The WheelTug is an electric taxi solution that has the capability to improve aircraft block time by significantly reducing the time it spends on the ground.

Wheeltug self-taxi system prepares for 2021 service entry

WheelTug is an electric motorised system installed in the nose wheel. This system allows the aircraft to drive forward and in reverse without engine power and the use of a pushback tug. This is referred to as e-taxiing.

The aircraft can therefore drive itself to and from the passenger gate and along taxiways. Pilots can therefore start engines while taxiing, rather than during the pushback sequence from the terminal building. This improves the efficiency of ground-handling time, engine start; and reduces pushback and taxi time, and the fuel used.

WheelTug has successfully completed its first live self-taxi demonstration of a 737 at Memphis International Airport. It is expected that the WheelTug system will be granted a Federal Aviation Administration (FAA) supplemental type certificate (STC) by the end of 2021 and will enter service shortly afterwards.

To maximise profitability and reduce unit operating cost per available seat-mile (ASM), passenger aircraft need to be in the air as much as possible by maximising utilisation and minimising time on the ground. WheelTug's self-taxi system, or 'e-taxi', has the ability to improve ground operations by allowing aircraft to complete a higher number of flight cycles (FC) per day. This ultimately makes aircraft operations more profitable.

According to WheelTug chief executive officer Isaiah Cox, "The industry average for a pushback and engine start for a narrowbody is about four minutes thirty seconds. WheelTug can complete the entire procedure in 60 seconds."

As WheelTug allows aircraft to park sideways at the gate and use two jet bridges, rather than nose-in, passenger disembarkation and boarding times can also be substantially reduced. Parallel parking also means the operator can generate advertising revenue by branding the sides of the aircraft.

Using WheelTug eliminates pushback charges, and the need for a high number of ground personnel. Because WheelTug is silent, it also makes early and late slots accessible at airports that have noise restrictions.

Fuel consumption has been a driving key performance indicator (KPI) for airlines for many decades. The ultimate benefit of e-taxi solutions is not to reduce fuel consumption, but to reduce the time that the aircraft spends on the ground. One of the reasons for this is that many airlines expect delays in their ground operations on a daily basis, so they factor these into the operating schedule. Departure times therefore have long pushback and engine start times already built in.

Taxi time begins once the cabin door is closed and the brakes are released. The actual taxi may not commence until up to 20 minutes later because of the tug being delayed or airport congestion.

"There is an entire grey zone in aircraft performance that does not belong to anybody's KPI because the time is out of the airline's control," says Cox. "The airline is at the mercy of whoever is running the pushback. Nobody manages this time, but airlines are aware that overall aircraft taxi and block times keep increasing."

In the past a flight from Houston to New York-LaGuardia was typically scheduled for three hours; today it is more than four. This is not because aircraft are flying more slowly, but because of allowances for delays in ground operations, and pushback and taxi times.

"Even if flight times have not changed, the overall block time increases," says Cox. "In the north-eastern US, some operators allocate two hours of block time or more for a regional flight that typically spends 30-40 minutes in the air."

Adding a buffer to the air time allows airlines to adhere to on-time performance and to absorb any ground delays. Furthermore, avoiding official delays prevents large operators in Europe and India from incurring passenger compensation fines when flights are substantially delayed.

Regardless of on-time performance, an overall increase in block times means a lower daily utilisation rate per aircraft, with negative financial consequences. Operators such as Ryanair, WizzAir and easyJet have a higher aircraft utilisation rate than Air France, KLM and IAG because their aircraft spend only 60-70 minutes on the ground between flights, rather than the majors' 100 minutes.

"The winners are the operators whose aircraft spend less time on the ground. In the US Southwest Airlines spends less time on the ground than American Airlines and United. In the Far East, AirAsia outperforms many of the Chinese and Japanese carriers," says Cox.

In 1972, Southwest Airlines found itself with only three aircraft when its schedule required four. The company found that by improving ground efficiency, aircraft utilisation increased enough for the three aircraft to do the work of four.

By improving performance on the ground, an airline can operate a smaller fleet yet still have the same utilisation rates or operate the same number of flights. This is especially important during the pandemic, because many operators are reducing their fleet size during the downturn.

As many taxiways are not wide enough, congestion is one of the reasons for prolonged ground handling time. When an aircraft is pushed back, it can typically block the entire ramp from three to 15 minutes. As soon as the tower gives clearance, WheelTug allows the pilot to quickly reverse and manoeuvre the aircraft in the best possible time.

The WheelTug reverse procedure does not rely on a tug and wing walkers to guide the aircraft backwards. Reducing the number of personnel and equipment during this procedure means fewer things can go wrong.

"Ground congestion is also a factor in aircraft pushback, which hinders ground operations. There is a queue of aircraft waiting to access the terminal breakaway area and runway at many airports," describes Cox. "Regardless of the length of the queue, the sooner you are in it, the sooner you get to the front and to where you are going."

Some aircraft with high mounted engines and many turboprops are certified to use reverse thrust to 'power back' from the gate without tug

assistance. Yet there is a high risk of damage to aircraft engines, airframe, and airport infrastructure from foreign object debris (FOD).

Jet blast means that it is not possible to taxi a narrowbody aircraft into a suitable position to be facilitated by two jet bridges. Taxiing with the Wheeltug system, or using e-taxiing, however, and with jet engines no longer running allows the aircraft to park parallel to the terminal building. This means both the front and rear passenger access doors can be serviced by jet bridges, which permits speedy embarkation and disembarkation processes.

The aircraft can complete a 'twist' manoeuvre into position at the terminal. By using both jet bridges, ground-handling time improves markedly. Using both jet bridges also facilitates access for reduced mobility passengers. "The airbridges do not need to be installed at a widebody gate and typical 757 gates can be used," says Cox.

A video camera installed beneath the aircraft allows crew members to see behind the aircraft when reversing. Called WheelTug Vision, the camera system is an optional extra that is recommended to get the full benefit out of the system.

Without WheelTug Vision, pilots still need to rely on wing-walkers to guide the aircraft backwards when leaving the gate, thereby negating some of the system's benefits.

In addition to WheelTug Vision, the company is collaborating with ADB Safegate to streamline ground operations. ADB Safegate automates gate operations by installing monitors and screens to guide the aircraft towards the gate removing the need for a ground marshal.

ADB Safegate and WheelTug are working to interface the two systems, so that the pilot knows when to turn, stop and identify if the aircraft is on the centreline.

"We are getting closer to achieving a fully automated gate that requires fewer ground staff," says Cox. "We have the opportunity to improve safety margins within the gate area and to create a greater engine-off zone. This will minimise jet blast and collision risk and translate into a safer and more efficient environment."

ADB Safegate can leverage real time data capture, big data and predictive analytics. This, when used in combination with WheelTug, will maximise ground operational efficiency.

"We have a new slogan - win the ground, win the air - because the speed and efficiency of ground operations has hardly improved in all the decades since the jet engine was invented," says Cox. "Weather prediction is excellent, and air traffic control is very good; but ground operations continue to be a source of inefficiency, cost and delays."

WheelTug is beginning with an STC for the 737NG, and is looking at developing a programme for the A320. It is likely that WheelTug will concentrate on developing STCs for narrowbodies first because they make up 80% of the commercial fleet. Nevertheless, it expects to include larger widebodies such as the 777 and 787 in the future.

The WheelTug solution can be installed over a series of overnight maintenance stops. This means that aircraft utilisation is not impacted. WheelTug is lessor- and lessee-friendly, because it can be seamlessly removed without any damage to the airframe at lease return.

It is reported that there is a high number of pre-orders for the WheelTug system. Indigo has placed the highest number of single orders, and there are orders from legacy carriers such as KLM and Alitalia. Other airlines with WheelTug orders include Fly Dubai, Volaris and Viva Aerobus, plus a number of Turkish carriers. AC