

The Lurio Report

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News and Analysis of the 'New Space' Enterprise

"Your newsletter is a great source of information with excellent topics and perceptive analysis."
-- Steve Landeene, Executive Director, New Mexico Spaceport Authority

"Thanks...for the great work you do with your newsletter keeping us up to date on private enterprise in space."
-- John Tierney, Columnist, "The New York Times"

Abundant Year-End Milestones Mark the Progress of New Space

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Forthcoming Meeting:

12th FAA Commercial Space Transportation Conference: This highly regarded annual meeting is taking place February 5-6 at the Crystal Gateway Marriot in Arlington, VA. I'm hoping to attend. (For press, basic entry is free, but they must pay for the luncheon and reception. Data for press entry is not on the conference web pages, but I can direct anyone interested to the best contacts.)

The conference this year is cosponsored by the American Institute of Aeronautics and Astronautics (AIAA) and there's been some concern about the increase in registration prices of several hundred dollars. Program and registration information is available at <http://www.aiaa.org/events/faa/08-0633%20FAA%20Prelim%2009.pdf>. Among topics: enabling technologies for new vehicles; business issues; spaceports; emerging markets; safety questions.

>Please note that the price of registration goes up in all (non-press) categories by \$100 after January 5th; similarly, the block of rooms set aside for attendees is only being held until that date.<

Dear Acquaintances,

- Year-End Milestones -

Introduction

In these last weeks of 2008 the pace of milestone events in New Space has, if anything, accelerated. **This year-end issue focusses on some of those major milestones and adds some “Lurio Report” exclusives.**

Virgin Galactic Item 1 - WhiteKnightTwo Flies!

After a bevy of powered and unpowered ground tests (and a near-delay caused by *_snow_* in Mojave), the future carrier aircraft of the SpaceShipTwo commercial suborbital vehicle, Scaled Composites' WhiteKnightTwo, took off on a first flight starting at about 8:17 am local time on December 21st (<<http://www.space.com/missionlaunches/081221-whiteknighttwo-test.html>>).

An article by Rob Coppinger at FlightGlobal.com stated that during the one hour flight, the vehicle reached an altitude of 16,000 ft, some 4000 ft above the original test plan. Virgin Galactic President Will Whitehorn declared, “...That is how confident we are about the aircraft. Now we have to download all the data. There will be another flight early in the new year”

See Coppinger's report and a flight video at <<http://www.flightglobal.com/articles/2008/12/21/320386/world-exclusive-video-spaceshiptwos-mothership-maiden.html>>; supplementary videos that include takeoff and landing are at his blog, <<http://www.flightglobal.com/blogs/hyperbola/2008/12/world-exclusive-video-whitekni.html>>.

My congratulations to all connected with this landmark achievement.

Stu Witt, manager of the Mojave Air and Spaceport (and a friend of “The Lurio Report”), reflected on the flight, saying (see the space.com report above), “When everybody's looking for a bailout, there are still people that are doing something for a much larger reason.”

He spoke with some awe, but with a punch, “And here we are on a Sunday morning...in a place out here in the middle of nowhere and really neat stuff is happening. It just looked beautiful ...What brings people to this desolate landscape on a Sunday morning in December [tells of] what forced them here. Innovation by the private sector is [filling a void] because NASA deserted 90 percent of the sandbox and left it open for us to fill.”

One hears murmurs of change at NASA that may result from the political transformation in DC. Let's hope that the Agency will start to be an increasingly aggressive enabler - and thus beneficiary - of the work being done by the entire New Space enterprise.

Virgin Galactic Item 2 - SpaceDev's Successful Nitrous Oxide Test for SpaceShipTwo

Apropos to the news above, I've now heard from two sources that SpaceDev, Inc., based near San Diego, recently ran a nitrous oxide flow test. This is in accord with its August agreement with Scaled Composites to work on the hybrid rocket propulsion system for SpaceShipTwo.

While one source had heard there'd been problems with this test, the other - which is much closer to the Virgin Galactic effort - told me that things had gone well, saying also that I must have had a good contact to know of the test at all. That same source added that components of SpaceShipTwo were "coming together." Still, as has been reported, the first 'captive carry' tests of SpaceShipTwo attached to the White Knight won't occur before the second half of 2009.

It was, of course, a nitrous oxide flow test in Mojave that resulted in the tragic fatalities of July 2007.

Reports From Human - Tended Suborbital Science Workshop

At the end of one of my "Quick Updates" of Vol. 3, No. 23, I noted the then-immanent meeting that took place the afternoon of December 15th in San Francisco. It intentionally coincided with the fall gathering there of the American Geophysical Union. This Workshop brought together for the first time possible users of the new suborbital flight vehicles for science and engineering applications and the prospective vehicle manufacturers/service providers.

The meeting intentionally excluded the press to allow freer exchanges between the two groups. One attendee told me that about a hundred people showed up.

Dr. John Karcz of NASA's Ames Research Center, who spearheads the Agency's present efforts in the area, told me that the meeting went well. Also, he noted that on December 5th applications had been submitted to NASA's Science Mission Directorate (SMD) for selection of probably eight studies of where SMD research could benefit from the suborbital flights. The awards should come within a few months, and areas of interest to the Directorate include astronomy/astrophysics, earth systems, heliophysics, planetary science and astrobiology (<<http://suborbitalex.arc.nasa.gov/node/27>>). That this project is first being funded for and by SMD is something of a historical artifact.

Pete Worden, Director of Ames, clearly wants the Agency to consider using the private suborbital systems *wherever* they may provide desirable, new, and/or lower cost capabilities. Mr. Griffin also recently hinted at a specified funding item for such initiatives in next year's Agency budget.

Suborbital vehicle providers present at the Workshop included not only Armadillo, Virgin Galactic, Masten and XCOR, but also Blue Origin, in keeping with its recent announcement of research opportunities (<<http://public.blueorigin.com/nsresearch.html>>).

XCOR was certainly among the earliest vehicle developers to itself have probed researcher interest in using the new suborbital systems. Despite favorable reactions, the unfamiliarity of the concept dampened concrete responses. But just the prospect of NASA looking seriously at the matter may have started to turn things around. **XCOR CEO Jeff Greason told me that he felt a "critical threshold" of serious interest from researchers may have been met at the San Francisco conclave.** He said that these persons are starting to see the new suborbitals as not just a *different* way of doing certain kinds of experiments, but as a *better* way, and one providing opportunities never before available.

XCOR Lynx Engine Test - A Lesson in Incremental Development

As expected, not long after the December 2nd press conference with their ticket marketing partner (RocketShip Tours, <www.RocketShipTours.com>), XCOR performed the first test firing of the engine to be used on the Lynx suborbital. The firing took place on

December 15th and was reported in a press release dated two days later (<http://www.xcor.com/press-releases/2008/08-12-17_Lynx_engine_first_fire.html>).

The new engine, the '5K15,' draws heavily from the design of the '4K14' successfully flown on XCOR's version of the Rocket Racer. The primary difference is that the earlier system used a (company-developed) reciprocating pump only on the kerosene fuel line, with the liquid oxygen (LOX) supply fed by helium pressurization. The 5K15 adds a cryogenic version of the pump on the LOX line to the one pumping fuel.

This is familiar territory, since the company built and tested a LOX pump with cryogen seals in earlier work for the DoD's DARPA (<<http://www.xcor.com/products/pumps/>>). The net result of having the LOX pump will be to approximately double the thrust attainable in the 5K15 versus the very similar Racer engine: from 1500 lbs to 2500-2900 lbs.

This first test of the Lynx motor was emblematic of the incremental development and testing by which XCOR has acquired an enviable record of reliable rocketry. It was performed using pressure-fed propellants on *both* the propellant lines. **Thus it isolated the thrust chamber systems - thermal, structural and so on - for checkout before going any further. More caution was exercised by keeping peak thrust levels a bit under 80% of expected performance (thanks to Doug Graham at XCOR for this additional detail).**

Armadillo (and Others) To Benefit from New Amateur Rocketry Rules

What seem to be small changes from an unexpected direction can have a big effect. This is evidently the case for the recently revised amateur rocketry rules issued by the FAA. (See discussion by Henry Spencer in his New Scientist column of December 9th, <<http://www.newscientist.com/blogs/shortsharpscience/2008/12/rocketeers-cleared-for-lift-of.html>>).

Long overdue revisions for such systems (by definition unmanned) include a specific altitude limit (150 km) and one on the total impulse (energy) that the propulsion system can apply (i.e. average thrust multiplied by time). But the previous 15 second engine burn time limit has been eliminated. That limit effectively excluded almost all liquid fueled rockets, which fundamentally are lower thrust systems than solid motors can be.

As Henry says, "The main importance of this for the entrepreneurial space community ... [is that] many small rocket vehicles qualify as amateur rockets, at least for early development testing. (For example, many designs for the Lunar Lander Challenge would qualify, although perhaps not with their tanks completely full.)"

The change is having an immediately positive impact over at Armadillo Aerospace, where they will be able to get in a lot more flight time a lot more conveniently as they work toward high altitude systems. The impulse limit will restrict maximum altitude, but the bulk of essential experience needed on a given configuration - for controlling extended vertical flight up or down as well as for takeoff and landing - can be acquired under the amateur rocket rules. Carmack says in his December update (all emphases his),

"We are planning on starting higher altitude flights at our home base in February, as soon as the brand new amateur rocket regulations go into effect. We should be able to fly to 8000[ft] altitude right behind our shop, which is going to be a HUGE benefit for us. We can learn a lot...[in] a new flight regime...without having to make long road trips [to the Oklahoma Spaceport]."

The rest of the posting demonstrates yet again that while there's nothing 'magically' difficult about rocketry, it can still involve a whole heck of a lot of detailed work to puzzle out problems. Recall that improper propellant flows led to a burn-through of the Pixel vehicle's film-cooled combustion chamber at the Level 2 Lunar Lander Challenge attempt in October. It seems that the problem was caused by relay signal interruptions triggered by acoustic vibrations. Carmack surmises that their Rocket Racer engine never had the problem because in that case the electronics box is much further away - in the cockpit.

New Mexico Spaceport Licensed, Agreements With Virgin, Spaceport After Richardson

Spaceport America is now really a spaceport - albeit one needing considerable construction work.

In a December 15th news release, the New Mexico Spaceport Authority (NMSA) announced that the license had been awarded by the FAA's Office of Commercial Space Transportation (FAA/AST), simultaneously with a 'Record of Decision' on the Environmental Impact Statement, the 'EIS' (<<http://spaceportamerica.com/news/press-releases/18-spaceport-press-articles/185-faa-issues-launch-site-operators-license-for-spaceportamerica.html>>).

Work on the EIS (with some bumps along the way) had been going on for some time; meanwhile, after iterative discussions, the license application had been formally submitted at the end of June 2008. That started the 180 day 'clock' allotted for approval. As hoped for and expected by the NMSA, the required EIS approval and the license award then dovetailed before the end of the year.

The license announcement was followed three days later by the selection of Gerald Martin Construction Management of Albuquerque, which, "...will represent the NMSA in all aspects of design team and contractor integration, quality control, value engineering, scheduling and budget management," (<<http://spaceportamerica.com/news/press-releases/18-spaceport-press-articles/188-construction-management-firm-named-for-spaceportamerica.html>>). Their responsibilities cover both the architecture/engineering work of Foster + Partners for the terminal and hangar, and that of DMJM Aviation for the runway and associated facilities.

Work at the site is expected to start in the first quarter of 2009. Meanwhile, construction of the access road is proceeding at a rapid clip: go to the Spaceport America home page (<<http://www.spaceportamerica.com>>) and click on the third dot down on the right side of the main box. You'll see a still photo of the road and can click as directed for a recent report on it by a local television station.

NMSA Director Landeene updated me on the status of the two agreements between the NMSA and Virgin Galactic (last noted in Vol. 3, No. 22, November 20, 2008). The 'development terms and conditions' document is complete and could be signed any day; the leasing agreement (which includes matters such as user fee structures) is a hair's -breadth away from completion. Landeene predicted that it would be signed on December 31st.

With Governor Richardson moving to Washington to join the new Administration, I asked Landeene if that might affect the politics of the Spaceport within the state. He responded that Lt. Governor Diane Denish (who will take over as Governor) has been a 'ex officio' member of the spaceport board, and cited a case demonstrating her strong public advocacy for the project. Landeene also said he was very hopeful about Richardson's becoming the strong advocate for commercial space in DC that he's promised to be. (Perhaps *neither* response would be unexpected given the Director's position, but Landeene has always struck me as being as straightforward as circumstances allow.)

ISS Cargo Transport Awards

On Tuesday, December 23rd NASA may finally have taken a long overdue and momentous step: putting competitive, fixed price commercial services in the ‘critical path’ of one of its major programs.

Many of us have been preaching this for years. Outstanding credit is due to the Space Frontier Foundation’s persistence on the issue; see their “Victory!” statement at <http://spacefrontier.org/blog/sff-news/2008/12/23/nasa-announces-commercial-iss-cargo-winners-space-frontier-foundation-decla>).

NASA stated explicitly that operation of a fully functional International Space Station (ISS) will be contingent upon commercial resupply services. Bill Gerstenmaier (Associate Administrator for Space Operations) took this change a step further, not only refusing to acknowledge a government-guaranteed backup plan, but stating outright that such backups have, in the past, only undercut the chance for developing commercial capabilities.

Big congratulations are due to SpaceX and to Orbital Sciences, the winners of contracts to provide pressurized and unpressurized cargo services (including return cargo deliveries) for ISS in the period 2010 through 2016. Respectively, SpaceX would be paid \$1.6 billion for 12 flights and Orbital \$1.9 billion for 8 flights. This is based on what Gerstenmaier called currently projected needs, but the potential value of *each* contract could go as high as \$3.1 billion.

First flights in the series would respectively be in December 2010 by SpaceX, and in October 2011 by Orbital.

Starting with a small down payment, the companies will be compensated in increments contingent on reviews and milestones reached. Final payment for each flight comes with completion. (I have often called for a broad shift from ‘cost-plus’ to incremental but fixed price contracting.) Responding to repeated questions from reporters about ‘backup’ to commercial suppliers, Gerstenmaier stated that, first, the two selected companies were to a degree each others’ backups; second, that an “onramp” remains open for other commercial suppliers. **Failing these provisions, NASA and station users would just have to live with the consequences - a position I cheer.** The station would have to operate for some period with minimal personnel and little experimental work being performed.

Answering questions about why the December awards could not have waited for proof-flights under the separate COTS program, Gerstenmaier said that that would not have allowed enough time for the supply systems to be ready when needed.

What if shuttle operations were extended? Gerstenmaier insisted that in that case the Agency would not go back on the new supply contracts and that added shuttle flights would transport “extra” items. **But, realistically, would the private supply contracts *really* be invulnerable under a budget saddled with the massive cost of continued shuttle operations?**

Late on December 23rd, the Orlando Sentinel noted that Mr. Griffin had told them in September that, “The space station is the customer for [commercial resupply] ... If I continue flying the shuttle, I don't have a commercial market,” (<http://www.orlandosentinel.com/news/space/orl-bk-nasa-gamble-122308,0,5219891.story>). Moreover, within the past few months Gerstenmaier himself has spoken with Japanese and European officials about possibly increasing use of their respective HTV and ATV government - developed supply systems for the ISS (e.g. <http://news.softpedia.com/news/NASA-Has-its-Eye->

on-JAXA-039-s-HTV-90380.shtml>).

This *_might_* provide that ‘back up’ to commercial transport. But the European vehicle is extremely expensive, and it’s possible that flight rate or production capacity might limit either. Meanwhile, the Russians are opportunistically raising prices on their systems and have their own limits. It *_may be_* that the awards made on December 23rd already take into account such limits.

Still, despite the deserved applause for the NASA moves earlier in this section, the question may remain: did a *_real_* new NASA stand up last Tuesday? I certainly want to believe so.

Meanwhile, indicators from the NASA transition team *_could_* portend larger steps, ones putting the commercial/New Space industry in the ‘critical path’ of more major Agency projects and tasks. **An overdue starting point for that that would be to quickly kickoff funding for COTS -D, the demonstration of private *_human_* transport to ISS. Making commercial services part of the core of the NASA human space exploration plan would be even more significant, and is key to lowering the cost of that program to an affordable and sustainable level.**

Conclusions

Over recent issues of this publication, I’ve talked a lot about the great uncertainties that currently face the commercial/New Space scene. The ramifications of the battering taken by the economy, the uncertainties of the policies of a new Administration and Congress, and the consequences of the interactions between these issues have dominated much of my thought.

Still, thinking back over the year, I wonder where that bothersome old thing we used to call the “laugh factor” has gone. Of course skepticism is still around, as well as casual dismissals from those entrenched in ‘Old Space’ redoubts. Yet perceptions overwhelmingly continue to change for the better.

And why not? New Space came along, and in a bold voice has been shouting “Stop! We *_don’t_* want spaceflight to be a black hole for taxpayer dollars. The spirit of entrepreneurship and innovation that sparked so many major industries in the past can do the same for spaceflight. New space markets will both spur and evolve from making the basic skills of spaceflight far less costly and far safer.”

This issue of “The Lurio Report” alone shows New Space reaching major milestones in demonstrating its credibility. Over the past year, the contributors to that proof have included the determination of SpaceX, the commitments and hardware of Virgin Galactic, and the increasingly public results of a revolution in reliable, reusable rocketry being wrought by XCOR.

The game is not yet won. The progress made - and perhaps moreso the perception of that progress - could be severely damaged by the economy, political obtuseness, or a string of technical bad luck. But despite all that, we deserve to look forward with hope.

My best to you all for the year ahead.

Yours very truly,

Charles A. Lurio, Ph.D.

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