Together, the Supplier Shortage and New Space Market Credibility

In the joint press release, Nelson asserted that the work with ULA, "... is a demonstration of how a large and established aerospace company can effectively work with smaller, innovative New Space companies to improve the prime contractor's product lines ... We are very pleased and fortunate to have such a good long term partner..." Kutter underscored to me that a properly managed collaboration between such different firms could provide rapid and useful results.

In Vol. 5, No. 6, I noted that Jeff Greason had opined "that the US industrial base for launch systems had decayed to a 'frightening' extent." He discovered the degree of that decline from access to industry documents while serving on the Augustine panel. Others - in the Pentagon and beyond - have raised the alarm about the eroding list of US launch system suppliers, primarily a result of the excessive export controls on space technology under the present ITAR regime. These have backfired, stimulating development of increased overseas capabilities. See, e.g., a recent report by the Center for Strategic and International Studies; see p. 9, item (D.3), "Fragile U.S. launch industrial base" in <http://csis.org/files/publication/100430_berteau_commercial_space.pdf>.

Thus it is apt that Nelson's remarks included the assertion that the ULA/XCOR work also demonstrates how New Space companies can, "... [help] restore the second and third tier aerospace supplier base our country has lost over the last twenty years."

XCOR and SpaceX are based in California, ULA is now building both Atlas and Delta rockets in Decatur, Alabama, and that's where it would be assembling boosters for commercial crew launch systems for customers such as Bigelow as well as for NASA. **I ask: _*when*_ will the politicians from those states and others realize that New Space - spurred cost reductions, innovations and consequent market expansion are a winning ticket of unlimited opportunities for new jobs?**

- New Space Competence: The Aftermath of Falcon 9's First Test -

Flight Notes

On June 4th, 7th and 18th, SpaceX posted "photo updates" from the first flight test, including stills from the on-board camera. These are particularly dramatic in showing the milestones of stage separation and beyond (<http://www.spacex.com/F9-001.php>). (***NOTE:*** By accident the initial June 4th photo and posting is out of order with the June 7th photos.)

You may recall that in my June 4th issue, I said that the accomplishments of the first flight, "d[id]'t mean that all will be perfection with this vehicle from this point forward; it's most often by finding mistakes that we learn." **During a June 16th press telecon (for the announcement of their contract as primary launch provider for the "Iridium-Next" satellites, see below), Elon Musk expressed similar prudence.** He commented that he was a bit concerned that the first flight had gone _*too well*_, saying that before the next Falcon 9 launch they would closely examine flight data for "near misses" of problems. (My appreciation to Rand Simberg of Transterrestrial Musings for posting a summary of this telecon at <http://www.transterrestrial.com/?p=27574>.)

As mentioned on June 4th, the vehicle rolled a bit while under second stage power. At the June 16th telecon Musk indicated that though this was still under evaluation it had probably been due to an anomaly with the roll control actuator. **Earlier, Musk had told "Space News" that the roll was so minor that it wouldn't have affected a delivery flight to the International Space Station (ISS) by a 'Dragon' capsule** (see <http://www.spacenews.com/venture_space/100611-spacex-drop-dragon-flight.html>, June 11th).

Both Rand and I noted a slight roll of the the _*first stage*_ immediately after liftoff. In a Popular Mechanics article he said that SpaceX had attributed this to, "... an initial torque bias by exhaust from the gas generators of the engines and the spiral windings of the nozzles, [that] will

be tuned out in future flights." (See <http://www.popularmechanics.com/science/space/rockets/spacex-falcon9-first-flight>).

It'd been hoped that the first stage could be recovered intact as part of the long term plan to develop reusability (it carried parachutes). **It instead broke up on entry, but it should be noted that the company's _*current*_ pricing does not depend on an assumption of reusability. That pricing itself easily beats all present competitors.**

Musk told Space News that while SpaceX plans an initial report on the first flight by the end of June, he wasn't sure that it would be made public. "There's not much point in releasing something that's just fodder for our competitors who will stop at nothing to kill us," he said.

Changing COTS Test Flight Plans

The next flight of the Falcon will be the initial mission under the NASA COTS experiments, and Musk now expects it in August. It will be a short (5 hour) tryout for the first active Dragon capsule, testing out basic functionality in orbit, followed by a return to Earth protected by its heat shield and using parachutes on a descent to a water landing.

The Falcon 9's first flight also led Musk to discuss his desire to make the _*second*_ COTS mission a full-up demonstration of rendezvous, docking and cargo transfer to and from the ISS. Previously, the Dragon capsule had been slated to come to only within about 10 km of the station while the telemetry to - and command capability from - the ISS was demonstrated. Under Musk's proposed revision, the planned third COTS test would occur only in case of difficulties with the second. I hear that this modification of plans has been under discussion with NASA for some time.

Recent reports stated that there would be about an eight month span between the first and second COTS test flights - a delay, as noted in that June 11th Space News item. There, Alan Lindenmoyer, head of the office in charge of COTS, attributed the change partly to extra time and resources (fundamentally workforce time) that SpaceX had applied to improve likelihood of a successful first flight of Falcon 9. Musk attributed the delay to the physical and avionics/software modifications required to add an ISS docking capability to the second COTS flight's Dragon. I understand that both are contributing factors.

In response to a question at the postflight press conference on June 4th, Musk noted that in addition to the over $2 billion in revenue that the company has on contract, he expected that the successful first flight would prompt entirely new deals as well as announcements of others hitherto not official. **That certainly proved itself rapidly, presenting a dramatic vote of confidence in a company spearheading New Space capabilities and competence.**

Additions to the SpaceX Manifest, Large and Small

In accord with a previous statement by SpaceX President Gwynne Shotwell, Musk told the June 16th press telecon that he expected a backlog of forty flights on the manifest by the end of the year.

At the small end of the scale, on June 14th a contract with Taiwan's national space organization, 'NSPO,' was announced for launch of the earth observation satellite Formosat-5

from Kwajalein Atoll "as early as December 2013" (<http://www.spacex.com/press.php?page=20100614>). That would use the Falcon 1e booster, a stretched and upgraded Falcon 1.

At the other end of the scale, in mid-May it was reported that Iridium had been talking with SpaceX about launching the replacement "Iridium Next" constellation of satellites on Falcon 9. At that time certain "industry officials" said that while SpaceX's, "prices [were] substantially lower than the competition," the company needed to prove that they could, "...meet the requirements of a commercial program like Iridium," (<http://www.spacenews.com/contracts/100513-downpayment-iridiumnext-launches.html>).

On June 16th, Iridium resoundingly stated their belief that SpaceX is up to such requirements, designating the Falcon 9 the primary launch system for Iridium Next and saying that (<http://www.spacex.com/press.php?page=20100616>),

"Hands down, SpaceX offered us the best value coupled with an unwavering commitment to flawless performance and reliability. SpaceX has combined the best of aerospace and commercial best practices to design reliable and cost-effective access to space..." [My emphases]

To be fair, Iridium also indicated their confidence that SpaceX would "cement" their track record in, "...24 Falcon 9 flights scheduled ahead of us... during the coming five years," i.e., before the anticipated Iridium launch campaign of 2015-17. A secondary launch provider will also be chosen.

The total value of the contract is $492 million, out of a $2.9 billion project cost for the new Iridium system of satellites and associated equipment. Though the precise orbital parameters were not stated, the first Iridium satellites are in near-polar (86.4 degree) inclination orbits distributed over six orbital planes at about 780 km altitude. The high inclination orbits require that SpaceX launch the Falcon 9s from Vandenberg AFB in California.

Musk added other details at the June 16th telecon. The SLC-4 pad at Vandenberg will require some $40-50 million to modify as a Falcon 9 facility. The total contract price includes developing a "dispenser" system to release multiple satellites per flight. While Musk didn't touch on the point, an article the following day quoted "industry officials" that each flight could carry nine satellites out of a total of 72 to be launched - i.e. as many as eight Falcon 9s < http://www.spacenews.com/launch/100617-spacex-undercut-competition-clinch-492m-iridium-deal.html>. The first generation Iridium uses 66 active satellites at any one time, so assuming again six orbital planes and the same operating scheme that would leave one spare in each orbit.

Correcting Misinformation

Among all the positive - if from some quarters, grudging - comments and reportage upon the Falcon 9's successful flight, a Wall Street Journal story puzzled many for its errors - which for a while threatened 'go viral' on the web. I cite here two statements:

Statement A: That the Launch Escape System (LES) for a Dragon capsule to carry humans would require a billion dollars to develop.

Correction to Statement A: **To start with, this is about twice what SpaceX has spent on _*everything*_ it has done to date.** The most comprehensive response was posted by Rand Simberg at <http://www.transterrestrial.com/?p=27458>. **Elon Musk told him that,**

"I definitely didn't tell [writer Andy] Pasztor that our LES would cost $1B. He is off by a factor of ten! *All I told him is that there is no way it would cost us more than $1B to demonstrate crew transport. That includes development, testing and certification to the most stringent NASA standards of everything needed for a seven-crew vehicle."*

Rand added that in a follow-on note Elon had specified that the "stringent" testing included, "two abort flight tests (one on the pad, one high altitude) and a demonstration flight to and from ISS."

Statement B: It was asserted that SpaceX was in need of as much as $1 billion just in the next year or two to be able to do "commercial crew" later in the decade. Paired with this was the statement that, "...while Mr. Musk tapped his own fortune for some $100 million of [past investment], U.S. taxpayers are the most likely source of future assistance."

Correction to Statement B: First, the very assertion of "... $1billion just in the next year or two ..." doesn't make sense in _*anyone's*_ commercial crew program parameters.

Then, the darker implications of 'Statement B' were thoroughly refuted by Musk and others in a June 8th article by Connie Loizos at "PEHub," a publication for the private equity community (<http://www.pehub.com/73752/elon-musk-weighs-in-on-wsj-piece-and-future-of-spacex/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+pehub%2Fblog+%28PE+HUB+Blog%29&utm_content=My+Yahoo>).

SpaceX has been profitable for several years (i.e., well before the Falcon 9 success or the Iridium deal) and Musk told Loizos that,

"SpaceX has over $2.5B in revenue under contract. Accounting rules require that revenue for long term contracts (over 2 years) be recognized as costs are incurred or milestones passed. ***For the past three years, revenue has exceeded cost on that basis and we expect that to continue into the future."***

My own irritation with 'Statement B' was amplified by the article's use of pejorative language: "back-door bailout," which was attributed to "some critics" concerning the supposed tab to taxpayers. Musk also said that,

"We don't anticipate needing to bring on additional investors and will not be conducting any equity financing rounds, although it is possible we may accept investment for strategic reasons... Also, under no circumstances would SpaceX be seeking a financing round from the taxpayers. That doesn't make any sense." [My emphases in both sets of quotes.]

Note: I have been acquainted with Andy Pasztor for more than a decade and don't doubt the sincerity of his work. But in recent times he has appeared increasingly trapped in a cycle of "Old Space"- influenced negativity. That may be a reason for the mistakes in the Journal item.

SpaceX, Dragon, and Beyond

Of course SpaceX would compete for a "commercial crew" test program and subsequent services for NASA, but as Musk has recently emphasized, his aims for the company - and that of potential as well as existing investors - also encompass a dedication to the ideal of opening spaceflight to humanity. **As he stated at the June 4th press conference, even if NASA's commercial crew program were not funded, work on a crew-capable Dragon would continue, though it would take perhaps twice as long (six years).**

Instead of the "traditional," tower-mounted system thrown away during each ascent, the Dragon's escape system would use liquid propellant motors integral to the capsule. So it would be available during the entire launch and flight. In particular, on normal flights it could provide enough upward thrust just before touchdown to allow parachuting onto land.

In response to Simberg's June 16th telecon question, Musk expressed determination to eventually achieve Falcon reusability and associated cost reductions that was, "adamant and vehement ... It was almost Churchillian ..." (<http://www.transterrestrial.com/?p=27608#comments>). Musk even said that if he doesn't achieve it, he will consider the company to have failed - no matter how big a player it becomes.

- Conclusion: XCOR, SpaceX and A New Space "Phase Change" -

No New Space company is guaranteed to be a success, whether in the short or the long term, or with each and every attempted achievement. But as long as economic and regulatory circumstances allow entrepreneurs (and enough of them) to try, our hopes for practical spaceflight can stay alive.

In this issue of "The Lurio Report" I have noted milestones reached by two companies at different scales. While SpaceX's Falcon 9 achievement has been more dramatic and rightfully celebrated, XCOR's work testifies just as forcefully to the same points.

Some of us have long spoken of the high competence and innovation being demonstrated on the New Space path. The circle aware of that potential has suddenly widened. Dare we hope that we are on the threshold of a "phase change" when many perceptions and actions concerning spaceflight can quickly shift? Given the amount of leftover mental baggage as well as the embedded interests of the politicians and NASA 'mandarins,' that may yet be too great a hope beyond limited areas.

But we _*can*_ believe that the grounding for such a wholesale shift has just become a lot more solid indeed.

Yours very truly,

Charles A. Lurio, Ph.D.

The Lurio Report - News and Analysis of the 'New Space' Enterprise
Winner of the 2009 Space Frontier Foundation Award for NewSpace Journalism!
(<www.thelurioreport.com>)
Charles A. Lurio, Ph.D., Writer/Publisher
charleslurio@thelurioreport.com
services@thelurioreport.com (subscription queries)
617.480.0755 Business, Cell & Voicemail