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News and Analysis of the 'New Space' Enterprise

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-- John Tierney, Columnist, “The New York Times”

Defying the Economic Tide, Blue Origin, Orbital Outfitters, DC Turmoil

Vol. 3, No. 23, December 12, 2008

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Quick Updates:

Sales Response To XCOR's Lynx: Just before sending out this issue I had a chat with Jules Klar, head of RocketShip Tours, the sales agent for Lynx tickets (see below, and <<http://www.rocketshiptours.com/>> , “888 rstours” or 888.778.6877) on first response after the December 2nd news conference with XCOR.

Main points:

- They're looking for the high net worth adventure travelers who've "done everything," and even if their worth has gone down with the market, this segment of the travel business is still projecting a good response in 2009;
- While RocketShip Tours will sell some tickets itself, its main thrust is to go through the established high-end travel agent market.
- They have already been in personal contact with 126 travel agents in the US about becoming sellers of Lynx tickets and there is "much, and very interesting" interest abroad from agents.
- He believes they have a particular advantage over others selling suborbital tickets working through that network and providing it incentives: a) a 10-15% commission (which I gather is high); b) earlier payments of commissions; c) an insurance policy for the agents for commissions in case of cancellations.

I hear from another source that after following up a media report on the December 2nd XCOR press conference, a person in London who'd intended to buy a ticket to fly on Virgin Galactic's SpaceShipTwo ended up buying one for the Lynx instead. The motivation was the lower price.

Blue Origin Revelations: The folks at Jeff Bezos's "Blue Origin" project who are developing a suborbital vertical takeoff and landing (VTVL) vehicle have briefly popped their heads above ground again - and as quickly disappeared (see item at <http://public.blueorigin.com/nsresearch.html>).

The page is fundamentally an announcement of opportunity for researchers interested in using the microgravity/space environment that will be provided by the project's operational "New Shepard" vehicle. It indicates that automated flights may be available starting in 2011, while experiments requiring an accompanying "researcher astronaut" can start in 2012. If reflective of the overall program, this represents about two years of slippage in human flight operations from previous information.

The data summary confirms earlier information that the New Shepard will consist of a propulsion module (PM) and Crew Capsule (CC). In an emergency, the CC can separate from the PM during ascent. The description also *seems* to indicate that in normal operation the CC separates from the PM when in space, each landing separately, the crew section landing under a parachute. Clark Lindsey points out that this option, the emergency case and a scenario where the two components land as unit were included in the launch site's Environmental Impact Statement. That site is located on Bezos's big Texas ranch (<http://www.hobbyspace.com/nucleus/index.php?itemid=9760#c>).

The CC accommodates three 'places,' each having a window and able to carry a person or experiments up to 120 kg in mass. Pointing accuracies, microgravity quality (it seems evident that someone left out the 'micro' indicator with the 'g' force range) and five categories of experiments with sample applications are listed; of these, "deployables" are shown as "under study." Maximum vertical acceleration of the vehicle is stated as "not higher" than 6g. This compares to a range close to 4g for the XCOR Lynx Mark 2.

The person listed as the company's representative for "research and education flights" is none other than Dr. Alan Stern. Recall that he was the initiator and a big enthusiast for using the new suborbital vehicles in such areas as environmental, engineering and astronomical research before departing some months ago as head of NASA's Science Directorate over other matters.

Rapid News At Two Major Companies: In recent weeks there has been a steady clip of developments and news items from:

SpaceX - On November 6th, SpaceX held a workshop to promote the free-flyer version of its "Dragon" capsule, "DragonLab," designed for unmanned on-orbit experiments. By December 1st the company had slotted into its manifest two projected DragonLab flights, one in 2010, the second in 2011. See the press release at <http://www.spacex.com/press.php?page=20081202>. Contrary to an erroneous early news report, these flights have *not* been purchased. But given the amount of interest spurred by DragonLab, preparation for the flights is now planned.

Max Vozoff, the Dragon/Dragonlab program manager, said that the workshop, "...was at full capacity and we even had to turn away qualified people. **With the U.S. Space Shuttle's retirement], clearly there is great demand from principal investigators, companies and institutions looking for ways to fly payloads in space and return them to Earth.**"

A full flight duration static firing of the nine engines to be used on the first Falcon 9 flight was performed at the SpaceX Texas test facility on November 22nd (<<http://www.spacex.com/press.php?page=20081123>>).

By December 9th, another company release announced milestones in the duration and restart firing of the "Drago" maneuvering thruster, 18 of which will be used on each Dragon (<<http://www.spacex.com/press.php?page=20081209>>).

Thanks to Clark Lindsey of space transportnews.com for pointing to the now continual and rapid accumulation of photos on the SpaceX "Updates" page related to preparation for the first Falcon 9 flight (<<http://www.spacex.com/updates.php>>). Among highlights: the newly painted Falcon 9 first stage, later wrapped in protective covering for shipping to Cape Canaveral (Dec. 2nd and 3rd); the nine engine first stage cluster for that flight being hoisted off the test stand in Texas (Dec. 4th); a vacuum version of the Merlin engine for the Falcon 9 second stage (Dec. 5th); and components of the erector/support structure for the Falcon at Cape Canaveral's Launch Complex 40 being prepared at the SpaceX plant.

Virgin Galactic - Rob Coppinger of FlightGlobal.com has been closely following their activities. He's not only been listening to company spokespersons at various venues, but has gone so far as to offer a bounty of \$100 if a person can beat out Virgin in providing a video of SpaceShipTwo's first flight to his publication. That flight is now expected by December 15th, according to Rob's posting at (<<http://www.flightglobal.com/blogs/hyperbola/2008/12/virgin-galactic-video-bounty-d.html#more>>).

Among his other items:

-- The company has concepts for a two stage satellite launcher that would be dropped from SpaceShipTwo at 70,000 ft altitude (20,000 ft higher than the previously announced operating ceiling for the aircraft). With a hybrid motor the launcher could carry about 100 kg to orbit; using conventional solid rocket motor stages it could carry a 200 kg payload (<<http://www.flightglobal.com/articles/2008/12/09/319910/virgin-galactic-in-spaceshipthree-talks.html>>).

-- A claim that the planned mid-2008 first flight of SpaceShipTwo was held up by "integration issues" between the (four) Pratt & Whitney Canada PW308A engines and the aircraft (<<http://www.flightglobal.com/articles/2008/12/06/319822/whiteknighttwo-first-flight-spaceshiptwo-roll-out-dates-tipped.html>>).

-- A talk on December 4th by Galactic's President Will Whitehorn at the UK's Rutherford Appleton Laboratories (<<http://www.flightglobal.com/blogs/hyperbola/2008/12/video-virgin-galactic-presiden.html>>). Among items from this talk were that a second group of 100 SpaceShip Two passengers were going through centrifuge testing and that Galactic expects outside investors by late 2009 (see, e.g. <<http://www.hobbyspace.com/nucleus/index.php?itemid=9704#c>>).

The "New Space" Solution and the NASA Transition: In my November 20th issue I commented on Washington's political transition and NASA, saying that the sane position was to rebuild the Agency upon a New Space framework.

Elements of this approach are also being endorsed from quarters where not long ago it would have been wholly unexpected, and I call upon the members of the new Administration's NASA transition team to focus upon it.

In the December 1st issue of Aviation Week & Space Technology, the Editor-in-Chief, Anthony Velocci, writes a, "[Message] to the President-Elect." Velocci expresses skepticism about NASA's current assurances that it can do what it promises under its present human Exploration plan without "extraordinary" budget increases and in the face of other massive federal fiscal demands. He then says,

"Fortunately, there is an enabling capability that is emerging in earnest, and [that]

the Obama administration should aggressively encourage: commercial entrepreneurship throughout the space program in which the market brings creative solutions to bear. Keep in mind, aviation didn't get to where it is today with central planning."

Update, later: I hear very positive signs that _some_ reforms of NASA plans, to some degree related to the above suggestions, have made significant progress at the NASA transition team level. Both promises and prudence about the hothouse of stories during a Washington transition dictate that I be no more specific.

Further update: Both the 'hot' house (in a slightly different sense than I was thinking of in the previous sentence) and indications that change is on the way are recounted in an article dated December 10th by Robert Block of the Orlando Sentinel, <http://blogs.orlandosentinel.com/news_space_thewritestuff/2008/12/nasa-has-become.html>. He has been doing outstanding investigative reporting about NASA - and is also on the mailing list for this publication.

NASA Transfer of All Parabolic Flights to Private Sector/Suborbital Experiments and a Meeting: NASA Administrator Griffin made several policy comments at December 5th's official ceremony awarding the Lunar Lander Challenge Level 1 prize to Armadillo Aerospace. One of them concerned the long-overdue transition of the agency's zero-gravity parabolic flights to the private sector.

Jeff Foust quotes Griffin:

"Tests aren't yet complete, but project managers are confident that Zero-G can meet our needs," Griffin said. "Thus, we're planning for the transition of all microgravity flight activities from the NASA C-9 to commercial aircraft." The C-9 will be retained for space shuttle training work, and as a backup to Zero-G, but Griffin said that "our primary path will be commercial." (<<http://www.spacepolitics.com/2008/12/06/griffin-on-parabolic-suborbital-and-other-commercialization/>>)

Griffin also spoke favorably about possible future purchase by the agency of research flights using the new privately developed suborbital vehicles, saying that "You should see more about this initiative in next year's budget request." **Per the topic of my "Dear Acquaintances" section in this issue, I hope that NASA's definite intent becomes tangible very soon. That could help spur private investment in suborbital systems' development during these difficult economic times.**

The statement that Griffin made about COTS Phase D (private human transport demonstration) for the Agency was much less encouraging. **But reading between the lines of the Orlando Sentinel item and other data, it's becoming clear that a) Griffin may be replaced sooner rather than later, and b) that this _could_ be part of a picture creating a positive result for COTS-D.**

Meanwhile, a meeting to bring together prospective providers and users of the new suborbital systems for science and engineering is taking place on December 15th, in association with an office at the Ames Research Center and in conjunction with the meeting of the American Geophysical Union taking place in San Francisco at the same time.

Richardson Appointed to Commerce, Transportation Dept. Uncertain: As I've noted, Governor Richardson of New Mexico has recently asserted that he would be a strong advocate of commercial space, whether or not he ended up in the new Administration.

Now he's to become Secretary of Commerce. **He can surely use his position to join, with those not at cabinet-level, who are arguing that not only is encouraging New Space good for the economy, but that it should play a big part in refashioning NASA's road to its stated objectives. That the new path would accomplish much more per federal dollar should be immensely attractive.**

I note that the Commerce Department has an "Office of Space Commercialization," which for reasons too convoluted to get into here is under the National Oceanographic and Atmospheric Administration (NOAA). Despite an "Entrepreneurial/New Space" page on its website and some nice pictures, this Office has been almost entirely focussed on extending

satellite/GPS businesses (<<http://www.space.commerce.gov/>>).

Meanwhile, earlier hints that Representative Oberstar might end up as head of the Department of Transportation (which includes FAA/AST, overseeing the new suborbital spaceflight industry - an industry he almost derailed at its inception) were proven unlikely. One of his aides reportedly said that he prefers the greater freedom of opinion and power he can have as head of the Congressional committee overseeing the Department (<<http://www.spacepolitics.com/2008/12/04/richardsons-in-but-what-about-the-transportation-job/>>).

Forthcoming Meeting:

Space Access '09: This is the meeting that was the 'point of origin' for many New Space efforts and where many of the essential ideas and issues of the field were first seriously discussed. Notice of its 2009 edition has recently appeared at <<http://www.space-access.org/>>:

“Space Access '09, our upcoming 17th annual conference on the technology, politics, and business of radically cheaper access to space, will take place Thursday April 2nd through Saturday April 4th 2009 at the Best Western Grace Inn in Phoenix Arizona. Our conference attendee hotel room rate is \$99 a night tax included, single or double, and comes with full buffet breakfast. For reservations, call 1-800-843-6010 and ask for the Space Access Conference 2009 room block. Conference advance registration is \$100, mail checks along with your name, email, and organization (if any) for your badge to: Space Access '09, 5555 N 7th St #134-348, Phoenix AZ 85014. We'll be posting a preliminary conference agenda in the coming weeks.”

Company Visits (*Concluding, Continued From Vol. 3, No. 22, November 20, 2008*):

Orbital Outfitters (<http://www.orbitaloutfitters.com>>): **To reword a statement in my preceding issue, allowing many parallel trial-and-error enterprises to thrive in new industries is key to creating an economy continually generating ever greater prosperity for all.** The Cold War era instead channelized space planning and skills through a few government agencies and their contractors. That severely restricted opportunities to develop low cost and safety, and allowed only few markets to emerge even with the billions spent both publicly and privately.

Orbital Outfitters shows how breaching the channels allows innovation to emerge from sources one might not predict. The company first showed off its “Industrial Suborbital Space Suit (IS3 - crew model) at the X-Prize Cup in New Mexico in October 2007 (<<http://www.orbitaloutfitters.com/media/OOXPCPressReleaseFinal.pdf>>). The first of these are scheduled for use by flyers on the XCOR Lynx suborbital vehicle. Work for that application continues in parallel with XCOR's schedule.

The suit incorporates features that reduce cost of manufacture and increase ease of use while protecting the wearer in case of cabin depressurization during a short suborbital flight. In an emergency it nominally provides 30 minutes or more of oxygen and pressurization from vehicle systems; should that source not be available, it comes with 15 min of its own supply. Cooling and electrical power are internal. These capabilities could be extended for the longer term operations of an orbiting spacecraft. Other features include biometric recording and integrated noise cancellation with audio feed (<<http://www.orbitaloutfitters.com/SpaceSuits.html>>).

Orbital Outfitters uses the facilities of the company 'Global Effects,' headed by Chris Gilman, for manufacturing its products. I visited there on October 16th. Gilman is Outfitters' Chief Designer; also present with him that day was Washington, DC - based CEO Jeff Feige. My thanks to Jeff for supplemental assistance after the visit.

Global Effects' roots go back over twenty years and is located in North Hollywood, just northwest of Burbank. They definitely *don't* give the impression of a typical aerospace firm. The company's primary business has been creating specialized props for the entertainment industry. All about are models of aliens, robots and creatures, medieval tableware (and tables) as well as armor of East and West used in the many productions whose posters are mounted on the wall. But one of the biggest parts of the business is building and renting out mock spacesuits. These are categorized according to increasing grades of fidelity to real ones.

That's a first clue that there's more there than meets the casual eye.

Gilman has designed and built prototypes of future spacesuits for NASA that incorporate mechanical and other design innovations (see, for example the Lunar/Mars surface excursion suits <http://www.globaleffects.com/B_02_frameset.html>). His company built four copies of NASA's "Mark 3" suit design that were recently used in evaluating the practicality of different roving vehicle concepts.

Gilman's mechanical abilities and interest in space-related matters got an early boost from his father, a highly skilled welder whose shop worked on many aerospace projects. He recalled helping his father sort parts that were incorporated into the Portable Life Support System (PLSS) backpacks used by Apollo astronauts on the Lunar surface. Another reminder of that era was on a workbench the day I visited: a Command Module pressure suit worn by Apollo 8 astronaut Frank Borman. The company is refurbishing it, replacing the cracked and dried out parts and fabrics for a customer.

Examples of real, historic armor (and associated weaponry) stand near similar ones that the company has made itself. There's an entire room stuffed with books on the history of armor. As Gilman points out, just because people of earlier times had different tools doesn't mean they were stupid or lacked creativity and the ability to perform remarkable feats using what they had. For example, starting from a flat plate and just using hand tools, Gilman (and some of his employees) can hammer out to amazing accuracy - a few thousandths of an inch - a smooth, constant gauge steel helmet replicating their work.

Armorers had many hundreds of years to create mechanical solutions for mobility required for various applications. Gilman continues to find 'new' ideas from their work. Underscoring their skill, he notes that their armor was cooler than today's common wisdom assumes, and usually no heavier than the combined weight of equipment carried by a modern infantryman.

Gilman's company is also able to innovate using the modern methods and materials used for spacesuits. For example, injection molding permits making the IS3's faceplate at very low cost. That faceplate and its helmet are designed for easy opening; yet in a vacuum a patented design ensures that the pressure differential locks them into an airtight, safe seal.

When working outside a spacecraft, astronauts have typically used suits pressurized to about 3.5 psi or so of pure oxygen. That low pressure reduces the (still substantial) physical effort created by volumetric changes when moving limbs, hands and fingers. But since spacecraft are usually operated much closer to sea level pressure with a nitrogen/oxygen gas mix, the suit user must spend hours pre-breathing to avert "the bends."

This time-consuming procedure could be eliminated if one could raise suit pressures to about 8 psi with a nitrogen/oxygen mix. But "fighting" that pressure level while moving in a conventional suit becomes nearly impossible.

Efforts have previously been made to create suits that can be operated at the higher pressures. Famously, a suit made entirely of hard components to avoid volume changes was built and initially tested decades ago at the NASA Ames center. Despite operating at higher pressure, it provided joint mobility far superior to that of the suits used for Shuttle/Space Station EVA. It may have had a disadvantage in compactness, but the reason it was abandoned was rivalry among the NASA Centers: Johnson Space Center prevented any but its own suit design - however inferior - to be used by the Agency.

The story demonstrates just one way that NASA ends up canceling innovative technical work where it really would make a huge difference. It also shows the huge advantage from innovation using parallel but independent research - even *within* a public agency.

NASA is apparently looking again at higher pressure suits for its human exploration programs, this time incorporating some 'soft' components. But after visiting Gilman's shop, I wouldn't be surprised if a practical high pressure suit could be devised at least expense by first studying the work of the armorers of old.

Dear Acquaintances,

- Defying the Tide -

More About the Economy and New Space

Recently, some have asked if *any* New Space firm that isn't primarily self-funded will be able to survive the present near lock-down of private borrowing and investing. Dollars available to investing individuals and entities have fallen with the value of their existing capital bases. The problem may only become more acute if spending on bailouts and public works projects further crowds out what money is still available.

The "self-funded" concerns are those leaning heavily if not totally on what I've called the "super-angel" investors. Among them are Bigelow Aerospace, Jeff Bezos's "Blue Origin" project, SpaceX and Virgin Galactic (that last if not formally, then perhaps effectively).

Depending how long and deep the storm tide of economic distress, even the most meritorious companies without the self-funding advantage could be washed away. It's one thing to live on gruel for six months; it's another to try to survive 18-24 months or more after that runs out.

Despite the gravity of the situation, opinion is not monolithic on the fate of those not self-funded. There are hints of still available investment dollars; there are varying dollars required to reach payback revenue on major products; and innovation in business plans can be critical. Income from products and services that have already been developed as well as advance sales for longer term items are also important elements.

The Google Lunar X-Prize

One person in the New Space community asserted that with the economic distress he was doubtful that *any* of the Google Lunar X-Prize (GLXP) entrants could raise sufficient funds in time to reach the moon and win the top prize.

That prize is \$20 million if the mission is completed before the end of 2012, with a \$5 million bonus if certain additional tasks are performed (<<http://www.googlelunarxprize.org/lunar/about-the-prize/rules-and-guidelines>>). If carried out during the following two years, the basic prize is \$15 million. It disappears entirely at the end of 2014. The \$5 million second prize for accomplishing the basic mission remains constant throughout the contest, until also disappearing at the close of that year.

Base Costs: Of course, it was never expected that the prize winnings would cover the full cost of performing the mission. By covering part of the money risked, the prize spurs excitement and hope among entrants for a bigger long-term payback. Recall that it was reported that Paul Allen put something between \$20 and \$30 million into winning the first X-Prize (\$10 million) with SpaceShipOne. Without (to date) a 'super-angel' in sight, the GLXP entrants are dependent upon multiple angels, venture capital and their larger business plans.

For example, at Space Investment Summit 5 (SIS 5) in LA in October, John Kohut of Astrobotic (<<http://astrobotictechnology.com/>>) cited their need to raise \$60 million of venture money, saying that winning the Prize is only 4% of their business model. That model depends upon their assumption of a \$600 million market for lunar data by 2012, from customers such as space agencies, foundations, and commercial ventures (e.g. television/web content).

Barring unlikely circumstances, launch costs alone may demand that all contestants raise tens of millions of dollars to win. Let's look at some rock-bottom figures for that ride, based upon SpaceX's "Falcon Lunar Capability Guide" at <<http://www.spacex.com/FalconLunarCapabilityGuide.pdf>>.

The present Falcon 1 is priced at \$7.9 million to send 425 kg into Low Earth Orbit (LEO); by mid -2010 it is scheduled to be replaced by the Falcon 1e, which can carry 1000 kg to LEO. In both cases, the customer must pay the additional cost of supplying an upper stage to boost the the lunar landing system and rover into a translunar trajectory.

Then there's the Falcon 9. Without an added stage, it can send a 1925 kg payload directly into such a trajectory. That vehicle's base price is projected at \$36.8 million, but the SpaceX manual (p.8) says that the translunar injection incurs an added \$10 million penalty, "since the second stage is non-recoverable." (I do have my concerns as to how fast and how much the company will be able to reuse its rocket stages, but that's not relevant here.)

A Project Participant's Personal Comments: The Odyssey Moon entrant and Astrobotic are the two most visible entrants in the contest. They also are very technically credible.

On October 30th, Odyssey Moon announced that they had reached an agreement with the NASA Ames Center, "...for the development of a robotic lunar lander...NASA will provide technical data and engineering support to Odyssey Moon Ventures in support of the company's efforts to develop its 'MoonOne' (M-1) robotic lunar lander... Odyssey Moon Ventures will reimburse NASA Ames for the cost of providing the technical support and will share its technical data from its engineering tests and actual lunar missions with NASA." (See <[http://www.odysseymoon.com/PDF/MEDIA_RELEASE_\(30-Oct-08\)_-_Odyssey_Moon_Partners_with_NASA_for_Lunar_Lander_Development.pdf](http://www.odysseymoon.com/PDF/MEDIA_RELEASE_(30-Oct-08)_-_Odyssey_Moon_Partners_with_NASA_for_Lunar_Lander_Development.pdf)>)

The agreement takes advantage of work that Pete Worden had initiated on a small 'Common Spacecraft Bus' concept when he became Ames director. The aim has been to develop a lander or orbiter spacecraft enabling missions with cost under \$50 million and that could fly on a Falcon 1e - class launcher (<http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/HOVR11128.xml>).

The agreement with Ames shows the kind of adaptability that is needed now more than ever for a GLXP winner to emerge. Michael Potter, a director of Odyssey Moon Ltd and well-known space entrepreneur, sent me a "personal perspective" on financing of a private lunar flight under present conditions.

Potter said that, "...despite the melt-down of the financial markets, the \$30 million GLXP itself remains solid and secure." Good to be assured of their commitment. Despite one's perception of Google's relative prosperity, the December digest of "Media and Telecom Analysis" from Near Earth LLC (a paying subscriber to this report, see <<http://www.nearearthllc.com/home/>>) notes that Google, "is reportedly cutting down employee perks, development expenditures, and even the number of independent contractors."

Potter mentioned that Odyssey Moon's overall business model includes ongoing flights. As with Astrobotic, something beyond fulfilling the GLXP is needed to try and raise the starting dollars required. (It'd be interesting to see the relative cost projections between the two of them.)

He then addressed the direct effects of the economy on the GLXP contestants, "...this financial environment is going to force all teams to be disciplined and resourceful if they stand a chance at succeeding with their mission.

"Teams will have to be extraordinarily creative both technically and financially. The winning team will have technical solutions that will directly related to a lower cost structure.

Those teams that are more business focused are going to have to work very closely with their customers in order to create successful win-win partnerships in order to achieve high impact results.”

His concluding words suggested another direction for entrants’ “creativity” as well as the complications that may arise from it,

“The one great shift resulting from the downturn of the financial markets, is that I think we will find much greater involvement of international partners and investors than most observers would have initially anticipated. Such relationships may also create greater ITAR burdens than previously imagined.”

I later asked Potter if Odyssey Moon Ltd had any advantage in overcoming such burdens because it is based on the Isle of Man and its prime contractor is MDA of Canada. He replied that, “The regulations are encompassing, complicated and burdensome enough, to an extent that there is no single magic bullet for any fully international team.”

XCOR Aerospace Press Conference and Contrasting Funding Needs

XCOR Aerospace has striven (many say to a fault) not to let promises outpace capabilities. As CEO Jeff Greason notes, its Lynx suborbital vehicle project had become too big not to talk about by the time it was publicly announced back in March. **The company’s press conference on December 2nd was primarily focussed on commercial milestones in the project that had become similarly significant.**

I’ll start with some major items and impressions from this latest event.

A total of 22 seats have now been presold on the Lynx by XCOR itself under certain starting parameters. One of these tickets is actually an XCOR donation to the “Teachers in Space” project of the Space Frontier Foundation. But from now on almost all passenger sales will be handled by the company’s new ticket sales partner, “RocketShip Tours.” The price is \$95,000 per seat, and the company can be found at <http://www.rocketshiptours.com/> or by phone at “888 rstours” (888.778.6877). RocketShip Tours is authorized to handle wholesale as well as retail ticket sales.

XCOR will continue to handle sales for those using the Lynx for science and engineering applications.

RocketShip Tours is a venture of Jules Klar, who helped initiate and popularize the “\$5/day” European tours that took off in the 1960s, and more recently has been a retail agent for luxury travel. Passengers can either pay the total price at one time or start with a \$20,000 deposit. Either will entitle them to a five night stay at an Arizona resort where they will get full briefings, medical evaluations and testing. Instead of using a centrifuge (as with Virgin Galactic), passengers will be tested in aerobatic aircraft for g-force tolerance. This will also allow checking for claustrophobia in a small cabin analogous to that of the Lynx. Once the prospective passenger pays the full ticket price, they will be put in the queue for a flight. Another medical checkup will just precede the Lynx flight.

Klar showed strong enthusiasm for the partnership with XCOR (reinforced also by his comment that he was not seeking to sell any others’ suborbital flights). He underscored the “due diligence” he’d done on the company, emphasizing their safety and consistency record of over 3500 reusable rocket firings to date without significant mishaps.

One assumes that the strong enthusiasm foreshadows an equally strong push for ticket sales. Existing travel agent networks are to be central to that effort. Individuals agents will “graduate” from a sales training course for the Lynx flight that is available

through the RocketShip Tours website.

The other part of the press conference that was particularly effective were some comments by former Shuttle astronaut and Lynx pilot Rick Searfoss. It's true that the *_zero-g_* experience on the Lynx Mark 1 will be shorter and much more confined than on Virgin Galactic's craft. But Searfoss said that sitting next the pilot will give a truly "Right Stuff" experience; more, he asserted that while zero-g is exciting, the *_view_* is at the heart of experiencing space. One might accuse him of making a virtue out of necessity, but I heard genuine emotion as he called the view a spiritual experience. It resonated powerfully with what others have called the "Overview Effect" of seeing Earth from the edge of space and beyond.

No doubt his comments also resonated because of my recent visit to XCOR, where I had a chance to sit in the Lynx cabin mockup and realize just how unobstructed a view the passenger will experience. I previously labeled this a 'planetarium effect,' but *_because of the very fact that the cabin is so small_* a more apt analogy recently became evident.

As Alan Boyle of MSNBC recounted in his item on the XCOR press conference, "When it comes to spaceflight, smaller just might be better, said Charles Lurio, writer/publisher of The Lurio Report... **'It's almost like you're doing a spacewalk without doing a spacewalk,' he told me.**" (See <<http://cosmiclog.msnbc.msn.com/archive/2008/12/02/1695273.aspx>>.)

The press conference included the introduction of the company's first Lynx passenger, Danish investment banker/adventurer Per Wimmer, who is based in London (he's also on the mailing list for this publication). Wimmer has also purchased a ticket for Virgin Galactic's SpaceShipTwo, and has invested in XCOR through various mechanisms. In what would be a modest indulgence in showmanship for other companies - but which was a big one for XCOR - Klar asked Wimmer to sign the "informed consent" document for flying on the Lynx at the podium, then handed him an oversized facsimile of "Ticket #1."

Chris Gilman of Orbital Outfitters had been expected to show up with one of the IS3 spacesuits, but was too ill that day to attend. Greason stated (as previously noted by this journal) that the first of the engines for the Lynx was very close to initial test firings, and expressed great satisfaction at seeing other parts of the vehicle beginning to take shape as well.

Financing XCOR and the Lynx: I noted the range of financing being sought by XCOR in Vol. 3, No. 21 (November 2, 2008), referencing COO Andrew Nelson's presentation at SIS 5 in October,

"Andrew outlined present fundraising activity, which he elaborated upon in a later conversation. Dollars invested today go into a convertible note that will automatically become Series A preferred shares when the \$5 - 10 million fundraising goal is achieved. But at this date it's estimated that only about \$2 million are required to take the initial capability version of the Lynx to first flight."

Getting that Mark 1 Lynx (capable of reaching 61 km altitude, about 200,000 ft) to first flight is only the start of an extensive test program before it carries passengers. The first of them wouldn't fly until sometime in 2011 (with vehicle first flight still set for 2010). But as Jeff Greason indicated at the December 2nd event, they'll test the vehicle, "as long as it takes" to demonstrate sufficient reliability and safety.

So while the \$2 million may get XCOR to a huge milestone, another significant number of dollars will be required to cover expenses for and during the test period. The Mark 2 Lynx, capable of reaching higher speeds and altitudes - 110 km, or about 360,000 ft - is also expected to be under development for a possible first flight sometime in 2011 (Aviation Week & Space Technology, December 8th issue, page 31).

Figure in these and other expenses as well as caution for uncertainties and one can see the rationale for Nelson's fundraising goals.

Of course, estimates of income from sales of Lynx tickets and of other products and services are included before projecting investment capital needs. For example, as is their habit, the company developed (and/or became comfortable with) the technologies of both Lynx versions well before last March's announcement of the vehicle. One of the most important of these for the Mark 2 is their trademarked "Nonburnite," a teflon-based, non-cracking, lightweight composite that can carry cryogenics such as liquid oxygen. It can be molded to the fuselage shape, adding propellant capacity needed to reach the higher altitude. They recently were able to sell some of this material.

Should sales of such products, government and private contracts, or Lynx ticket sales "take off" at a pace beyond the company's (I assume) conservative projections, that could quickly slash fundraising needs. But with current economic conditions one shouldn't rely on that.

So XCOR's investment capital needs over the next few of years are likely in the millions. That could be as much as (or more than) an order of magnitude *less* than required by GLXP entrants.

Conclusions

Obviously I'd much prefer a situation where all worthy GLXP entrants as well as companies like XCOR can find the capital they need. It is certainly an advantage to require fewer dollars 'up front.' But under present conditions all are vulnerable.

Yours very truly,

Charles A. Lurio, Ph.D.

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