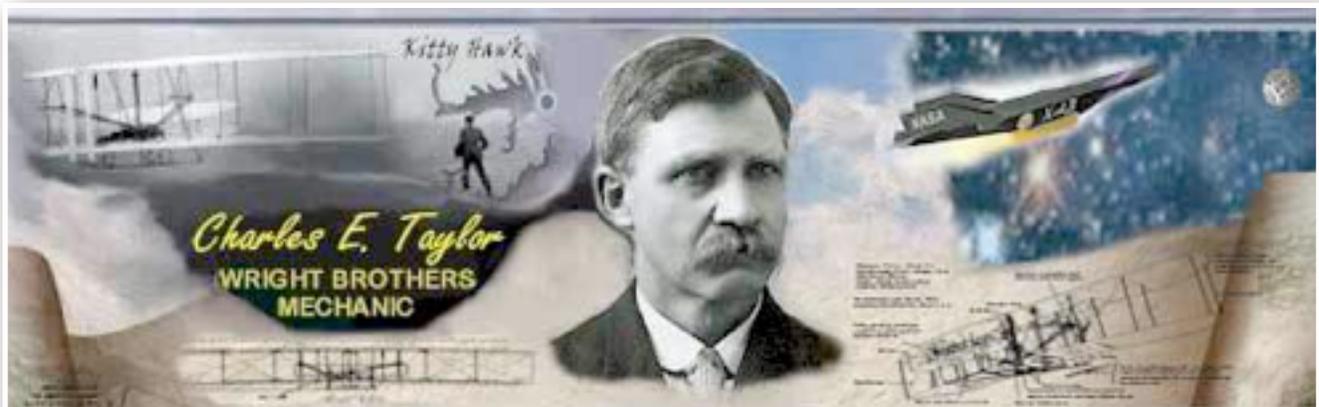


# Aviation Human Factors Industry News

Volume XV. Issue 14, July 07, 2019



From the sands of Kitty Hawk, the tradition lives on.

Hello all,

To subscribe send an email to: [rhughes@humanfactorsedu.com](mailto:rhughes@humanfactorsedu.com)

In this weeks edition of *Aviation Human Factors Industry News* you will read the following stories:

★FAA Aviation MX Human Factors Quarterly

★NTSB Faults Pilots  
“Mismanagement” in Asiana Flight

★Maintenance error leads to oil leak

★Top 10 causes of fatal GA accidents

★FAA to Debut Remote ID Rule in July

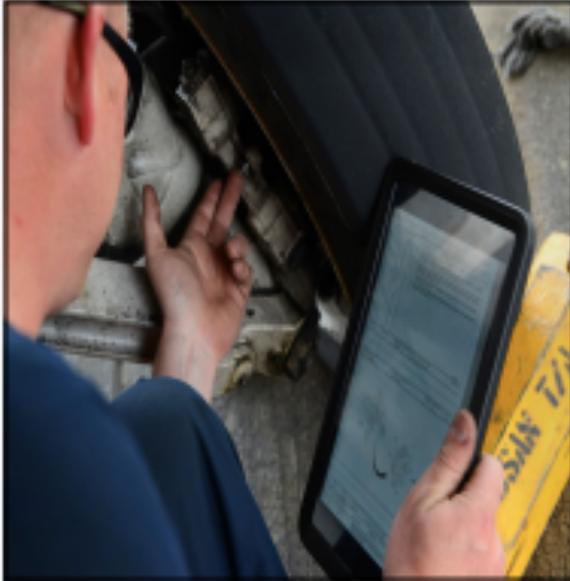
★A quarter of all pilots at aviation safety conference admit to falling asleep on the job

★Japan outlaws flying drones while drunk

★RUSSIA RELEASES FINAL REPORT ON 2018 SARATOV AIRLINES AN 148 CRASH

# FAA Aviation Mx HUMAN FACTORS Quarterly

June 2019  
Vol 7, Issue 2



## Inside This Issue:

Authors of this Newsletter	2
Factoring In: The Human Equation	3
Safety Culture Promotion in an Example Mx Organization	4
Multi-Disciplinary Approach to identifying Safety Challenges	6
Meet the Newsletter Staff	8
Author Appreciation and Upcoming Events	10

[https://www.faa.gov/about/initiatives/maintenance\\_hf/fatigue/publications/](https://www.faa.gov/about/initiatives/maintenance_hf/fatigue/publications/)

## **NTSB Faults Pilots “Mismanagement” in Asiana Flight**

Asiana Flight 214’s pilots caused the crash last year of their airliner carrying more than 300 people by bungling a landing approach in San Francisco, including **inadvertently deactivating the plane’s key control for airspeed**, the National Transportation Safety Board concluded Tuesday.



But the board also said the complexity of the Boeing 777’s auto-throttle and auto flight director — two of the plane’s key systems for controlling flight — **contributed to the accident**. Materials provided to airlines by Boeing that **fail to make clear** under what conditions the auto-throttle doesn’t automatically maintain speed were also faulted.

The 777 has been in service 18 years and is one of the world’s most popular wide-bodied airliners, especially for international travel. Until last year’s accident, it had not been involved in a single fatal crash.

## **Maintenance error leads to oil leak**

The Piper PA-32R-301T was in cruise flight when the engine’s forward main seal — the crankshaft seal — began to leak engine oil.

Shortly thereafter, the engine lost power, and the pilot subsequently performed a forced landing to a field near Dalhart, Texas, about five miles west of the departure airport.

Post-accident examination of the engine revealed that the bottom half of the crankshaft seal **had slipped forward from its placement**, which allowed engine oil to leak from the engine. The seal had an approximate time in service of 21 hours since its replacement. It is likely that maintenance personnel installed an **improperly sized crankshaft seal**, which led to it slipping, allowing the engine oil to leak.



**Probable cause:** The failure of the engine's front bearing seal due to maintenance personnel's installation of an improperly sized crankshaft seal, which resulted in oil starvation and a forced landing.

NTSB Identification: [CEN17LA226](#)

This June 2017 accident report is provided by the [National Transportation Safety Board](#). Published as an educational tool, it is intended to help pilots learn from the misfortunes of others.

## **Top 10 causes of fatal GA accidents**

In the latest information from the FAA, officials looked at the top causes of fatal accidents in general aviation from 2001 to 2015.

Not surprisingly, **loss of control in flight tops the list**.

Loss of control can happen because an aircraft enters a speed outside of its normal flight envelope, which can quickly create a stall or spin danger.

According to FAA officials, there is one fatal accident involving loss of control every 5.5 days.

However, from 2008 to 2017, fatal accidents from controlled flight into terrain (CFIT) — another leading cause of general aviation accidents — **were reduced by about half.**



One reason for that is work by the General Aviation Joint Steering Committee, as well as the Fly Safe outreach campaign to prevent dangerous loss of control (LOC) situations.

**It seems to be working.** For the first time in years, preventing loss of control accidents was not included on the 2019 Most Wanted List by the NTSB.

**What other causes of accidents are on the list?**

1. Loss of control in flight
2. Controlled flight into terrain
3. System component failure — engine
4. Fuel
5. Unknown
6. System component failure — non-engine
7. Unintended flight into instrument meteorological conditions
8. Mid-air collisions
9. Low altitude operations
10. Other

<http://www.gajsc.org/>

<https://www.faa.gov/news/updates/?newsId=83106>

<https://www.nts.gov/safety/mwl/Pages/default.aspx>

## FAA to Debut Remote ID Rule in July

The FAA plans to release its remote identification ruling for UAS in July, UAS Integration Office Executive Director Jay Merkle said in front of Congress recently.

[The remote ID rules](#) — often compared to license plates for drones — would allow the FAA, police officers and

other public officials to look up a UAS by a broadcast unique identifier and find out information about the operator. This would go hand-in-hand with registration rules to prevent uncooperative flights around airports or other illegal uses from going unpunished.

"We are working currently to ensure that we keep the policy component along with standards and remote id infrastructure all developed and harmonized," Merkle said during a Senate Commerce Committee hearing about integrating new entrants into the National Airspace System.

Remote ID has its detractors, who say it exposes too much private information of operators, but the FAA determined that it is necessary since, unlike with a car, the operator is not present, and there needs to be [some accountability](#) attached to that anonymity. Industry and regulators are trying to figure out who gets access to what information, but everyone has largely been waiting for the FAA to release its verdict after it put out a request for information on the topic at the end of last year.

Once remote ID is tackled, Merkle said, it will enable the agency to get to more of its drone-related priorities. For example, Section 2209 of 2016's FAA Extension, Safety and Security Act tasks the Administration with establishing procedures so that applicants can petition for the restriction of drone operation near sites such as critical infrastructure.



Merkle said that the FAA has been able to map out some such areas and put restrictions in place with existing authorities, but that it needs to generate a rule to more effectively meet that mandate. However, once it does, the agency expects "thousands and thousands of potential requests for restrictions," Merkle said, requiring not only policies to manage the flow but also the implementation of remote ID to help enforce those restrictions.

Merkle has previously said that the [FAA learned a lot from its grappling with drones](#) — a learning curve which he believes will help it more smoothly deal with the urban air mobility industry — and that it is now in a place of effectively facilitating industry.

There is more work to do though, according to Dallas Brooks, director of Mississippi State University's RASPET Flight Research Laboratory and associate director of the FAA's co-located Center of Excellence for UAS Research.

Despite Merkle's claims of having learned, Brooks said that recent changes have actually slowed down innovation.

"Due to a recent policy change mandating department-level review [of funding requests for proposed projects], it now takes up to six times longer to approve UAS Center of Excellence research," Brooks said. "Such reviews add no discernible value, nor perceivable effect other than slowing a once-efficient process from a few weeks to many months."

Pushed by Senator Roger Wicker (R-Miss.), the committee chairman, on the reason for that change, Merkle demurred, saying only that the FAA shares "a desire to be as effective and timely as possible," but that number or complexity of grant requests can sometimes have an impact on turnaround time.

Brooks also emphasized to Congress the importance of supporting small, effective teams and setting and enforcing deadlines.

"Success in integration comes in bites, not in meals," he said. "Those who 15 years ago were trying to solve all our problems at once are still trying."

## A quarter of all pilots at aviation safety conference admit to falling asleep on the job

The peak body representing pilots in Australia says it is concerned that proposed changes around workplace laws regarding fatigue rules will lead to more cases of **chronic fatigue** among pilots. It comes as a pilot fell asleep while flying an aircraft solo from Devonport to King Island in Tasmania. He landed safely.

**Duration:** 3min 21sec

**Broadcast:** Wed 26 Jun 2019, 6:25pm



[https://abcmedia.akamaized.net/radio/local\\_sydney/audio/201906/ppm-2019-06-26-pilots-asleep.mp3](https://abcmedia.akamaized.net/radio/local_sydney/audio/201906/ppm-2019-06-26-pilots-asleep.mp3)

## Japan outlaws flying drones while drunk

**Operating a drone in Japan while drunk could lead to a year in prison thanks to new legislation.**

The law, passed by the country's parliament this week, seeks to rein in growing use of the unmanned aerial vehicles.

Those found to be intoxicated while flying a drone could also face a fine of up to 300,000 yen (£2,200).

The law covers drones weighing more than 200g (7oz) and also puts limits on where drones can be flown.

"We believe operating drones after consuming alcohol **is as serious as (drink) driving**," a Japanese transport ministry official told the AFP news agency.



As well as fines over drunken use, the legislation also levies fines on pilots who **perform dangerous stunts** with their drone. Those caught quickly plunging the craft towards crowds could face fines of up to 500,000 yen.

Operators also face restrictions on where they can fly their craft under the new legislation.

Drones are now banned from being flown within 300m (985ft) of Japan's armed forces, US military personnel and "defense-related facilities" without prior permission.

This follows an earlier ban on them approaching nuclear power plants, Japan's parliament buildings and the prime minister's office. The stadiums and other sites for the 2020 Olympics are also off-limits to drone pilots.

Anyone operating a drone in Japan does not need a license but must abide by a **series of regulations including:**

- 1 staying below 150m
- 2 avoiding airports
- 3 avoiding crowded areas
- 4 only flying during daylight
- 5 keeping the drone in sight at all times

Anyone failing to abide by the established regulations could face a fine of up to 500,000 yen.

## **RUSSIA RELEASES FINAL REPORT ON 2018 SARATOV AIRLINES AN 148 CRASH**

A Saratov Airlines Antonov AN-148-100 that crashed while flying from Moscow to Orsk in February 2018 **suffered from ice in the aircraft's pitot tubes and erroneous actions of the crew**, investigators have found.



Russia's Interstate Aviation Committee (MAK) has handed down its final report into the February 11 2018 flight 6W 703 involving the AN-148-100 RA-61704.

All 65 passengers and six crew died in the incident.

While the final report was published in Russian, *The Aviation Herald* has translated portions of the report that relate to the **probable cause** of the accident.

The translation is reproduced here, with minimal editing:

The crash of the An-148-100B RA-61704 was caused by **erroneous actions of the crew** during departure in instrumental weather conditions in relation to unreliable indications of the air speed caused by the icing (ice blockage) of all three dynamic probes of the pitot system, which led to the loss of control over the parameters of the aircraft's flight resulting in a dive and collision with the ground.

The accident falls into the category **loss of control in flight** (LOC-I).

The investigation revealed **systemic deficiencies** in the assessment of risk as well as risk control, the **failure** of the airline's flight safety management system as well as lack of supervision of training of flight crew by aviation authorities at all levels, which led to the issuances of certificates to aviation personnel and crew, **who did not fully qualify**.

### The most likely contributing factors were:

- **Crew's rush in preparation for the flight** due to the late arrival of the aircraft from the previous flight and attempts to "catch up" time;
  - **The crew's failure to turn on the heating of the pitot probes** before take-off and non-compliance with/non-execution of the "BEFORE TAKEOFF" checklist, which provides for this action.
  - **Design features of the An-148 aircraft** which restrict the duration of pitot heating while on the ground, which required to move the items pitot heating into the "BEFORE TAKEOFF" checklist rather than the "ENGINE START" checklist, which creates additional risks of missing these operations.
  - **Systematic failure by airline crews to comply with the principle of "dark cockpits"** and the requirements of the pitot system, which contributed to the "habit" of taking off despite the presence of emergency and warning messages on the electronic indication and alarm system (KISS) and failing to identify the fact that the heating of the pitot probes is not included. Six warning messages were displayed on KISS before departure for the accident flight including three relating to the absence of pitot probes' heating.
  - **Design features of the An-148 aircraft** which disabled removal of KISS messages related to system defects which have been deferred under MEL.
  - **Low safety culture** within the airline which led to non-entries of inflight problems into the tech logs as well as performing flights with issues that were neither rectified nor deferred with the relevant fault messages displayed at KISS >
- and failure to identify the KISS messages and analyze them to identify lack of pitot probe heating.

- **The crew's unpreparedness** when the ALARM "SPEED DISAGREE" was issued because of lack of theoretical training, lack of according simulator training and lack of according training on aircraft. This resulted in the failure to follow the proper procedures once the alarm was raised.
- **Lack of supervision** by the Civil Aviation Authority in certifying the flight simulator according to Russian Air Code
- **Approval of the An-148 flight simulator without** consideration to their ability to reproduce special cases in flight as stipulated in Russian Air Code and FAR-128.
- **Lack of specific guidance** on values of flight parameters that must be sustained in case of "SPEED DISAGREE" alarm respective lack of an unreliable airspeed procedure.
- **Increased psycho-emotional stress by flight crew members** during the final stages of flight due to the inability to understand the speed fluctuations. As result the captain suffered "tunnel view" on his speed indications for speed control rather than considering all flight parameters.
- **Insufficient training of flight crew** with respect to human factors, cockpit resource management, threat management and error management.
- **Individual psychological characteristics** by both flight crew, for the captain reduction of intellectual and behavioral flexibility, fixation on own position and inability to hear prompts from the first officer, for the first officer problems in organization and sequencing actions) which in the stressful situation with inadequate CRM became apparent.
- **Loss of psychological efficiency the captain** (resulting on psychological incapacitation) which led to complete loss of spatial orientation and did not permit to respond properly to correct advice offered by the first officer or the EGPWS PULL UP warning.
- **Absence of criteria to determine psychological incapacitation/loss of health** which did not permit the first officer to take more efficient measures.

- Large arrear of annual leave that could have caused accumulation of fatigue and might have adversely affected the efficiency of the captain.
- System operations features not described in operations manual.
- Elevator control offset during reconfiguration mode with unreliable airspeed doubles elevator deflection with same control input and has the elevator deflected nose down with the control in neutral position for about 60 seconds which reduced time available to the crew to recognize the situation.

More information about the accident can be found on *The Aviation Herald* [website](#).

<http://avherald.com/>

## **Have Aviation Labor Shortages Reached a Critical Point?**

by [John Goglia](#)

We've all been reading about future pilot and mechanic shortages for a long time. While some people believe that the predictions are hyped by labor unions looking to pay their members higher salaries, others believe that the predictions **aren't dire enough and don't fully capture the current hiring situation**. I have been concerned about both the forecast shortages and the current ability of many aviation entities to recruit qualified candidates for pilot and maintenance technician openings.

**I have reviewed applicants** for openings at a number of different entities—both airline and corporate—and have concerns about the dearth of applicants, even for well-paying jobs, and the caliber of some of those applications.

That's especially true at smaller aviation entities away from aviation centers.

But have these shortages reached a critical point where [warning bells](#) should be ringing? Some recent news reports should raise alarm in the industry and prompt much more action to accelerate the pipelines for these jobs.



Worldwide, the latest Boeing Pilot & Technician outlook for 2018-2037 projects that in this 20-year period “[790,000](#) new civil aviation pilots, [754,000](#) new maintenance technicians, and [890,000](#) new cabin crew will be needed to fly and maintain the world fleet.” For North America, Boeing predicts the need for 206,000 new pilots, 189,000 new technicians, and 174,000 new cabin crew.

Boeing attributes the demand to a mix of fleet growth, retirements, and attrition and warns that “meeting the extraordinary demand will require [proactive planning and collaboration](#) within the global aviation industry...[and] educational outreach and career pathway programs will be essential to inspiring and recruiting the next generation of personnel.”

Back to the two recent news reports that caught my attention. One involved a pilot at a major airline’s commuter subsidiary who was arrested for a triple homicide. The other involved quality complaints at Boeing’s South Carolina plant due in part to an apparent lack of qualified personnel.

The New York Times article about the pilot caught my attention for several reasons. Of course, an airline pilot arrested for a triple homicide is very unusual. But the article also revealed that the pilot had been hired by American Airline’s subsidiary, PSA, at the age of 50.

While hiring 50-year-old pilots is not terribly unusual in the corporate or air-taxi worlds, it is rather unusual for a Part 121 air carrier, at least in my experience.

Most Part 121 airlines don't hire pilots after a certain age, and 50 is usually well beyond that age. [But that's just one red flag here.](#)

According to the article, the pilot had been dishonorably discharged from the military. That's certainly another red flag. And, perhaps most startling, the pilot—who had served as a pilot in the U.S. Army—was court marshaled in 2016 and found guilty of simple assault and of mishandling classified information. He reportedly served 90 days in jail.

Is it possible American Airlines or PSA was not aware of this criminal record? According to the carrier, the *Times* noted, "pilots undergo a criminal-background check and are then vetted on a recurring basis; the vetting of [the pilot] had not turned up criminal history that would disqualify him from becoming a commercial pilot." I don't know for sure what that last line means, but it sounds to me like being court-marshaled and jailed for, among other things, simple assault was not a disqualifying enough criminal record. Alternatively, something is wrong with the way American does its criminal background checks [that it missed](#) a jail sentence for assault.

So, while the pilot plans to plead not guilty on the triple homicide charge, his prior record with the military would not seem to make him the most desirable candidate for an airline pilot job, especially at a Part 121 airline. Unless, of course, the airlines are really desperate for pilots and are willing to overlook recent convictions for assault and jail terms. Pretty shocking state of affairs, if that is the case.

The other example that, to me, highlights a potentially critical shortage of experienced aviation personnel was a New York Times investigation of "shoddy production" at Boeing's plant in North Charleston, South Carolina. In large part, it appears that the shoddy standards—including multiple examples [of debris left inside airplanes](#) that could cause significant safety issues, such as sharp metal fragments on wiring—are due to the difficulty in recruiting qualified workers in the South Carolina area.

The report highlights complaints by a number of whistleblowers and past employees but also contains what, for me, is the most glaring signal that a serious problem exists: Qatar Airways stopped accepting Dreamliners manufactured >

at Boeing's plant in South Carolina. [It now will only purchase](#) aircraft made in Boeing's legacy plant in Everett, Washington.

In 2014, factory employees were told to watch a video from the chief executive of Qatar Airways. He chastised the North Charleston workers, saying he was upset that Boeing wasn't being transparent about the length or cause of delays. In several instances, workers [had damaged the exterior of planes](#) made for the airline, requiring Boeing to push back delivery to fix the jets.

Ever since, Qatar has bought only Dreamliners built in Everett. I have never heard of an airline or any aircraft purchaser specifying which plant they wanted their aircraft manufactured in.

So are these just two random indicators of aviation personnel recruiting issues? Can we just dismiss a pilot with a criminal past getting through a background check at a major airline as a one-off? Similarly, can we dismiss a major airline like Qatar Airways refusing to buy aircraft manufactured at a South Carolina plant as some kind of foreign idiosyncrasy? [Maybe](#). But then again, what if they're the proverbial canaries in the coal mines? If we ignore them, we do so at our own peril.

<http://www.boeing.com/commercial/market/pilot-technician-outlook/>

<https://www.nytimes.com/2019/05/14/us/pembroke-kentucky-murders-christian-richard-martin.html>

<http://www.nytimes.com/2019/04/20/business/boeing-dreamliner-production-problems.html>

## **Fatigue can affect pilots in similar way to alcohol**

The Australian Society of Aerospace Medicine president, Kate Manderson, said fatigue [could have a severe impact](#) on a pilot's mental and physical functioning.

She said fatigue could impair a pilot's ability to make decisions, retain information and perform mental calculations, affect their physical coordination and reaction times, and even their ability assess how much tiredness was affecting them.

"We know that when people have been [continuously awake for 17 hours](#), it's a similar level of [impairment to a blood alcohol concentration of 0.05](#), so that gives you a bit of a feel for the level of impairment in brain function, as well as fine and gross motor control," she said.

Dr Manderson said proper fatigue management required aircraft operators and airlines to support pilots [to speak up](#) when they felt too tired to fly safely.

"We can have systems and cultures but the person has got to be able to make that decision and say, 'I have been awake for too long, my quality of sleep wasn't great, perhaps I've got too much going on in my world right now and [I'm not fit \[to fly\]](#),'" she said.

Civil Aviation laws on flight time limitations state that:

"A flight crew member shall not fly, and an operator shall not require that person to fly if either the flight crew member is suffering from, or, considering the circumstances of the particular flight to be undertaken, is likely to suffer from, fatigue or illness which may affect judgement or performance to the extent that safety may be impaired."

If a pilot or aircraft operator is found to violate these rules, CASA [can](#) suspend or cancel their certificates, licenses, or approvals.

In a statement, CASA said the incident highlighted the need for both pilots and air operators to take responsibility for managing fatigue.



Unless a matter goes to court, CASA does not release information about conditions on individual pilots' licenses.

While the ATSB investigates transport safety incidents, it does not have the power to apportion blame or liability.

Vortex Air said the pilot had not had any scheduled flights in the five days before the incident and [made his own decision to fly back](#) to Moorabbin without additional rest.

It said it had counseled the pilot while he was on King Island and when he returned to Moorabbin.

## **This Cessna Aircraft Will Test an All-Electric Propulsion System**

AeroTec is prepping to flight test a magniX all-electric propulsion system on a Cessna Caravan 208B turboprop plane.

["The electric-aviation revolution is very real](#), and AeroTec is the right team to help innovative aviation companies like magniX bring their technology to market sooner," said Lee Human, AeroTec's president and founder. "AeroTEC is responsible for the magni500-powered 208B's modification design, integration and flight test."



The Cessna Caravan is one of the world's most used Middle Mile (traveling fewer than 1,000 miles) planes, with more than 2,600 operating in 100 countries. By refitting this aircraft with magniX's electric-propulsion system, the industry will [witness a quick hit to the emissions-reduction tally](#).

The Caravan can seat up to 10 passengers and sports a range of 1,079 nautical miles, and it needs 2,055 feet for takeoff.

Owners configure these planes for business or cargo use, with a choice of three interior packages to luxe as little or lot as desired. The cockpit features the Garmin G1000 NXi avionics suite, with all kinds of displays and increased situational awareness. "Retrofitting an iconic workhorse like the Cessna Caravan for the first time is no small feat. Through our work with AeroTec, we are committed to meeting and exceeding expectations of our solution so we can continue to advance electric aviation," said magniX CEO Roei Ganzarski. "Electrifying existing aircraft enables flexible, clean air-travel...[at a fraction of the cost](#). And for operators not ready to make the leap into new, clean-sheet, all-electric aircraft, retrofitting the Cessna Caravan provides a solution that allows them to reap the benefits of clean, cost-effective aviation in a shorter time frame."

magniX began production of the propulsion system this spring, and AeroTec is busy modifying aircraft in anticipation of the new system. The first flight is scheduled for the end of this year at the AeroTec's Flight Test Center in Moses Lake, Wash.

## **From Flight Attendant to Aircraft Engineer: How Women Are Breaking Down Gender Stereotypes**

Let's be perfectly honest... When we think of flight attendants we think of them as female and when we think of aircraft engineers we think of them as men.

We're not entirely to blame for these preconceptions - these roles were traditionally segregated by gender with airlines using female cabin crew as a key element of their advertising, while aircraft hangars were rarely ever visited by a woman.

But while some airlines and other industry organizations haven't yet gone to nearly enough effort to challenge these old fashioned stereotypes, >

t's [nice to see roles](#) in engineering and other traditionally male-dominated careers [open up to more and more women](#).

When Rachel Whatmough first joined British Airways as a member of cabin crew she only intended to keep her wings for a year. Rachel wanted to visit some new destinations before leaving the airline to pursue a university degree in chemistry - before long though, Rachel had made the momentous decision to not bother going to university at all. When her friends were graduating three years later, Rachel was still flying high.



"I felt privileged to be traveling the world and seeing and doing so many things that my friends weren't able to," Rachel explains. "I especially loved visiting the Caribbean islands, they really are breathtaking."

But during her time at the airline, Rachel kept on bumping into the myriad of [aircraft engineers](#) that swarm over an aircraft during turnarounds and pre-departures - she wondered whether she might be able to pursue her passion for science and aviation without having to leave the airline.

"[It was time for a new challenge,](#)" said Rachel ahead of International Women in Engineering Day.

"Once I realized that I could still work for British Airways, but as an Aircraft Mechanic, it was an easy decision to swap my cabin crew uniform for overalls." Luckily for Rachel that was a decision that was definitely supported by British Airways - she's now been an aircraft engineer for 10-years and is currently on maternity leave having recently given birth to a daughter. Perhaps, one day, her daughter will follow in her mother's footsteps and pursue a [STEM career](#).

"I would definitely recommend a career change and it's never too late to make the move," Rachel says of her experience. "Being cabin crew really helped me to understand how even the smallest delay can affect our customers and I always keep that in mind when we're under pressure."

According to British Airways, the airline currently offers a [three-year apprenticeship program in Aircraft Maintenance](#) which is open to anyone, of any age, and at any stage of their career. Students can also apply to take part in week-long work experience placements at the airline's engineering bases in Heathrow, Gatwick, Cardiff and Glasgow.

## **TED: Talks Worth Spreading**

TED Fellow and astronomer Erika Hamden leads the team building FIREBall, a telescope that hangs from a giant balloon at the very edge of space and looks for clues about how stars are created. She takes us inside the roller-coaster, decade-long journey to get the telescope from an idea into orbit -- [and shows how failure is inevitable when you're pushing the limits of knowledge.](#)



<https://www.ted.com/talks/erika-hamden-what-it-takes-to-launch-a-telescope>