Welcome to the April 12th, 2017 Edition of THE REVENGE HUMP DAY!

Well, this week descended to a new low for our family. We have had a large number of our family and friends who have passed away over the past 6 months and this week, I am sorry to say, we lost another important member of our family. Gladys Spraker, Grandmother of Derek and Great Grandmother to Alex and Beth passed away peacefully last week. She was a great lady who set a great example for the kids. Granny Gladys will be missed by all of us.

On Sunday we the LibertyCon family gathered for the April meeting at Casa Spraker. We started going over all the details for the upcoming LibertyCon and got through in about 2 hours and 15 minutes. One of the important things was that Brandy finalized the price of the banquet with the hotel and we will be going selling tickets shortly on the website. The same thing is true for the T-
Shirts. We are still waiting for the finalized high definition art file from Daniel Santos and when that comes in, we will be selling them on the website. Someone sent a question in about us selling T-Shirts at the convention. This is normally a looser for use so we decided years ago to only buy what is ordered plus a couple of extras just in case.

One thing I can tell you is that Matt said that we will be handing out badges in the Convention Center on the Thursday night of the convention because it worked so well last year. So, if you come in Thursday, you can pick up your badge in the convention center registration area between 6pm and 9pm. Also, if you feel the need, we can always use volunteers to help us setup. ;^) BTW, Rich has agreed to start programming on Friday at 1PM of LibertyCon. So if you are there early, you will have something to do. No bad if I do say so.

So on that "happy note", why don't y'all sit back and relax because here's the best in gossip, jokes and science for your reading pleasure!

Uncle Timmy

<G>~<O>~<S>~<S>~<I>~<P>~~~<S>~<T>~<A>~<R>~<T>~<S>~~~<H>~<E>~<R>~<E>~<!>

IN MEMORY OF GLADYS L. SPRAKER

From Brandy Bolgeo Spraker's 'Facebook posting

May 23, 1925 - April 6, 2017

Gladys L. Spraker, 91, formerly of East Ridge, passed away on Thursday, April 6, 2017.

Mrs. Spraker was born on May 23, 1925 in Wytheville, Virginia to William and Cordelia Umberger. She was a longtime resident of East Ridge, most recently Spring City Care & Rehab. Gladys retired from Loveman's where she worked for over 30 years. She was a member of Trinity Lutheran Church in Hixson, and loved working in her yard with her flowers.

She was preceded in death by her husband in 1992, Jim R. Spraker who she married on November 25, 1944; sisters, Kathleen Wampler and Geneva Hancock; and brothers, Kenneth Umberger and Carl Umberger.

Surviving are her sons, Stanley (Carol) Spraker of St. Augustine, FL and Ray (Janet) Spraker of Spring City, TN; two grandsons, Derek Spraker and John Srpaker; and two great-grandchildren, Alex and Beth Spraker.

Visitation will be from 12 Noon to 2 PM on Saturday at the funeral home.

Funeral Services will be at 2 PM on Saturday, April 8, 2017 at the funeral home with Rev. Stanley Combs officiating.

Burial will follow at Lakewood Memory Gardens South.

THIS IS ANOTHER KICK IN THE TEETH FOR MY GRANDCHILDREN TO LOOSE ANOTHER GREAT GRANDPARENT SO SOON. GRANNY GLADYS WAS A GREAT LADY AND WILL BE MISSED BY ALL WHO KNEW HER. I HOPE THAT ALEX AND BETH WILL ALWAYS HAVE FOND MEMORIES OF GRANNY GLADYS AS THEY WALK THROUGH THE REST OF THEIR LIVES. MAY THE PERPETUAL LIGHTS SHINE ON GLADYS AND MAY SHE REST IN THE ARMS OF THE LORD. TIM BOLGEO

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From Brandy Bolgeo Spraker's Facebook posting April 8, 2017

A beautiful service for the kids' great grandmother, Gladys Spraker. A strong lady, she will be missed. We want to thank everyone for all of the FB love and prayers that have come our way!!!!

<L>~<I>~<B>~<E>~<R>~<T>~<Y>~<C>~<O>~<N>

HAVE STARSHIP, WILL TRAVEL: TENNESSEE VALLEY INTERSTELLAR WORKSHOP DEBUTS LATEST NEWSLETTER

From: "Tennessee Valley Interstellar Workshop" rickcross@bellsouth.net

CONTACTS:
David Fields, TVIW Director at Large
fieldsde@gmail.com

Les Johnson, TVIW Conference Chair les.johnson@tviw.us

April 10, 2017

HAVE STARSHIP, WILL TRAVEL: NEW TVIW NEWSLETTER BUILDS EXCITEMENT FOR 2017 SYMPOSIUM COMING TO HUNTSVILLE, ALABAMA

As anticipation mounts for the fifth Tennessee Valley Interstellar Workshop, set for Oct. 3-6 at the Embassy Suites Hotel in Huntsville, Alabama, the organization has issued its latest

newsletter, showcasing symposium highlights and featuring an exclusive commentary by noted technologist, entrepreneur and space exploration advocate Dr. John Rather.

Automatically download the new issue of "Have Starship, Will Travel," the semiannual TVIW newsletter, in PDF format here: https://tinyurl.com/m9cl4oj

Among its contents are Dr. Rather's reflections on the course and future of human space exploration; information about TVIW's new board of directors; and an advance look at the symposium's planned "Breakthrough Starshot" sessions, showcasing the groundbreaking research and engineering program which seeks to launch a light-propelled nanocraft to Alpha Centauri, just four light years from our own star system.

Archived PDF issues of the newsletter are available here: https://tviw.us/newsletters

More about TVIW 2017
Interested parties are encouraged to register early for TVIW 2017. Symposium organizers continue to seek papers and presentations from aerospace technologists, communicators, and other researchers working to promote the exploration of interstellar space.

TVIW partners with the interstellar starship development symposium Starship Century (http://www.starshipcentury.com), and with Tau Zero Foundation (https://tauzero.aero), a coalition of scientists, engineers, artists, and writers seeking practical solutions for interstellar exploration. Symposium sponsors include science fiction publisher Baen (http://www.baen.com) -- "The Heart of Science Fiction," proudly supporting TVIW since 2013 -- and Digital Oilfield Solutions (http://www.digitaloilfieldsolutions.co.uk).

Learn more about TVIW 2017 online and connect via social media:

Web: https://tviw.us
Facebook: https://www.facebook.com/TNValleyInterstellarWorkshop
Twitter: https://twitter.com/tviwus
YouTube: http://youtube.com/tviw

<T>~<H>~<E>~~~<J>~<O>~<K>~<E>~<S>~~~<S>~<T>~<A>~<R>~<T>~~~<H>~<E>~<R>~<E>

From: "Mike Waldrip" waldripk@gmail.com

GETTING OLD JUST AIN'T WHAT THEY SAID IT WOULD BE.....

Ray came home one night from a long day at work, slid into bed beside his sleeping wife, and fell into a deep slumber.

He awoke before the Pearly Gates, where St. Peter said, 'You died in your sleep, Ray.'

Ray was stunned. 'I'm dead? No, I can't be! I've got too much to live for. Send me back!'

St. Peter said, 'I'm sorry, but there's only one way you can go back, and that is as a chicken.'

Ray was devastated, but begged St. Peter to send him to a farm near his home. The next thing he knew, he was covered with feathers, clucking and pecking the ground.

A rooster strolled past. 'So, you're the new hen, huh? How's your first day going here?'

'Not bad,' replied Ray the hen, 'but I have this strange feeling inside. Like I'm gonna explode!'

'You're ovulating,' explained the rooster. 'Don't tell me you've never laid an egg before?'

'Never,' said Ray.

'Well, just relax and let it happen,' says the rooster. 'It's no big deal.
He did, and a few uncomfortable seconds later, out popped an egg! He was overcome with emotion as he experienced motherhood. He soon laid another egg - his joy was overwhelming.

As he was about to lay his third egg, he felt a smack on the back of his head, and heard.....

"Ray, wake up! You crapped the bed!"

<J>~<O>~<K>~<E>~<S>

CONFUSION WITH BC

An elderly and rather old fashioned lady, always most delicate and elegant, especially in her language, was planning an RV trip to Florida with her husband for their vacation. So, she sat down to write to the Kozy Korner Kampground for a reservation.

Now, she wanted to make sure the campground was fully equipped but didn't know how to ask about the toilet facilities. She just couldn't bring herself to write the word "toilet" in her letter. After much deliberation, she finally came up with the old fashioned term, "bathroom commode." But, as she wrote that down she still thought she was being too forward, so she started all over again, rewrote the entire letter, and referred to the bathroom commode merely as the B.C. She asked, "Does the campground have its own B.C.?"

Well, the campground owner wasn't familiar with the old-fashioned terms, and when he got the letter he just couldn't figure out what the woman was talking about when she used "B.C."

After worrying about it for awhile, he showed the letter to several RVers, and they couldn't imagine what the lady meant, either. The campground owner finally came to the conclusion that the lady must be asking about the location of the Baptist Church (B.C.), so he sat down and wrote the following reply:

"Dear Madam: I regret very much the delay in answering your letter, but I now take the pleasure of informing you that a B.C. is located 9 miles north of the campground and is capable of seating 250 people at one time!

Now, I admit that's quite a distance away if you are in the habit of going regularly, but no doubt you will be pleased to know that a great number of people take their lunches along and make a day of it. The last time my wife and I went was six years ago, and it was so crowded we had to stand up the whole time we were there. Not going oftener has been

painful for both of us, but other more pressing matters have made it so. It may interest you to know that right now there is a supper planned to raise money to buy more seats. I would like to say that it distresses me very much not to be able to go more regularly. There surely is no lack of desire on my part, but as we grow older it seems to be more of an effort, particularly in cold weather.

If you do decide to come down to our campground, perhaps I could go with you the first time you go, sit with you, and introduce you to all the other folks. Remember, ma'am, this is a friendly community."

<J>~<O>~<K>~<E>~<S>~~~<of>~<the>~~~<W>~<E>~<E>~<K>

From: "Ray Beloate" beerman@rittermail.com

<J>~<O>~<K>~<E>~<S>

MOTORCYCLE POLICE OFFICER

A motorcycle police officer stops a driver for shooting through a red light. The driver is a real jerk, steps out of his car and comes striding toward the officer, demanding to know why he is being harassed by the Gestapo !

So the officer calmly tells him of the red light violation. The motorist instantly goes on a tirade, questioning the officer's ancestry, sexual orientation, etc., in rather explicit offensive terms.

The tirade goes on and on without the officer saying anything.

When the officer finishes writing the ticket he puts an "AH" in the lower right corner of the narrative portion of the ticket. He then hands it to The 'violator' for his signature. The guy signs the ticket angrily, and when presented with his copy points to the "AH" and demands to know what it stands for.

The officer says, "That's so when we go to court, I'll remember that you're an asshole!"

Two months later they're in court. The 'violator' has a bad driving record with a high number of points and is in danger of losing his license, so he hired a lawyer to represent him.

On the stand the officer testifies to seeing the man run through the red light..

Under cross examination the defense attorney asks;"Officer is this a reasonable facsimile of the ticket that you issued to my client ?"

Officer responds, "Yes, sir, that is the defendant's copy, his signature and mine, same number at the top."

Lawyer: "Officer, is there any particular marking or notation on this ticket you don't normally make ?"

"Yes, sir, in the lower right corner of the narrative there is an "AH," underlined."

"What does the "AH" stand for, officer ?"

"Aggressive and hostile, Sir."

"Aggressive and hostile ?"

"Yes, Sir.

"Officer, are you sure it doesn't stand for asshole ?"

Well, Sir, you know your client better than I do.

How often can one get an attorney to convict his own client ?

<J>~<O>~<K>~<E>~<S>

FOR THOSE WHO THOUGHT THEY KNEW EVERYTHING. HERE IS A REFRESHER COURSE.

The liquid inside young coconuts can be used As a substitute for Blood plasma.

No piece of paper can be folded in half more than seven (7) times. Oh go ahead ... I'll wait...

Donkeys kill more people annually than plane crashes or shark attacks. (So, watch your Ass)

You burn more calories sleeping Than you do watching television.

Oak trees do not produce acorns until they are fifty (50) years of age or older.

The first product to have a bar code was Wrigley's gum.

The King of Hearts is the only king WITHOUT A MOUSTACHE.

American Airlines saved $40,000 in 1987 by eliminating one (1) olive from each salad served in first-class.

Venus is the only planet that rotates clockwise.

(Since Venus is normally associated with women, what does this tell you?) (That women are going in the 'right' direction...?)

Apples, not caffeine, are more efficient at waking you up in the morning .

Most dust particles in your house are made from: DEAD SKIN!

The first owner of the Marlboro Company died of lung cancer.

So did the first 'Marlboro Man'.

Walt Disney was afraid: OF MICE!

PEARLS DISSOLVE: IN VINEGAR!

The ten most valuable brand names on earth: Apple, Coca Cola, Google, IBM, Microsoft, GE, McDonalds, Samsung, Intel, and Toyota, in that order.

It is possible to lead a cow upstairs...but, not downstairs.

A duck's quack doesn't echo, and no one knows why.

Dentists have recommended that a toothbrush be kept at least Six (6) feet away from a toilet to avoid airborne particles resulting from the flush.

(I keep my toothbrush in the living room now!)

And the best for last.....

Turtles can breathe through their butts.

(I know some people like that, don't YOU?)

So.....Remember, knowledge is everything, so pass it on..... And go move your toothbrush!

And stop folding the paper

<J>~<O>~<K>~<E>~<S>~~<of>~<the>~~<W>~<E>~<E>~<K>

From: "Karen Boyd" abtales@comcast.net

HARLEY BIKER

A Harley Biker is riding by the zoo in Washington, DC when he sees a little girl leaning into the lion's cage. Suddenly, the lion grabs her by the collar of her jacket and tries to pull her inside to slaughter her, under the eyes of her screaming parents. The biker jumps off his Harley, runs to the cage and hits the lion square on the nose with a powerful punch. Whimpering from the pain the lion jumps back letting go of the girl, and the biker brings the girl to her terrified parents, who thank him endlessly. A reporter has watched the whole event.

The reporter addressing the Harley rider says, 'Sir, this was the most gallant and bravest thing I've seen a man do in my whole life.'

The Harley rider replies, 'Why, it was nothing, really. The lion was behind bars. I just saw this little kid in danger, and acted as I felt right.'

The reporter says, 'Well, I'll make sure this won't go unnoticed. I'm a journalist, you know, and tomorrow's paper will have this story on the front page. So, what do you do for a living, and what political affiliation do you have?'

The biker replies "I'm a U.S. Marine, a Republican and I'm voting forTrump".

The journalist leaves.

The following morning the biker buys the paper to see if it indeed brings news of his actions, and reads, on the front page:

U.S. MARINE ASSAULTS AFRICAN IMMIGRANT & STEALS HIS LUNCH

And THAT pretty much sums up the media's approach to the news these days!

<YOU>~<>~<JUST>~<>~<CAN'T>~<>~<MAKE>~<>~<THIS>~<>~<STUFF>~<>~<UP!>

YOU JUST CAN'T MAKE THIS STUFF UP!

From: "Bob Bolgeo" bbolgeo@aol.com

THE PARTY IS OVER...

HORRORS !!!!!!!!!! The press will have to buy their own tickets instead of freeloading on tax-payer funded jaunts.

And who does Tillerson think he is by using a smaller jet with a smaller carbon footprint, better fuel economy and creates less noise pollution.

A Reuters filing en route to Asia showcases the bitterness, anger and seething rage of U.S. Journalists who have been forced to fly First-Class Commercial to cover Secretary of State Rex Tillerson's Asia trip.

State Department correspondents are used to the exclusive wide-body private charters of the U.S. Federal government's airline fleet. Previous heads of the Department of State have flown aboard Air Force 3. Normally a Boeing 757. At the very worst Air Force 3 would be a C17 Globemaster.
However, T-Rex is taking a smaller jet to Asia and only one journalist accompanies him. To make matters exponentially worse, T-Rex did not select a journalist from the corporate stable of the refined and pedigreed media elites.

We can only imagine how Andrea Mitchell must be seething at having to take simple first-class commercial flight accommodations with ordinary people. The scope of the almost unimaginable horror she has to face will soon pour from her pursed and vengeful lips. We can predict a retaliatory report soon from the wrath of the ignored elitist within NBC. This shall be, as they say, epic.

Secretary Tillerson has rebuked customs and norms. The traveling correspondents will have to pass through customs and passport checks as if they are ordinary travelers. There is a very real possibility no-one will recognize them or care diligently for their very individual and specific needs.

Can you imagine Mrs. Alan Greenspan flying all the way to Asia from the Eastern Seaboard and having to do that on a commercial flight? My God, have we really dropped our standards of decency that far…

Oh yeah, the pontificating journalist elites are pi Ed off. After traveling with every possible indulgence aboard exclusive State Department accommodations with Secretary Clinton and Secretary Kerry, you cannot even fathom how angry they are right now without private dining, DoS chefs, shaved chocolates and Cristal mimosas.**

None of this is me joking. This bunch of snobs having to fly commercial is unheard of.

They are ready to tear into Secretary Tillerson in every single filed report. Just watch what you see on TV:
(Reuters) U.S. Secretary of State Rex Tillerson is traveling to Asia this week accompanied by only one reporter, a White House correspondent from the Independent Journal Review (IJR), a digital news outlet founded in 2012 by former Republican political operatives.

The IJR said in a statement late Tuesday the State Department last week offered one of its reporters, Erin McPike, a place aboard the Secretary's aircraft on his trip this week to Asia.

Air Force 3 – Not being used by T-Rex

The State Department had previously told reporters covering Tillerson's trip to South Korea, Japan, and China that he would not be taking reporters on his plane and that they would have to fly commercially, breaking with decades of precedent stretching back to Henry Kissinger.

Major news organizations complained, among them the BBC, CNN, New York Times, Washington Post and Reuters.

The State Department Correspondents Association, which represents reporters who cover U.S. Diplomacy, said in a statement that it was "disappointed" Tillerson chose to travel to Asia without a full contingent of media "or even a pool reporter".

"After saying it was unable to accommodate press on the Secretary's plane to Asia due to space and budget constraints, the State Department offered a unilateral seat to one reporter," the statement said.

"Several of our members have traveled commercially to meet Secretary Tillerson on the ground in Asia. We expect that the diplomatic press corps will be afforded access to Secretary Tillerson equal to that given to the reporter on the plane."

A spokesman for IJR, Matt Manda, did not immediately respond to a request for comment on whether McPike would file pool reports to colleagues, or whether IJR had any comment on the SDCA's statement.

For decades, secretaries of state have nearly always invited media to travel with them. In rare cases, particularly late in a secretary's tenure, some outlets have declined the invitations, such as for former Secretary John Kerry's December 2016 trip to Saudi Arabia. Republican secretaries of state Alexander Haig, George Shultz, James Baker, and Condoleezza Rice routinely took 10 or more journalists on their overseas trips, even to conflict zones such as Lebanon and Central America.

Up through Tuesday, just hours before Tillerson was scheduled to leave, the State Department declined to confirm whether there would be any reporters on Tillerson's plane.

Acting State Department spokesman Mark Toner said in a phone briefing with reporters on Tuesday that the agency was considering "having a seat available" on his plane.

"We've been very clear, frankly, that this is a smaller footprint all around, and this is the Secretary's decision, to travel with a smaller footprint," Toner said. "To some degree, it's a cost-saving measure." (read more)

The rest of the article is Reuters tearing into IJR for having the audacity to accept a seat on the flight with T-Rex. This is like High School mean girls taken to exponential levels of vitriol and hatred.

This is going to be ugly. Very, very ugly.

<YOU>~<>~<JUST>~<>~<CAN'T>~<>~<MAKE>~<>~<THIS>~<>~<STUFF>~<>~<UP!>

YOU JUST CAN'T MAKE THIS STUFF UP!

DOCTOR DRAGGED FROM OVERBOOKED FLIGHT

http://www.courier-journal.com/story/news/2017/04/10/video-shows-man-forcibly-removed-united-flight-chicago-louisville/100274

The more information about this situation, the more it stinks.

> The "overbooking" was in fact United employees who were being ordered to "deadhead" on the flight to make a flight the next day. (What? you can drive from Chicago to Louisville in seven hours - I know, I've done it - and hiring a van would probably have been cheaper than what they were paying people to leave the flight. They might have had to preplan a bit but knowing the flight was full...)

> United offered $800/seat but then instead of continuing to increase the offer, "randomly" selected people to eject.

> United involved the police in forcibly restraining a person who was not performing a criminal action but was involved in what amounted to a contract dispute - and who,

apparently, was nonviolent, just firmly resistant of having his contract randomly canceled because of his own professional obligations. If the situation was honestly portrayed in full to them, they probably shouldn't have been there. If they were just told of an unruly passenger who had to be removed...

In any event, by the time this is over, I hope that United will be out of significantly more money than they would have had to pay if they had kept increasing the offer until they found people willing to accept it. And the persons who made those decisions out of work.

And I shall avoid United in the future whenever I have a choice.

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JIMMY KIMMEL DESTROYS UNITED AIRLINES IN HILARIOUS FAKE COMMERCIAL SPOOF

But Kimmel wasn't as generous when he lit into United Airlines CEO Oscar Munoz.
"This might be the worst part of all of it," he said. "This is what the CEO tweeted… 'This is an upsetting event to all of us here at United. I apologize for having to re-accommodate these customers.'"

"That's right. He said, 're-accommodate.' Just like we re-accommodated El Chapo out of Mexico."

"That is such, sanitized, say-nothing, take-no-responsibility, corporate BS speak," Kimmel continued. "I don't know how the guy who sent that tweet didn't vomit when he typed it out."

SEE THE VIDEO OF THE SKIT AT THE WEBSITE.

http://www.bizpacreview.com/2017/04/11/jimmy-kimmel-destroys-united-airlines-hilarious-fake-commercial-spoof-470774?utm_source=BizPac+Review+Email+Newsletter&utm_campaign=7f7e993571-EMAIL_CAMPAIGN_2017_04_11&utm_medium=email&utm_term=0_fbf9323fb3-7f7e993571-32881293

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From: "Tim Bolgeo" tbolgeo@epbfi.com

T-X EXPERIENCE KEY TO BOEING'S FUTURE FIGHTER BIDS

Apr 4, 2017James Drew | Aerospace Daily & Defense Report
http://aviationweek.com/military-trainers/t-x-experience-key-boeing-s-future-fighter-bids?NL=AW-05&Issue=AW-05_20170405_AW-05_108&sfvc4enews=42&cl=article_1&utm_rid=CPEN1000001477803&utm_campaign=9425&utm_medium=email&elq2=bd109135e72645a7abb62420c7758222

Boeing Phantom Works sees its joint development of the T-X next-generation training aircraft with Saab as the No. 1 example of how it would approach the development of future front-line fighters for the U.S. Air Force and Navy.

Boeing Phantom Works says new airframes packed with the latest available technology for Penetrating Counter-Air and F/A-XX, along with Eagle and Super Hornet upgrades, will ensure U.S. air superiority for decades to come: Boeing

The advanced prototyping arm of Boeing Phantom Works is leading the company's development of future military aircraft and armaments, chiefly for the Air Force Penetrating Counter-Air (PCA) and Navy F/A-XX programs.

David Bujold, the organization's director of fixed-wing and weapons, singled out the T-X program—which rapidly designed and prototyped two production-conforming models—as an example of how the company will bid for PCA and F/A-XX.

The "BT-X" trainer brings together technologically mature subcomponents in a high-performance fuselage that is optimized by design for producibility. Phantom Works chief Darryl Davis told reporters during the aircraft's unveiling last September that the T-X clean-sheet requires far less touch labor than traditional military aircraft, and the design is mature enough to roll straight into assembly without a drawn out engineering and manufacturing development program.

T-X is a $16 billion Air Force program to replace the Northrop T-38 Talon. Boeing and Saab joined forces to capture the 350-aircraft order in 2013. The service published its requirements in March 2015, and the first Boeing/Saab model took flight from Boeing's fighter facility in St. Louis one year and nine months later, on Dec. 20, 2016.

Bujold tells Aviation Week that T-X is an incremental innovation, bringing together the latest aircraft and training technology available within the military supply base in a quick and risk-managed way. Spooked by the high cost and protracted development of the Lockheed Martin F-22 and F-35 stealth fighters, the government is approaching PCA and F/A-XX cautiously.

Boeing sees demand shifting in favor of high-speed future fighter production programs with low technical risk over exotic "next-generation" designs. It also sees some subsystem upgrades to current-generation aircraft—such as mission systems, sensors, and electronic warfare suites, among others— being carried forward into future airframes.

"No one is comfortable anymore with long development programs or unaffordable single-shots," Bujold says. "There's been a notion until recently that the next one always has to be so much better than the last one because you're only going to get a shot at it every decade-and-a-half. Many of our customer communities are done with that."

Air Combat Command is especially disenchanted with long development programs. It took 14-15 years to go from contract to initial operational status for the F-22A and F-35A. Since the F-22 Advanced Tactical Fighter development contract was awarded in 1991, the service has averaged about 20 aircraft per year. Its last fourth-generation Boeing F-15 and Lockheed F-16 orders were delivered in 2004 and 2005, respectively. The Air Force says it must now begin buying fighters at a rate of 100 aircraft per year to begin rejuvenating its legacy inventory, which averages 27-28 years old.

The Air Force is considering whether to remove its 235 remaining Boeing F-15C Eagles as it brings PCA online because of the high structural life extension cost. The F-22 could assume the F-15's homeland defense role, while PCA assumes the F-22's combat duties. But Boeing is not so sure, saying the F-15C is still a viable asset and has "lots of runway in front of it" with upgrades.

"It's not 'either-or,' it's 'and'," Bujold says. "Our focus is to deliver PCA as a purpose-built aircraft while at the same time updating, modernizing and responding to customer needs on the platforms they've already got in their inventory.

"The Eagle is an essential part of the dominance and air superiority for the U.S. To the extent [that] current capability cannot evolve to address the threats, we can backfill it with technology plays like Penetrating Counter-Air."

The F-35C Lightning II has been designed to stop the buying of new Boeing F/A-18 Super Hornets already. But loading orders continue because the carrier-based F-35C Lightning II variant is taking longer to develop and deliver than expected. It will not be fielded in operationally significant numbers until the early 2020s.

The F-35C succeeds the Navy's legacy F/A-18A/B/C/D Hornets, and F/A-XX could someday replace the F/A-18E/F and its EA-18G Growler electronic warfare variant. Boeing still sees an enduring place for the F/A-18E/F Super Hornet and is now pitching an advanced Block III version to keep the line going.

Boeing will not provide details about its future fighter concepts, citing security classification and the competitive environment. Nor would it release any details about future weapons concepts, other than to say cyber resilience and GPS independence are key technology focus areas.

Phantom Works confirms it is developing clean-sheet aircraft designs, as well as Super Hornet and Eagle upgrade packages.

The company's F-22 Raptor mission systems will work in play, but Bujold says life-cycle costs and low technical risk will be key discriminating factors in Boeing's bid, as well as its manufacturing prowess.

"Economic quantities are beneficial in some respects, but we've also looked at strategies to gain affordability and not just rely on huge economic quantities," he says. "I think we're in a great position."

<S><C><I><E><N><C><E>

SPACEX TO LAUNCH FALCON HEAVY WITH TWO 'FLIGHT-PROVEN' BOOSTERS THIS YEAR

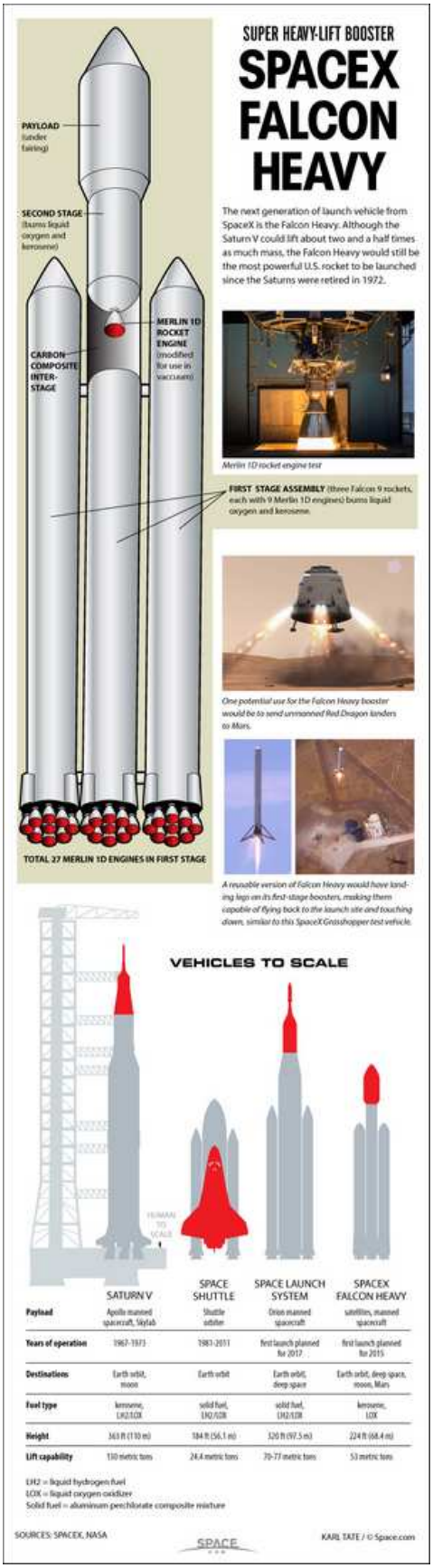
By Caleb Henry, Space News | April 4, 2017 04:00pm ET
http://www.space.com/36338-spacex-falcon-heavy-will-launch-flight-proven-boosters.html

WASHINGTON — SpaceX plans to conduct the debut launch of the Falcon Heavy rocket this summer using two boosters that have already flownon other missions, SpaceX Founder and Chief Executive Elon Musk said March 30.

Speaking after the company's success in launching its first pre-flown first stage with the SES-10 satellite aboard, Musk said SpaceX has worked out most of the challenges associated with getting three Falcon 9 cores to fly together — a task that has proven much more complex than it originally appeared.

SpaceX Falcon Heavy concept art. Credit: SpaceX

"Falcon Heavy is one of those things that at first it sounded easy," Musk said. "We'll just take two first stages and use them as strap-on boosters. And like, actually no, this is crazy hard, and required a redesign of the center core, and a ton of additional hardware. It was actually shockingly difficult to go from a single core to a triple-core vehicle."



SpaceX's Falcon Heavy rocket is a heavy-lift booster that will be the largest, most powerful privately built rocket in history. See how SpaceX's Falcon Heavy rocket will work in this Space.com infographic. Credit: By Karl Tate, Infographics Artist

Falcon Heavy is designed to lift more than 54 metric tons to low Earth orbit, 22 metric tons to geostationary transfer orbit, or 13.6 metric tons to Mars. When SpaceX first revealed the Falcon Heavy in 2011, the company anticipated a first mission in 2013, but complexities in getting the vehicle to work, combined with delays from two Falcon 9 failures, dragged out that timeline.

"Our expectation is probably a late summer launch of Falcon Heavy," he said.

Musk tweeted March 31 that SpaceX is also considering trying to retrieve the Falcon Heavy demo flight's upper stage for full reusability. The probability of success is low, he said, but could be worth trying anyway. Yesterday Musk mentioned trying to return the second stage from Falcon 9 missions as well, and as an added bonus from the SES-10 mission, already accomplished a surprise recovery of the Falcon 9 payload fairings.

The first stages reused in the Falcon Heavy's tentative 2017 debut will go towards SpaceX's plan to refly about six boosters this year.

"For Falcon Heavy, two of the side boosters are pre-flown boosters, so that alone will be two cores right there," Musk said.

SES is considering using two more "flight-proven" Falcon 9 rockets this year, which would fulfill five of the six reusable rocket missions SpaceX is gunning for, according to SES Chief Technology Officer Martin Halliwell.

Halliwell said SES has three more launches with SpaceX this year, and is willing to use flight proven rockets again to help normalize the concept of using reusable launchers.

"My belief is that within 24 months, people like SpaceX, or SpaceX specifically, will offer a service to orbit, and it will be irrelevant," Halliwell said. "It will be irrelevant if it's new or if it's pre-flown — it will be irrelevant within 24 months."

Musk said the rocket cores for Falcon Heavy's first flight are two to three months away from completion. He emphasized that the first launch will carry a lot of risk, and as such, SpaceX doesn't plan to carry a valuable payload or payloads with it.

"We will probably fly something really silly on Falcon Heavy because it is quite a high risk mission," he said.

SpaceX will seek to recover all the boosters from the first Falcon Heavy flight, assuming all goes according to plan. Musk said the two side boosters would land back at Cape Canaveral Air Force Station, followed by the center core returning to a drone ship in the Atlantic.

SpaceX anticipates having Cape Canaveral's Space Launch Complex-40 — the pad damaged in the September 2016 explosion of a Falcon 9 during a fueling procedure — operational again before launching Falcon Heavy. SpaceX needs to exercise this caution because were a Falcon Heavy launch to go awry from Pad 39A, the company would be out of launch sites in Florida. Musk said SLC-40 would serve as the go-to location for Falcon 9 missions, and SpaceX would keep Falcon Heavy launches at Pad 39A.

Musk also said SpaceX is prioritizing fulfilling launch commitments to its backlog, which is mainly waiting on Falcon 9 missions. A number of those customers have faced protracted delays and some, such as Spaceflight Inc., have sought alternative launchers after the wait became too much to bear.

SpaceX does have customers for Falcon Heavy as well. The U.S. Air Force, Intelsat, Inmarsat, ViaSat and Arabsat all booked Falcon Heavy missions, though Inmarsat and ViaSat have since sought alternative rides. ViaSat switched its ViaSat-2 satellite to a mid-2017 Arianespace Ariane 5 launch. Inmarsat reserved a Proton launch as a backup for Europasat/Hellas-Sat-3, a condo-satellite split between Inmarsat and Greek satellite operator Hellas Sat, the latter of which is a subsidiary of Saudi Arabia-based Arabsat.

Currently both Arianespace and Proton's commercial services provider, International Launch Services (ILS), are experiencing delays of their own. Arianespace has been unable to launch for nearly two weeks due to territory-wide protests in French Guiana where it launches. Russia's Proton rocket has been grounded since late 2016 due to quality control issues with second and third stage engines, and is not expected to return to flight until May. Although Inmarsat had reserved a 2017 ILS launch, delays with Proton have pushed that mission back too. ILS's commercial manifest for 2017 includes three commercial missions: one for EchoStar, one for AsiaSat and one for Hispasat.

This story was provided by SpaceNews, dedicated to covering all aspects of the space industry.

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SPACEX GAINING SUBSTANTIAL COST SAVINGS FROM REUSED FALCON 9

by Jeff Foust — April 5, 2017
http://spacenews.com/spacex-gaining-substantial-cost-savings-from-reused-falcon-9/#sthash.Gc1rjcbb.dpuf

"Looking forward for reusability, we don't believe it really, really counts unless you can turn it around rapidly, or almost as rapidly, as you turn around an aircraft," SpaceX President Gwynne Shotwell said Wednesday at the 33rd Space Symposium. "Our challenge right now is to refly a rocket within 24 hours. That's when we'll really feel like we've got reusability right." Credit: Tom Kimmell

COLORADO SPRINGS — SpaceX saw significant cost savings by reusing a Falcon 9 first stage in a launch last week, a key factor for the economic viability of reusable launch vehicles.

SpaceX President Gwynne Shotwell, speaking at the 33rd Space Symposium here April 5, said the company expects to see greater cost savings on future launches of reused Falcon 9 vehicles as the company reduces the amount of refurbishment work it does on the recovered stages.

SpaceX's first previously flown Falcon 9 booster lands after launching SES-10. Credit: SpaceX

Shotwell did not give a specific figure for the cost of refurbishing a Falcon 9 first stage that first flew on an April 2016 launch of a Dragon cargo spacecraft so it could launch the SES-10 communications satellite March 30. "It was substantially less than half" the cost of new first stage, she said.

That cost savings, she said, came even though SpaceX did extensive work to examine and refurbish the stage. "We did way more on this one than we're doing on future ones, of course," she said.

The company's long-term goal for first stage refurbishment is to turn the stage around within 24 hours for another launch. "Looking forward for reusability, we don't believe it really, really counts unless you can turn it around rapidly, or almost as rapidly, as you turn around an aircraft," she said. "Our

challenge right now is to refly a rocket within 24 hours. That's when we'll really feel like we've got reusability right."

That rapid and low-cost turnaround is critical as SpaceX seeks to recoup the large investment it has made in reusability. At a press conference after the March 30 SES-10 launch, SpaceX Chief Executive Elon Musk estimated the company had spent at least $1 billion on reusable launch vehicle technologies to date.

"We do have to figure out some way to pay off the development costs of reusability," he said, noting that the company was still working to determine how much of a discount to offer for missions using a "flight-proven" stage. "The price savings can't be as much as the cost savings because we need to repay the massive development costs."

"Imagine if you had $6 million in cash in a pallet flying through the air, and it was going to smash into the ocean. Would you try to recover that? Yes, yes you would." — Elon Musk

In addition to reusing the first stage, SpaceX is also attempting to recover and, eventually, refly the payload fairing. Musk revealed at the March 30 briefing that the company made its first attempt to recover the two halves of the payload fairing used on the SES-10 mission, recovering at least one of the two sections.

"We are planning on recovering the fairings. They're actually quite expensive," Shotwell said. She confirmed SpaceX recovered one payload fairing section, but was not certain if the company found the other.

"It looked pretty good," she said of the recovered fairing section. "You'll see more fairing recoveries as we go this year."

Musk said at last week's briefing that each payload fairing costs about $6 million. "At one point we were debating if we should try to recover it or not," he said. "Imagine if you had $6 million in cash in a pallet flying through the air, and it was going to smash into the ocean. Would you try to recover that? Yes, yes you would."

Shotwell said she believed an industry skeptical of SpaceX's efforts to reuse Falcon 9 boosters had become convinced it would be useful. She recalled a quote from science fiction author Arthur C. Clarke describing the three stages of reactions to revolutionary ideas. "'It's completely impossible.' We've heard that for 15 years. 'It's possible, but not worth doing.' We're still hearing that a little bit," she said."

"But," she added, "we're also starting to hear, 'I said it was a good idea all along.'"

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GOLDMAN SACHS HOPES TO BUILD AN 'ASTEROID-GRABBING SPACECRAFT' TO MAKE BILLIONS FROM MINING PRECIOUS METALS

*** Company report says a 'psychological barrier' is stopping us from space mining**

*** But it notes an asteroid-grabbing spacecraft could be built for $2.6bn (£2.1bn)**

*** Precious metals and minerals found on asteroids could be worth quadrillions**

By Daisy Dunne For Mailonline. 6 April 2017
http://www.dailymail.co.uk/sciencetech/article-4386462/Goldman-Sachs-hopes-build-asteroid-grabbing-spaceship.html

Bankers from Goldman Sachs hope to build an 'asteroid-grabbing spacecraft' to make billions from mining space metals.

The celestial objects are thought to be loaded with tonnes of precious metals and minerals, including pricey platinum, worth quadrillions on Earth.

A 98-page report from the banking investment company claims that mining asteroids for precious metals in the near future is a 'realistic' goal.

Bankers from Goldman Sachs hope to build an 'asteroid-grabbing spacecraft' to make billions from mining space metals (stock image)

TOP FIVE ASTEROID MINING PROSPECTS
*** 162385 (2000 BM19) - Profit: $6.94trillion**
*** 4034 Vishnu - Profit: $5.28trillion**
*** 65679 (1989 UQ) - Profit: $1.74trillion**
*** 5143 Heracles (1991 VL) - Profit: $2.33trillion**
*** 7753 (1988 XB) - Profit: $1.31trillion**

Source: Asterank

'While the psychological barrier to mining asteroids is high, the actual financial and technological barriers are far lower,' the report reads, according to Business Insider.

'Prospecting probes can likely be built for tens of millions of dollars each and Caltech has suggested an asteroid-grabbing spacecraft could cost $2.6bn.'

Nasa has also expressed an interest in finding mineral-rich asteroids.
In January, it announced plans to find 16 Psyche, one of the most mysterious objects in our solar system.

16 Psyche is located in the large asteroid belt between Mars and Jupiter, and may have started as a planet, before it was partially destroyed during the formation of the solar system.

*** Meet the Nasa astronauts who believe that ALIENS are real...World's fastest battery-powered plane breaks the world...Astronomers discover a MONSTER galaxy which formed 'like a...Hey Alexa, change the channel! Amazon's Fire TV Stick allows...**

16 Psyche is one of the most mysterious objects in our solar system and is thought to hold metals worth quadrillions (artist's impression)

16 PSYCHE

16 Psyche is located in the large asteroid belt between Mars and Jupiter, and may have started as a planet, before it was partially destroyed during the formation of the solar system.

Now, it is a 130 mile (200km) wide chunk of metal, made up of iron, nickel and a number of other rare metals, including gold, platinum and copper.
If the asteroid could be transported back to Earth, the iron alone would be worth $10,000 quadrillion (£8,072 quadrillion).

In comparison, all the money on Earth is thought to be worth $60 to $75 trillion.
Now, it is a 130 mile (200km) wide chunk of metal, made up of iron, nickel and a number of other rare metals, including gold, platinum and copper.

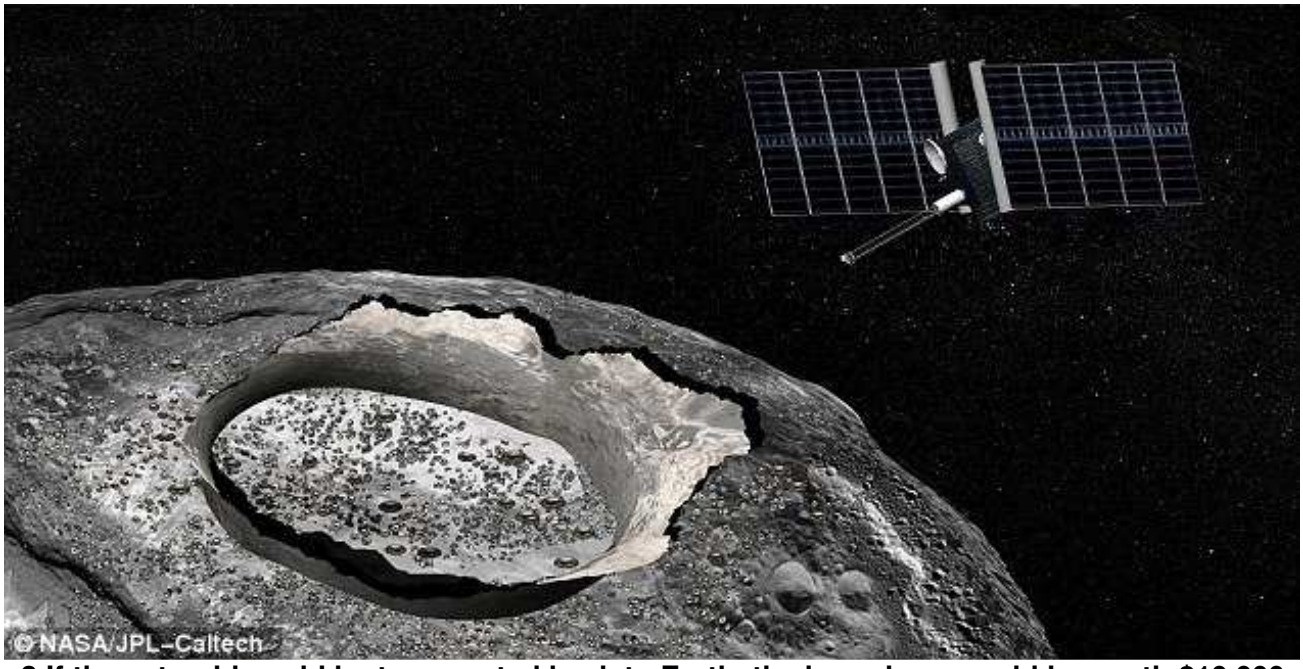
Lindy Elkins-Tanton the lead scientist on the Nasa mission and the director of Arizona State University's School of Earth and Space Exploration, said: '16 Psyche is the only known object of its kind in the solar system, and this is the only way humans will ever visit a core.

'We learn about inner space by visiting outer space.'

If the asteroid could be transported back to Earth, the iron alone would be worth $10,000 quadrillion (£8,072 quadrillion).

In comparison, all the money on Earth is thought to be worth $60 to $75 trillion.

Experts have warned that its value would be large enough to destroy commodity prices and cause the world's economy to collapse.



+3 If the asteroid could be transported back to Earth, the iron alone would be worth $10,000 quadrillion (£8,072 quadrillion). Pictured is an artist's impression

But that hasn't stopped a number of other companies besides Goldman Sachs from expressing their interest in mining asteroids.

Start-up firm Deep Space Industries intends to launch a fleet of unmanned ships to intercept small asteroids as they speed past our own planet, possibly finding metals such as platinum.

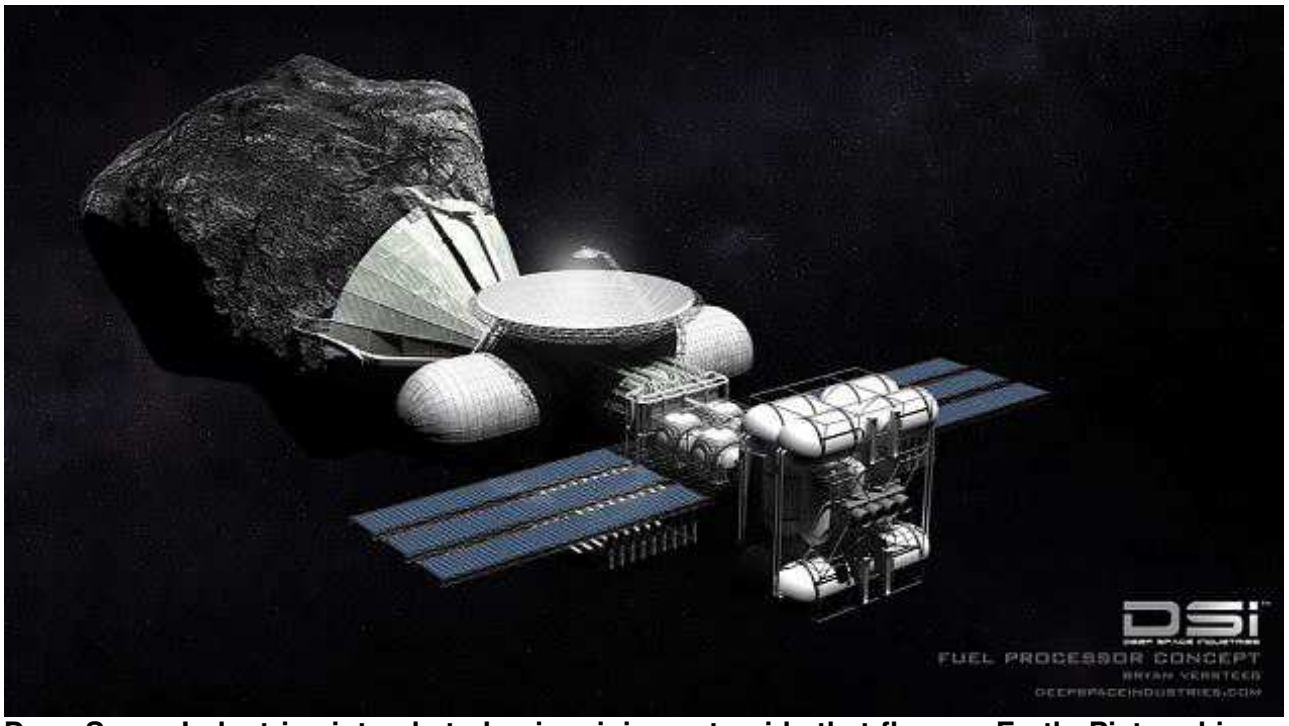
'Deep Space Industries is an asteroid mining company, developing the technologies to find, harvest, and supply the asteroid resources that will transform the space economy,' the firms website reads.

A concept for a spacecraft to harvest fuel from asteroids: The company joins a host of other start-up firms which hope to soon exploit the untapped resources of near-Earth objects

Chief executive David Gump, who produced the first ever TV commercial shot on the International Space Station, said: 'Using resources harvested in space is the only way to afford permanent space development.

'More than 900 new asteroids that pass near Earth are discovered every year.
'They can be like the Iron Range of Minnesota was for the Detroit car industry last century – a key resource located near where it was needed.

'In this case, metals and fuel from asteroids can expand the in-space industries of this century. That is our strategy.'



Deep Space Industries intends to begin mining asteroids that fly over Earth. Pictured is an artist's impression of an asteroid-grabbing spacecraft

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TILTROTOR TRIALS, TRIBULATION AND TRAGEDY

Leonardo believes the AW609 could give it decade-long market lead among high-speed civil rotorcraft

Mar 13, 2017Tony Osborne | Business & Commercial Aviation
http://aviationweek.com/technology/tiltrotor-trials-tribulation-and-tragedy?NL=BCA-01&Issue=BCA-01_20170407_BCA-01_293&sfvc4enews=42&cl=article_2&utm_rid=CPEN1000001477803&utm_campaign=9470&utm_medium=email&elq2=201ece62686a48558606cce4645312ae

This article, originally published on Feb 24, appears in the March 2017 issue of Business & Commercial Aviation with the title "Tiltrotor Trials, Tribulation and Tragedy."
RELATED MEDIA

There is something undeniably alluring about the prospects of tiltrotor flight. The ability to fly long distances at turboprop speeds without the need of a runway at either end presents an attractive proposition for people whose time really is money.

Yet, 14 years after its first flight, and more than two decades since program launch, the Leonardo Helicopter (formerly AgustaWestland) AW609 commercial tiltrotor has yet to achieve certification, let alone enter operation. Its development has swallowed hundreds of millions of dollars, resulted in two joint-venture divorces and cost the lives of two test pilots.

The first prototype, AC1, is now flying in Italy after being transferred from the U.S. following the crash of the second prototype in October 2015.

But certification of the pressurized, nine-passenger aircraft boasting a 275-kt. max speed — now targeted for mid-2018 — could be game-changing for the world of rotary-wing flight and give the Italian manufacturer as much as a decade-long lead against any future high-speed vertical-lift competition.

Born initially as a joint venture between Bell and Boeing in 1996, the Model 609 was to be a 16,000-lb. civilian spinoff from that partnership's V-22 Osprey military tiltrotor and Bell's XV-15 test aircraft that preceded it. Bell took a leading share of the civil program, and company officials forecast sales of up to 1,000 aircraft over 20 years. But in March 1998, Boeing withdrew as a partner, forcing Bell to find another company to share the risk. Its search took it to Europe, where Italy's Agusta, a company that had worked closely with Bell for decades, was willing to invest.

The new partnership was announced at the 1998 Farnborough Airshow and a new company, the Bell/Agusta Aerospace Co. (BAAC), was created to push the renamed BA609 program forward, and slightly trailing that of the V-22.

But it was never supposed to take this long.

When the program was launched in 1996 first flight was envisaged for 1999, and deliveries planned for 2001. But the BA609 didn't take to the air until March 2003, and another two years passed before the aircraft finally flew in airplane mode. And even with those milestones achieved, Bell was having doubts about the market for the civil tiltrotor. Indeed, executives at Textron, Bell's corporate parent, had reportedly tried to pull the plug on the program before first flight. With enthusiasm cooling in the Bell camp, friction developed between the two partners.

Concurrently, problems with the more important V-22's development were also weighing heavily on the BA609 project. By 2008, and with the global financial crisis biting hard, development work on the civil tiltrotor was grinding to a standstill, and managers at Bell in particular were growing increasingly convinced that the aircraft would not be a commercial success, a view arguably held by the American firm's management to this day.

AW609 CHARACTERISTICS

Propulsion		
Powerplant	2 x PWC PT6C-67A	
Weight		
MTOW	8-ton class	18,000 lb class
Useful load	up to 2,860 kg	up to 6,300 lb
Capacity		
Crew / Passengers	2/9	2/9
Fuel		
Fuel Load (std tank)	1,166 kg	2,571 lb
Performance		
Max Cruise Speed	510 km/h	275 kt
Hover OGE (ISA)	1,828 m	6,000 ft
Service Ceiling (ISA)	7,620 m	25,000 ft
Maximum range - std/aux fuel tanks	1,389 km/1,852 km	750 nm/1000 nm

Primary certification Authority: FAA /Federal Aviation Administration
Powered Lift Category - Tiltrotor Class Aircraft

Unwilling to see the program slip further, Agusta, then AgustaWestland and now Leonardo Helicopters, began negotiating with Bell to take the program off the latter's hands. Details of the early negotiations slipped out in 2009, but it was not until 2011 when the then-CEO, Giuseppe Orsi, revealed at Heli-Expo that the two companies were in final negotiations for the Italian firm to purchase the program outright, something that Bell was not keen to disclose. A deal was finally inked at that year's Paris Air Show and cleared all regulatory hurdles five months later.

The sale gave Bell the option to use the proceeds to improve the V-22, which has since become a key platform of U.S. Marine Corps aviation, and the Fort Worth manufacturer is now firmly invested in tiltrotor as the solution to the U.S. Army's Future Vertical Lift needs with the development of the V-280 Valor. In addition, Bell continues to be a supplier to the AW609 program and will take a limited royalty from sales. Notably, as part of the agreement, Leonardo cannot produce an armed military version of the aircraft.

Protytype 3 is seen here being assembled in Italy. It is due to begin flight testing in Philadelphia, Pennsylvania, shortly.

Today, the commercial tiltrotor is Leonardo's flagship product. In a May 2016 presentation to the Italian government, CEO Mauro Moretti revealed that the company was set to spend more than €400 million ($419 million) on the program between 2016 and 2020. The next closest investments by the company were for its M345 jet trainer and production improvements on composite structures for Boeing 787 production, each priced at just over €150 million ($157 million).

Leonardo Helicopters CEO Daniele Romiti claims that despite delays to AW609 certification, achieving that in 2018 could give the company a 10-15-year lead over the competition. The nearest manufacturer perhaps is Airbus with its X3 (X-cubed) technology, currently being adapted for a European Union Clean Skies 2 program called LifeRCraft.

"We have never said we would sell [the AW609] in large numbers," Romiti said in a 2016 interview. "The market has to be made ready to accept this innovative architecture."

He went on to note the aircraft was sized to operate out of existing helipads and landing sites — "the benefit of the dimensions."

The general configuration of the aircraft has changed little since the first mock-ups made their trade show debuts in the early 2000s. A long, narrow pressurized fuselage with a T-tail rudderless vertical stabilizer, the AW609 has a high-set, slightly forward-swept 34-ft.-long main-wing with a Pratt & Whitney Canada PT6C-67A mounted on both wingtips, which swivel from 95-deg., or just beyond vertical, to a horizontal position for forward flight. The engines, which feature full authority digital engine controls (FADECs), are interconnected mechanically to allow either to drive the other in the event of a failure. Each engine turns a 26-ft.-diameter prop rotor with a variable-pitch system capable of pitching the blades for horizontal and vertical flight. The aircraft is roughly the same length as the company's AW139, twin-engine medium helicopter with a maximum gross weight of 18,000 lb.

Prototype 3 undergoing ground runs before it was sent to the U.S.

The AW609 prototypes are equipped with Rockwell Collins Pro Line 21 avionics suites, but production aircraft will be fitted with the Pro Line Fusion system featuring 14-in. touch-screen displays and integrated FMS with satellite-based navigation, synthetic and enhanced vision, and head-up display interfaces.

The avionics are integrated with the aircraft's fly-by-wire (FBW) flight control system, allowing the AW609 to be flown with conventional helicopter controls even while in horizontal flight. The engine nacelles are controlled with a thumbwheel on the collective. The nacelles move at 3 deg. per second but can rotate faster — up to 8 deg. per second — in an emergency. The aircraft is designed to be flown single pilot.

The pressurized cabin can seat up to nine people comfortably but could potentially be configured for missions other than passenger transport.

Over the course of the aircraft's development, engineers have introduced a series of drag and weight reduction measures including a new vertical stabilizer with part of the trailing edge removed, as well as a new tail cone. The shape of the engine exhaust nozzles was altered to a more oval, rather than square, shape and the rotor spinners were enlarged. These changes reduced drag by 10%, the company said.

The benefits of the tiltrotor are obvious, if customers can justify the cost, now estimated at $25 million to $26 million per unit. During 2015, the manufacturer demonstrated the AW609's capability by flying between company sites in England and northern Italy, a distance of 540 nm (1,000 km), in 2 hr., 18 min. at a cruising altitude of 25,000 ft. Leonardo claims that the tiltrotor comfortably beats the combination of car, helicopter and business jet on the same journey by 30-50%. The addition of an auxiliary fuel tank system positioned on the wing near the nacelles could extend maximum range up to 1,100 nm (2,000 km) or fly six passengers over a range of 800 nm (1,482 km) in a little over 3 hr. This has been driven by the request of some customers to fly from helipads in New York to Bermuda, an overwater distance of roughly 670 nm (1,244 km).

Three organizations are now studying the practicality of the tiltrotor as a business case. Bristow, which supports the offshore oil and gas industry, was the first to sign a joint development agreement in February 2015 to examine the potential role of the AW609 as well as the larger, more advanced tiltrotors that the manufacturer wants to develop in the future. The company's internal studies, presented in London last April, showed that tiltrotors could eliminate the need to transfer passengers from fixed-wing airliners to helicopters, and fly oil workers to offshore platforms or remote locations directly from major airports.

As an example, one current contract requires a Boeing 737 to fly oil workers between Fairbanks and Deadhorse, Alaska, where they transfer to helicopters for transport to drilling facilities in the Beaufort Sea. But a tiltrotor could fly the entire journey from Fairbanks to the rigs in one hop. In addition, the studies show that tiltrotors could fly to every rig in the Gulf of Mexico directly from Houston, potentially negating the need for the numerous coastal helicopter bases that now support operations in the region.

"Flying up at 18,000 to 25,000 ft. means you are away from congestion of other aircraft flying around the platforms. This means reduced mission, costs, time and risk and enables more productive days," Russell Gould, director of global fleet support at Bristow, told the Royal Aeronautical Society.

Although best known for its oil and gas support services, Era Group also signed a joint development agreement on the tiltrotor to look at the aircraft's potential for providing emergency medical care to high-net-worth individuals. The review focused on markets like

India where poor ground infrastructure could slow the transport to hospitals in an emergency.

And then at the 2015 Dubai Airshow, the United Arab Emirates Joint Aviation Command (JAC) signed for three aircraft to support the country's new National Search and Rescue Center. The goal is to provide critical healthcare within the so-called "Golden Hour," the short period of time when a patient's chances of survival are greatest if given care after a severe injury.

In addition, Leonardo has been studying the potential of a search and rescue capability for the AW609 for several years. Despite the aircraft's relatively small cabin, the company has looked at developing a two-panel door operable in flight, with the upper part containing the hoist needed for rescues over water or inhospitable terrain. The AW609's speed and radius of action means it can respond faster and at longer distances than conventional helicopters, flying over the weather and then descending to the rescue area. The tiltrotor's productivity would also be higher, which means fewer would be required to provide the same coverage as multiple helicopters.

Of the development partners, only the UAE Joint Aviation Command is known to have signed a firm purchase agreement for the aircraft, with options for another three. But little is known about the other customers who have signed up. As far back as 2001, Bell/Agusta Aerospace Co. was claiming 80 agreements had been signed, but that number has dropped to 60, according to Leonardo. Several have been ordered by wealthy individuals, with reports that one is destined to service a mega-yacht. Strategy documents by the Italian armed forces and its public agencies have also listed tiltrotors as a capability high on their shopping lists.

"This is the new frontier . . . and the number of people believing in this is increasing," Romiti said.

But there are still many hurdles for the AW609 to overcome, the tallest being certification, and the nature of the aircraft demands a new category of oversight: the FAA's Powered Lift category, which calls for the AW609 to meet elements of both FAR Part 25, the airworthiness standards for fixed-wing aircraft, and Part 29, which governs rotorcraft. These requirements have put significant pressure on the development program, forcing test pilots to explore areas of the flight envelope that even after more than 50 years of tiltrotor experience — involving the V-22, XV-15 and the XV-3 —are full of unknowns.

This examination has included recovery from the phenomenon of vortex ring state, or settling with power where the rotor system no longer generates lift, as well as autorotation, and one-engine- and all-engine-inoperative flight states. Leonardo made several requests to the FAA to exempt the aircraft from various requirements to reflect the tiltrotor's unique design.

Then in October 2015, tragedy hit the program when the second prototype, AC2, crashed near the town of Varese in northern Italy, claiming the lives of veteran test pilots Herb Moran and Pietro Venanzi. Eyewitness reports claimed the aircraft was on fire before it hit the ground. The manufacturer immediately halted flight testing. A full and final report from the Italian air accident investigation board, the ANSV, is yet to be published.

An interim report posted in June 2016 by the ANSV revealed that the aircraft had begun experiencing oscillations as it entered a high-speed flight regime, required as part of the certification testing. When the pilots attempted to correct the oscillations, the AW609's flight control system tried to compensate and inadvertently generated a phenomenon that investigators called "divergent Dutch roll." The investigators found that the company's simulator was unable to reproduce the phenomenon, and so the condition could not have been predicted. They also urged the manufacturer to review the AW609's flight control laws.

There were other challenges, too. The investigators struggled to recover flight data off the aircraft's combined cockpit voice recorder and flight data recorder, which had been seriously damaged and failed to record some key parameters. However, the recorders' data was confirmed through telemetry sent by the aircraft during the fatal test flight. Early in the investigation, the third prototype, AC3 (whose first flight occurred on Jan. 30 in Philadelphia), was briefly impounded by the authorities.

After flight testing re-commenced at the end of July 2016, the first prototype, AC1, was moved from Arlington, Texas, to Leonardo's facility in Philadelphia where it manufactures the AW119Kx Koala and some AW139s for the North American market. Subsequently that aircraft was transferred to Italy, while AC3 was sent to Philadelphia for flight testing. AC3 will play a critical role in the development of the deicing system and will head for the cold of Minnesota in the coming winter. Part of those tests will involve the AW609 flying behind the U.S. Army's Helicopter Icing Spray System (HISS) CH-47 Chinook test helicopter.

Meanwhile, AC4 is being assembled in Philadelphia and will be the closest to the production standard of the three prototypes, equipped with the Pro Line Fusion avionics, and will ultimately be used for function and reliability tests, maintenance flight and customer demonstrations.

The assembly of AC4 in Philadelphia is giving technicians and engineers there a better idea of how the aircraft will come together when production begins, probably at the end of 2018. A second assembly line will be created later, if needed, at Leonardo's Vergiate, Italy, production facility.

As the AW609 nears its entry into commercial service, the manufacturer is already envisioning a 20-seat civil tiltrotor for delivery in the 2030 timeframe. In addition, it plans to fly a demonstrator to validate five new, evolved tiltrotor technologies in 2023 as part of the European Union's Clean Sky II aerospace technology development program. For Leonardo, the future clearly tilts toward tiltrotors.

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NEW SUPPLY COULD PREVENT DEEP-SPACE PLUTONIUM SHORTAGE

Public-private partnerships may boost available nuclear fuel for space exploration

By Mike Wall, SPACE.com on March 29, 2017
https://www.scientificamerican.com/article/new-supply-could-prevent-deep-space-plutonium-shortage/?WT.mc_id=SA_SPC_20170406

The production of nuclear spacecraft fuel, currently a dwindling resource, could go into overdrive in the early 2020s.

Credit: NASA, JPL-Caltech, MSSS

A public-private partnership led by a company called Technical Solutions Management (TSM) aims to start generating usable amounts of plutonium-238 (Pu-238) — the material that powers deep-space explorers such as NASA's Curiosity Mars rover and New Horizons Pluto probe — by 2022 or so.

This newly unveiled project would complement, not supplant, the Pu-238 production efforts currently underway at the U.S. Department of Energy (DOE), said TSM CEO Billy Shipp.

TSM's work "could establish a redundancy in the production of plutonium; it could potentially increase capacity, if the [NASA] missions needed increased capacity, and as a result, it could minimize the programmatic risk overall to the space program," Shipp, a former director of the DOE's Idaho National Engineering and Environmental Laboratory (now known as the Idaho National Laboratory, or INL), told Space.com.

NUCLEAR-POWERED EXPLORATION

Pu-238 is the key ingredient in radioisotope thermoelectric generators(RTGs), which convert, into electricity, the heat produced by the radioactive stuff when it naturally decays into uranium-234.
Most of NASA's iconic planetary-exploration missions over the decades have depended on RTGs, including the twin Voyager 1 and Voyager 2 probes, the Viking 1 and Viking 2 Mars landers, and the Cassini Saturn orbiter.

The United States used to produce the Pu-238 needed for such spacecraft at the DOE's Savannah River Site in South Carolina, as an offshoot of the facility's weapons work. (Pu-238 is not a bomb-making material, but its close cousin Pu-239 is.)

That production line ceased in 1988, as the Cold War wound down. The U.S. began buying Pu-238 from Russia in 1992 but received its last shipment from Moscow in 2010. Since then, the U.S. stockpile has been shrinking; NASA's allocation is now down to about 77 lbs. (35 kilograms), only half of which is usable in its current state, agency officials have said (though the rest could conceivably be brought up to grade by blending it with newly produced Pu-238).

NASA's current RTG design, known as the Multi-Mission Radioisotope Thermoelectric Generator, requires 10.6 lbs. (4.8 kg) of Pu-238. So, currently, the U.S. has enough Pu-238 to power just three or four more deep-space missions. [Nuclear Generators Power NASA Deep-Space Probes (Infographic)]

PU-238 RESTART—TIMES TWO?

But efforts to avoid a nuclear-fuel shortage are underway.

The DOE recently started a new Pu-238 production program, which manufactured a 1.8-ounce (50 grams) sample of the stuff at the Oak Ridge National Laboratory (ORNL) in Tennessee in late 2015. If everything goes according to plan, this pipeline should begin churning out the amount that NASA has requested — 3.3 lbs. (1.5 kg) of Pu-238 every year — by 2023, DOE officials have said.
TSM's production would supplement that of the DOE , Shipp said.

The company publicly unveiled its plans a few weeks ago, at the Nuclear and Emerging Technologies for Space 2017 conference in Orlando, Florida, but the project has been in the works for several years.

"We have done this project very quietly, because we simply didn't want to have any kind of public pronouncements until we had a confidence level that organizations of this caliber could stand behind," Shipp said.

The organizations he referred to are the key partners in the new Pu-238 production effort: Canadian Nuclear Laboratories (CNL), the DOE's Pacific Northwest National Laboratory (PNNL), and Ontario Power Generation (OPG), a corporation owned by the Ontario government.

Here's how it will work. PNNL has developed new technology for producing "targets" made of neptunium-237, Shipp said. These targets will be shipped to CNL's Chalk River Laboratories in

Ontario, where they will be assembled into reactor bundles. These bundles will then go to OPG's Darlington reactor, where they will be irradiated to generateplutonium-238. Then, the bundles will head back to CNL for disassembly and chemical processing. (The DOE's plutonium pipeline is similarly complex, involving ORNL, INL and Los Alamos National Laboratory in New Mexico.)

OPG reactors already generate cobalt-60, which is used to sterilize surgical and medical equipment. So commercial isotope production is not a foreign concept, Shipp said.

"There are no known showstoppers in this, so we're highly confident from both a regulatory base as well as a technical base that this will go forward," he said.

Indeed, the ball is rolling on the project, which is managed by TSM. (TSM also licensed the PNNL technology.) Two neptunium-237 targets have been built, and they were put into a CNL reactor for qualification purposes this month, Shipp said. One target will stay in for 90 days, and the other will remain for 300 days, he added.

The next phase of the project — which the team aims to start toward the end of this year, if it can raise enough funding — involves qualification of the reactor bundles. Then, the project will develop and demonstrate an overall "flow sheet" of Pu-238 production from start to finish, Shipp said.
If everything goes according to plan, the TSM-led effort could be in production as early as 2022. The process is designed to make 11 lbs. (5 kg) of Pu-238 per year, though yields could nearly double if the customer desired, Shipp said.

That customer would likely be the DOE (and, by extension, NASA), he said, primarily because the neptunium-237 needed to make the targets comes from the U.S. federal government. Shipp also anticipates collaborating with the DOE to some degree on an overall manufacturing strategy.
"Our desire is to have a fully integrated plutonium-238 mission for DOE that we're just a part of," he said.

In addition to making the Pu-238 production system more robust, the TSM-led effort could help the nation rebuild its nuclear-fuel stockpile, potentially enabling increased planetary exploration down the road, Shipp added.

"Our space program is a dynamic program," Shipp said. "We stand really ready to assist the program in how it may evolve." [NASA's 10 Greatest Science Missions]
TALKING TO NASA

Shipp said his team has discussed its plans with NASA informally. Official discussions should begin soon, he added; the group plans to submit a funding proposal to the DOE and NASA to help pay for Phase 2 of its project (qualification of the bundles).

Assuming the current DOE manufacturing effort proceeds as planned, NASA won't face a Pu-238 shortage anytime soon, said David Schurr, deputy director of the space agency's Planetary Science division.

"That's clearly enough through 2030," Schurr told Space.com. (He declined to forecast any further into the future, saying not enough is known yet about NASA's post-2030 plans.)

Schurr voiced theoretical support for adding another player to the Pu-238 pipeline: "Having other reactor sources is a good thing," he said. But he stressed that the DOE, not NASA, is in charge of plutonium production and will therefore have chief responsibility for assessing any proposal by the TSM group.

"At the end of the day, I'm looking for inexpensive ways to get my job

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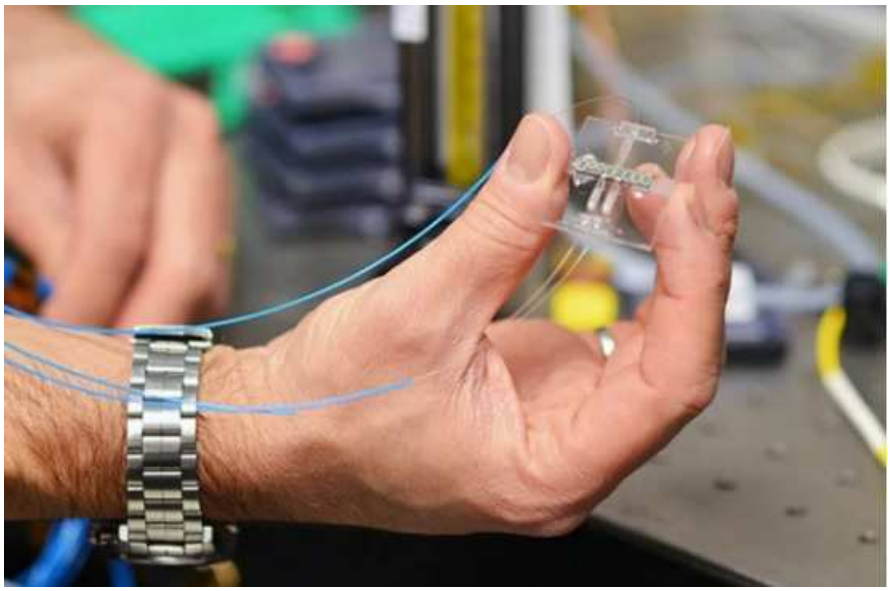
A TINY DETECTION CHIP COULD FIND METHANE LEAKS AUTONOMOUSLY

IBM will soon field-test technology that sees methane leaking from oil and gas well pads

By Annie Sneed on April 5, 2017
https://www.scientificamerican.com/article/a-tiny-detection-chip-could-find-methane-leaks-autonomously/?WT.mc_id=SA_ENGYSUS_20170406



In the next five years, networks of sensors like this miniature silicon chip trace-gas spectrometer will help us "see" and manage environmental pollutants. This sensor design uses IBM's expertise in silicon photonics to detect methane with infrared light brought in via optical fibers. Thousands of sensors can be manufactured on each silicon wafer, allowing large-scale sensor networks at low cost. Credit: IBM Research Flickr

Last week Pres. Donald Trump issued an executive order to pull the nation back from climate change action. One target was methane emission regulations set by the U.S. Environmental Protection Agency and Bureau of Land Management under the Obama administration. The rules require the oil and gas industry to control methane emissions, a powerful greenhouse gas, at its operations. Trump's order directs agencies to reconsider those rules, and possibly rewrite or get rid of them altogether.

Despite Trump's declaration, cities, states and companies still want to stop methane leaks across industry, because the gas worsens global warming and leaks lower revenues. That's why researchers are developing a technology they think may help: a tiny chip to continuously monitor methane emissions.

Although the U.S. releases much less methane than CO2, the former has 25 times more warming potential per pound across a 100-year period. Oil and gas producers emit more of this gas than any other industrial activity in the U.S., and a significant portion of it comes from leaks in equipment at locations like well pads, where drilling and extraction happens. Today the industry uses an expensive, inefficient method to monitor for leaks: infrared cameras, which cost $85,000 to $125,000 and require a human operator. That means companies must send a person to manually scan equipment for escaping gas. "These cameras are expensive, and it takes one to two hours to do a well pad, four to six hours for a compressor station, and it could be a full day for a processing plant," explains Doug

Jordan, corporate environmental program director at Southwestern Energy. "It's very resource-intensive." Companies typically do these checks only once a quarter to once a year. If, say, a piece of equipment starts leaking right after a survey, it might go undetected for months. Furthermore, a camera might only be sensitive enough to catch larger leaks, potentially missing smaller ones.

IBM scientists and engineers, working with researchers at Harvard and Princeton universities, have devised a miniature sensor chip—about five by five millimeters in size—that continuously watches for methane. The sensor, housed on a small silicon wafer, contains a laser and a glass cablethat channels the laser light through it. Some of that light shines outside the cable into the air; when methane molecules waft above the sensor, they absorb a specific wavelength of the light, creating a unique signature. "Our method is designed to detect very small changes in light absorption," explains William Green, manager of the Silicon Integrated Nanophotonics Group at IBM. That information gets fed back to a photodetector on the chip, which converts the signature into an electrical signal. "We map out the absorption and figure out how much methane is there," Green says.

Oil and gas companies would embed a handful of these sensors at various locations around a well pad or compressor station, anywhere from 10 to 100 feet apart. The whole system is wireless, which is critical because oil and gas sites are often remote. When the chips, which continuously monitor the environment, identify a leak, they automatically send that data to IBM's cloud-based computers. The computers rely on physical models that IBM is currently working on, which combine complex dynamics like wind turbulence, humidity, elevation and temperature to determine the methane's origin. The system will also eventually incorporate machine learning to help improve the modeling.

Once IBM's models determine the leak source, companies can immediately send people out to fix it. "One of the advantages is that you're getting alerted real time and it's being time-stamped and geographically identified," explains Norma Sosa, manager of Systems and Technologies for Cognitive IoT at IBM. To make the system even more autonomous and maintenance-free, the sensor system can work off solar power. The research is part of a program funded by the U.S. Department of Energy's Advanced Research Projects Agency–Energy (ARPA–E).

Some commercial tools already exist for methane detection. These include the infrared cameras used by the oil and gas industry as well as individual sensors that rely on the same laser light absorption technique that IBM uses—although the design and make-up of IBM's chip and its smart system are unique. Plus, Green says, methane sensors on the market today are very expensive, large and require a lot of power. "It is impossible to envision deploying a network of [those] sensors, let alone even one such instrument at each well pad for continuous monitoring," he explains. "The cost is just too high." IBM has designed its new methane sensor to be low cost—it is aiming for $200 per chip. That means oil and gas companies could set up a large number of these wherever they need them. "This new breed of chip-scale sensors is really intriguing," says Daniel Zimmerle, director of Colorado State University's Electric Power Systems Laboratory and principal investigator of its Methane Emissions Test and Evaluation Center. "It's untested, but it moves the needle on price."

IBM is currently testing its sensor in-house, and plans to test its data models and related components this summer in Colorado. It is also in discussions to run a pilot test for at least one of Southwestern Energy's well pad sites. IBM envisions other possibilities for this

technology as well. The company says its sensors may one day monitor vehicle exhaust pollutants or water contaminants, detect chemical changes around volcanoes or even analyze someone's breath for disease biomarkers. "That's a vision for the more distant future," Green says.

For now, the researchers will settle for tackling climate change.

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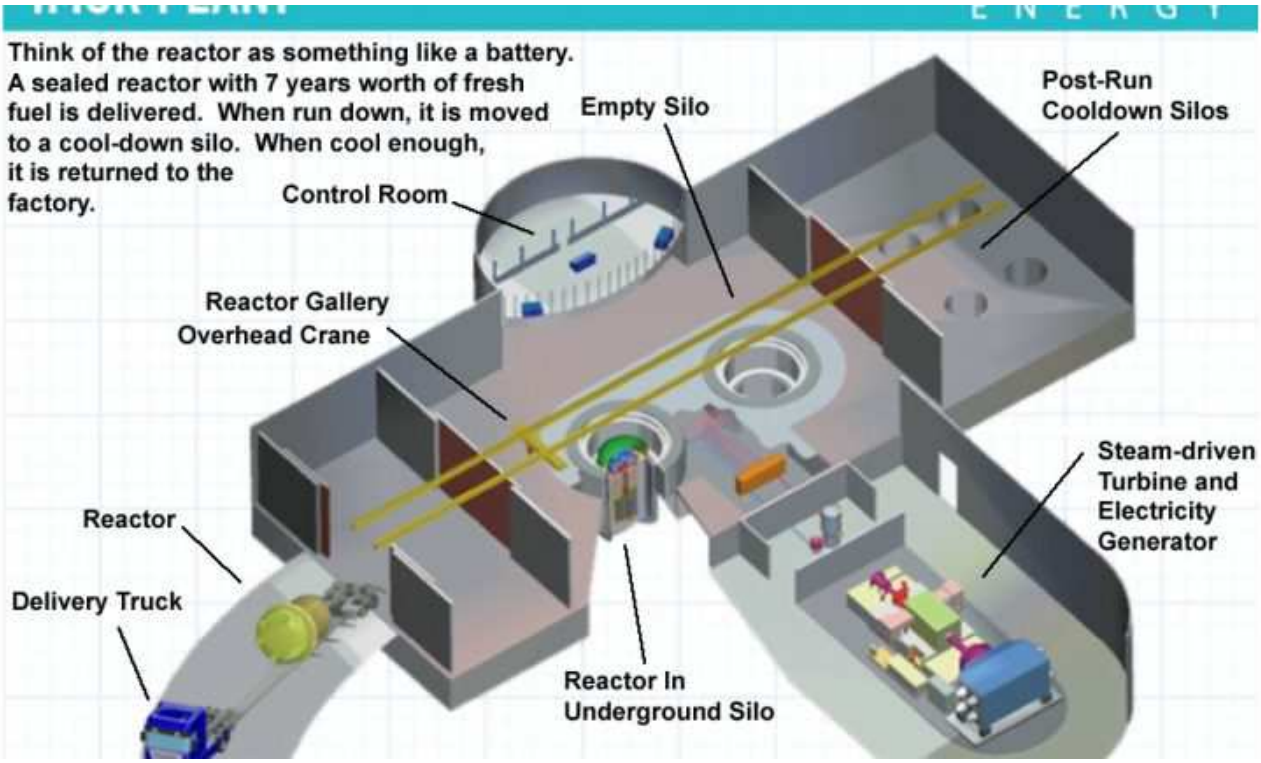
TERRESTRIAL ENERGY MOLTEN SALT REACTOR COULD PASS FIRST REGULATORY PHASE WITHIN FOUR MONTHS

Brian Wang | April 8, 2017
http://www.nextbigfuture.com/2017/04/terrestrial-energy-molten-salt-reactor-could-pass-first-regulatory-phase-within-four-months.html



Terrestrial Energy has entered into the first phase of the reactor regulatory process in Canada by deciding to submit its design for a vendor design review in February 2016. That process, which is scheduled to be completed 18 months after acceptance, is a voluntary step that developers can take to obtain "an overall assessment of the vendor's nuclear power plant design against the most recent CNSC design requirements for new nuclear power plants in Canada."

Terrestrial Energy should complete the Canadian regulatory process for vendor design review within about four months.

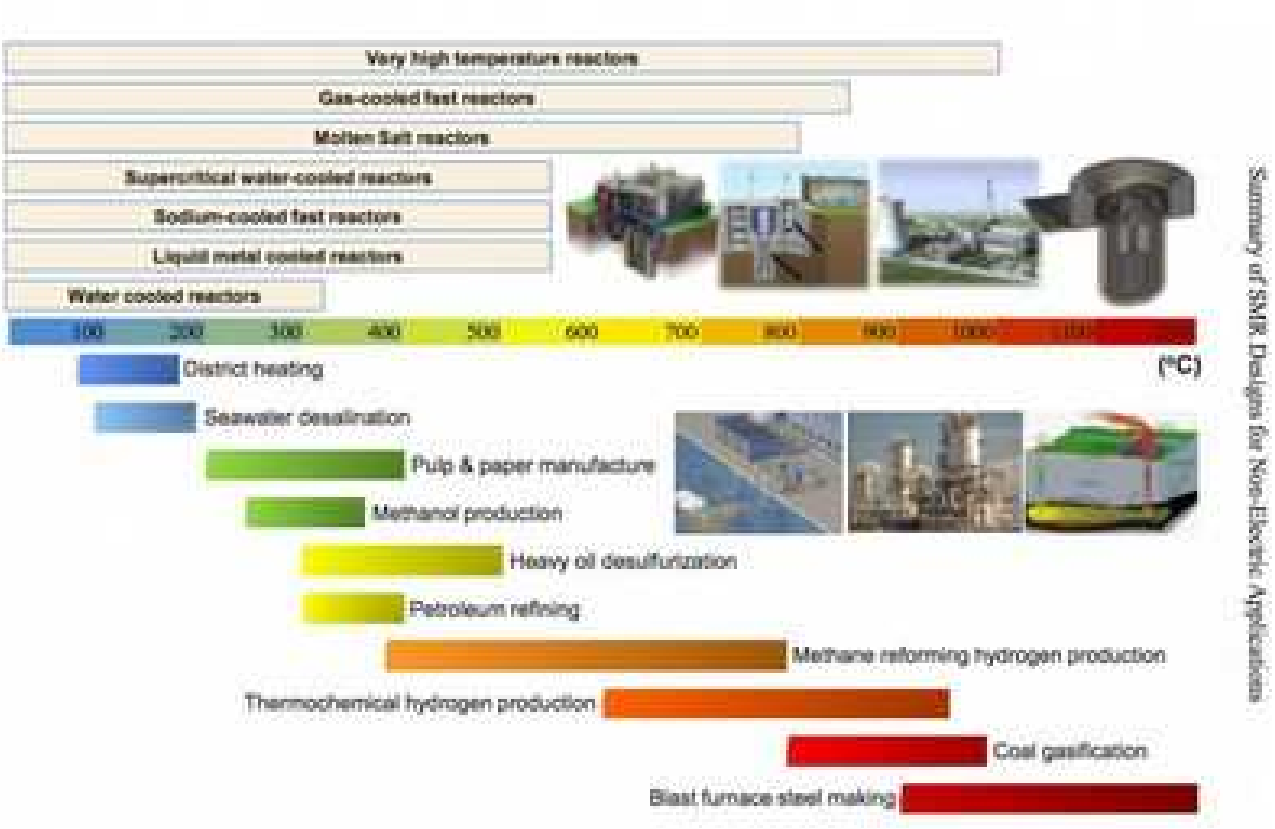
Terrestrial Energy USA has also notified the U. S. Nuclear Regulatory Commission of its intention to submit a design certification application during fiscal year 2019.

Development Milestones

2015	Concept design completed
2016	Start of pre-licencing vendor design review (by Canadian nuclear regulator)
2016	Start of basic engineering phase
Early 2020's	Secure necessary licenses
Early 2020's	Plan construction of a first full-scale NPP in Canada

Terrestrial Energy is in business because it has determined that its advanced small modular reactor, the IMSR, is a "better way to generate heat compared to fossil fuel combustion." Their product is not limited to generating electricity; electric power generation is only one of several different markets for the high quality, 700 ? heat that can be provided by the system's tertiary salt loop. According to Irish's presentation, it is possible for heat customers to be located up to several kilometers from the reactor.

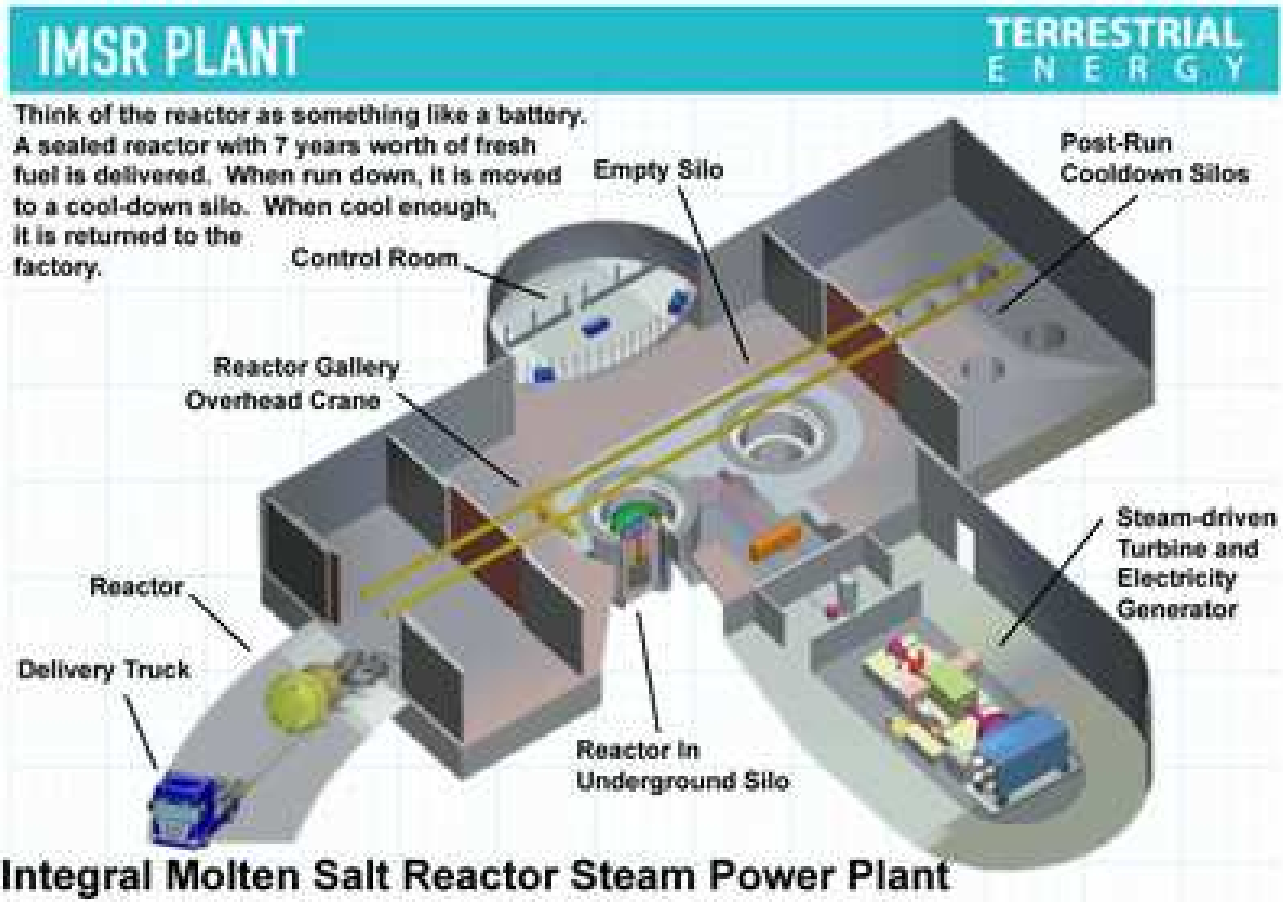
One of the markets where participants have expressed the most interest is in petrochemicals.



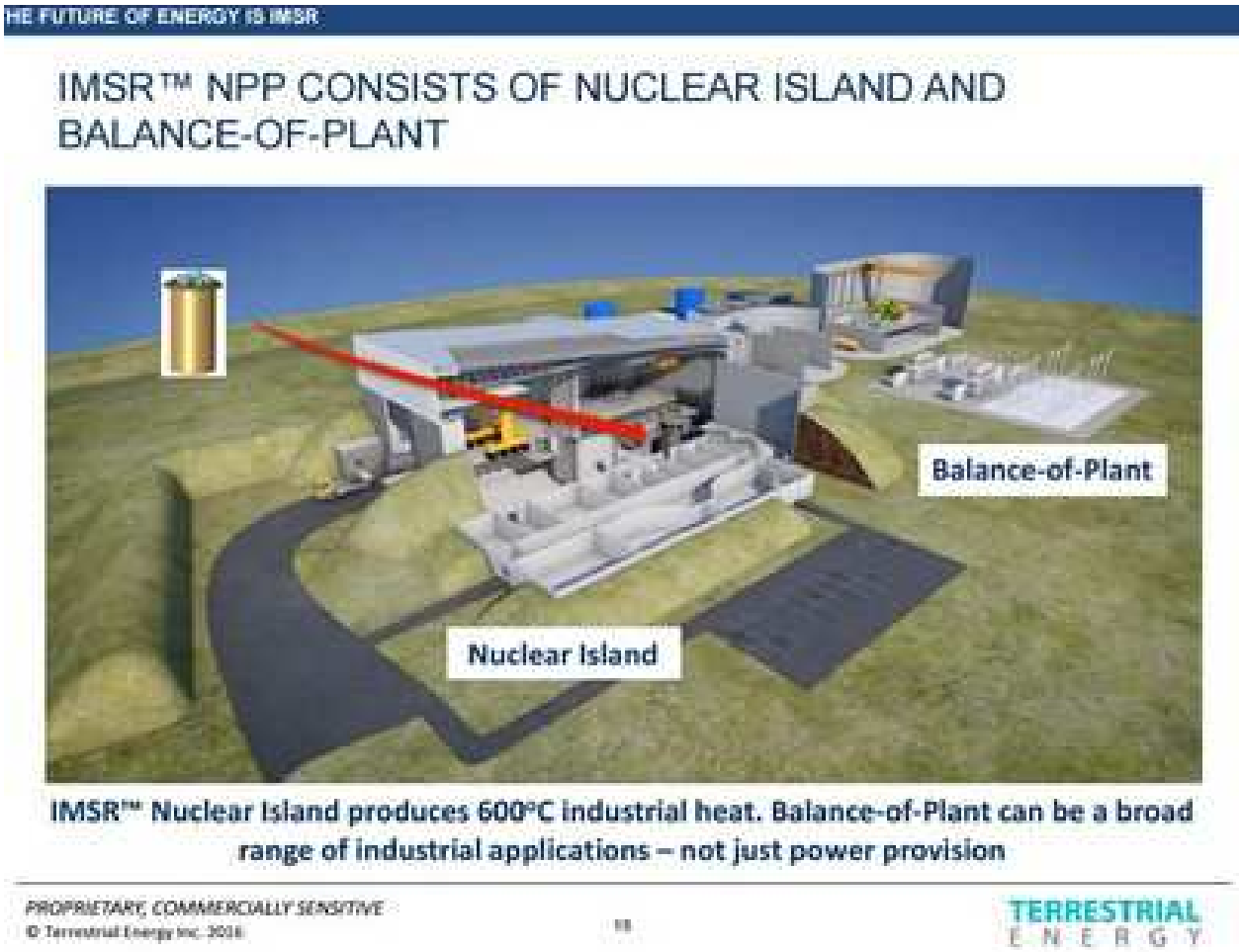
A vast quantity of heat is consumed in refining petroleum and in extracting unconventional crude oil from reservoirs like Canadian oil sands or Colorado shale rock.

The heat from the integral molten salt reactor could be used in a process that creates hydrogen. And the interesting thing about that is, even though natural gas in North America is one of the most competitive sources of BTUs in the world, Terrestial Energy is pretty close to being cost competitive with steam methane reforming, which is the standard methodology today, with high temperature steam electrolysis driven by IMSR heat and power.

Synthetic fuel production can also combine coal with hydrogen from water or natural gas to produce clean, domestic distillate fuels. If done in the traditional way with heat input from burning part of the carbon input, it is an emission-intensive process, but the IMSR heat would avoid a major source of emissions.



Integral Molten Salt Reactor Steam Power Plant



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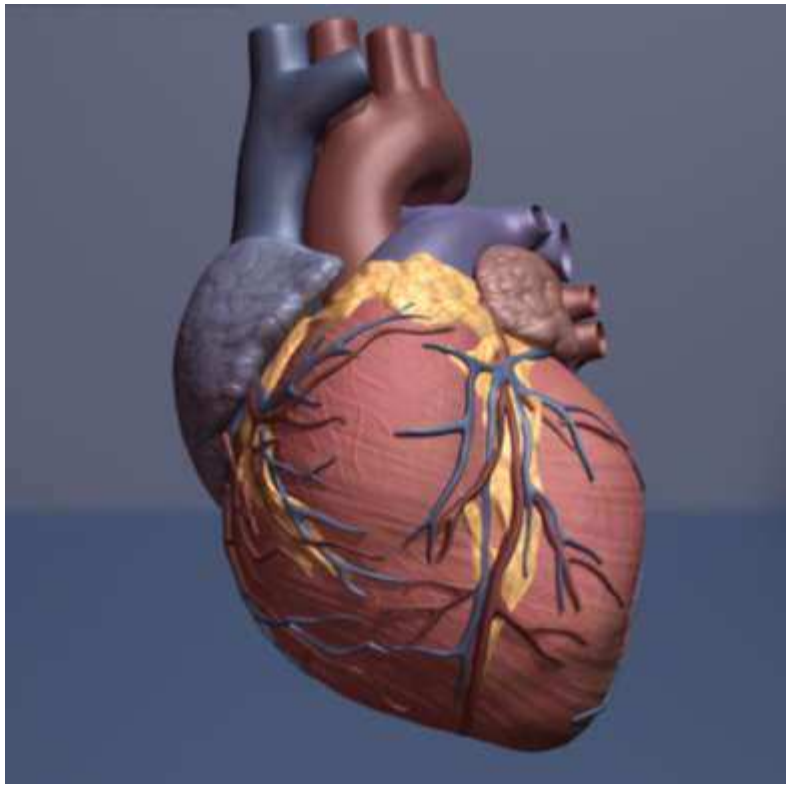
FROM HEART FAILURE TO HEALTH: PUMP SHOWN TO RESTORE ORGAN TO FITNESS

April 10, 2017
https://medicalxpress.com/news/2017-04-heart-failure-health-shown.html



Human heart. Credit: copyright American Heart Association

As we face a shortage of donated hearts for transplant, the study authors are calling for the devices to be considered as a tool which can allow patients to restore their health.
The research examined the effect of mechanical heart pumps, known as left ventricular assist devices (LVAD).

The devices are used to support patients with severe heart failure while they wait for a heart transplant.

Surgeons implant the battery operated, mechanical pump which helps the main pumping chamber of the heart- the left ventricle - - to push blood around the body. Fitted at the six specialist NHS centres across the UK, LVADs are used for patients who have reached the end stage of heart failure.

Publishing today in the Journal of American College of Cardiology, the team report that LVAD combined with medication can fully restore heart function in patients.

Dr Djordje Jakovljevic, Senior Research Fellow in Cardiovascular Ageing and Heart Failure within the Institute of Cellular Medicine at Newcastle University, is lead author on the paper.

He said: "We talk about these devices as a bridge-to-transplant, something which can keep a patient alive until a heart is available for transplantation.

"However, we knew that sometimes patients recover to such an extent that they no longer need a heart transplant.

"For the first time, what we have shown is that heart function is restored in some patients - to the extent that they are just like someone healthy who has never had heart disease. In effect, these devices can be a bridge to full recovery in some patients."

TOOL TO RECOVERY

In the clinical trial, 58 men with heart failure were tested for their heart fitness levels. Of the men, 16 were fitted with an LVAD and then had it removed due to the extent of their recovery. Furthermore 18 still had an LVAD and 24 patients were waiting for a heart transplant. On average, a patient had a device fitted for 396 days before it was removed, though it varied from 22 days to 638 days.

The participants were compared with 97 healthy men who had no known heart disease. All were tested on a treadmill with a face mask to monitor their oxygen utilisation and heart pumping capability.

In the publication the authors report that 38% of people who recover enough to allow the device to be removed demonstrated a heart function which was equivalent to that of a healthy individual of the same age.

Dr Jakovljevic explains: "We can consider these pumps as a tool which can lead to a patient recovering, rather than as a device which keeps people alive until a heart transplant is available.

"Our ongoing and future research is aiming to identify the markers of early heart recovery while patients are fitted with a device. These markers will inform clinical care teams to make right decisions about which patient respond well to device and when to consider potential removal or disconnection of the device while ensuring heart failure will not occur again in the future."

Although heart transplantation offers a second chance of life for patients with advanced heart failure, a shortage of donor hearts has opened doors for developments and use of mechanical devices.

Dr Guy MacGowan, Consultant Cardiologist within the Newcastle upon Tyne Hospitals NHS Foundation Trust, and Honorary Clinical Reader in Heart Failure at Newcastle University, is co-author of the paper.

He said: "It is very difficult to get a heart transplant, especially in the UK, so any alternative treatment is important and recovery of heart function especially so. The UK has a long way to go in comparison with the number of heart transplants in other developed countries.

"Within Newcastle upon Tyne Hospitals NHS Foundation Trust, we are pioneering a new strategy to use the LVAD to enhance chances of recovery, monitor for signs of recovery, and then use a minimally invasive procedure to disconnect the device."

Consultant Cardiac Surgeon within the Newcastle upon Tyne Hospitals NHS Foundation Trust and co-author, Professor Stephan Schueler, added: "In most cases the device reverses the symptoms of heart failure so that patients feel less short of breath and with less fatigue. In a smaller proportion of patients there is actually an improvement in heart function so that the pump can be disconnected or explanted."

The average price of a LVAD is approximately £80,000 and the transplant operation costs around £69,000.

The team involved researchers at Newcastle, Cambridge, Leeds, London and Louisville (USA) who are currently studying how to identify patients who will respond best to being fitted with an LVAD by identifying markers of early heart recovery.

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PRINTED TITANIUM PARTS EXPECTED TO SAVE MILLIONS IN BOEING DREAMLINER COSTS

By Alwyn Scott | SEATTLE
http://www.reuters.com/article/us-norsk-boeing-idUSKBN17C264?feedType=RSS&feedName=technologyNews

Boeing Co hired Norsk Titanium AS to print the first structural titanium parts for its 787 Dreamliner, a shift that the Norwegian 3-D printing company said would eventually shave $2 million to $3 million off the cost of each plane.

The contract announced on Monday is a major step in Boeing's effort to boost the profitability of the 787 and a sign of growing industrial acceptance of the durability of 3-D printed metal parts, allowing them to replace pieces made with more expensive traditional manufacturing in demanding aerospace applications.

Strong, lightweight titanium alloy is seven times more costly than aluminum, and accounts for about $17 million of the cost of a $265 million Dreamliner, industry sources say.

Boeing has been trying to reduce titanium costs on the 787, which requires more of the metal than other models because of its carbon-fiber fuselage and wings. Titanium also is used extensively on Airbus Group SE's rival A350 jet.

Visitors take pictures of a model of Boeing's 787 Dreamliner during Japan Aerospace 2016 air show in Tokyo, Japan, October 12, 2016.REUTERS/Kim Kyung-Hoon

"This means $2 million to $3 million in savings for each Dreamliner, at least," starting in 2018 when many more parts are being printed, Chip Yates, Norsk Titanium's vice president of marketing, said in a telephone interview.

Boeing builds 144 Dreamliners in a typical year. The company declined to comment on the estimate but said Norsk's technology would help reduce costs.

The Dreamliner turned profitable last year after racking up nearly $29 billion in production-related losses.

Norsk worked with Boeing for more than a year to design four 787 parts and obtain Federal Aviation Administration certification for them, Yates said.

Norsk expects the U.S. regulatory agency will approve the material properties and production process for printed parts later this year. That will "open up the floodgates," Yates said, by allowing Norsk to print thousands of other parts for each Dreamliner, without each part requiring separate FAA approval, resulting in the millions in expecting savings per plane.

"You're talking about tons, literally," on the 787 that would be printed instead of made with traditional, expensive forging and machining, he said.

General Electric Co is already printing metal fuel nozzles for aircraft engines. But Norsk and Boeing said the titanium parts are the first printed structural components designed to bear the stress of an airframe in flight.

Norsk said it will print initially in Norway, but aims to have nine printers running by year-end at a 67,000-square-foot (6,220-square-meter) facility in Plattsburgh, New York.

(Reporting by Alwyn Scott; editing by Jonathan Oatis and Mary Milliken)

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ABSOLUTELY & TOTALLY POLITICALLY INCORRECT & AS FAR TO THE LEFT AS YOU CAN GO!

From: "Tim Bolgeo" tbolgeo@epbfi.com

IT'S REALLY UNFORTUNATE FOR ELIZABETH WARREN THAT THIS STAFFER PAYROLL REPORT CAME OUT ON 'EQUAL PAY DAY'

April 4, 2017 | Tom Tillison
http://www.bizpacreview.com/2017/04/04/really-unfortunate-elizabeth-warren-staffer-payroll-report-came-equal-pay-day-467248?utm_source=BizPac+Review+Email+Newsletter&utm_campaign=a77fd83aaa-EMAIL_CAMPAIGN_2017_04_05&utm_medium=email&utm_term=0_fbf9323fb3-a77fd83aaa-32881293

It's all in the timing…
An analysis by The Washington Free Beacon showed that women employed by Sen. Elizabeth Warren"were paid just 71 cents for every dollar paid to men during the 2016 fiscal year."

It didn't help the progressive social justice warrior much that this damning data was shared on Equal Pay Day, a day set aside to celebrate the Equal Pay Act becoming law in the United States — President John F. Kennedy signed it into law on June 10, 1963.

Elizabeth Warren's Female Staffers Made 71% of Male Staffers' Salaries in 2016 https://t.co/S5PQ2paL4Y via @BrentScher pic.twitter.com/4Fw286RHIe
— Free Beacon (@FreeBeacon) April 4, 2017

The study shows that gender pay gap in the Democratic lawmaker's office is "nearly 10 percent wider than the national average."

An embarrassing showing, no doubt, and while Warren actually referenced a "day of embarrassment" at this time last year on Twitter, this year she is surprisingly quiet.

[SNIP]
