

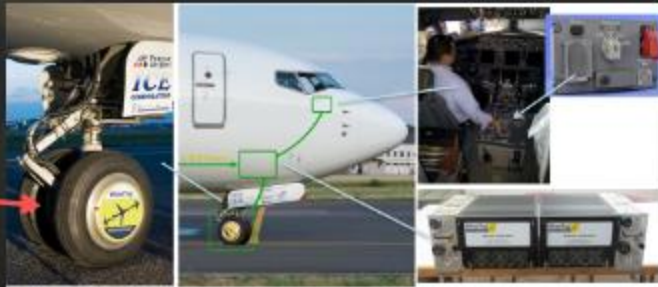
What is E-Taxi?





2013 ATW Eco Aviation Technology of the Year

The WheelTug System



Rapid retrofit & removal

Fits in existing wheel well space

Powered by the APU

WheelTug

23 airlines 985 reserved slots
For 737NG/MAX & A320CEO/NEO



-350 million kg/yr in CO₂ emissions reductions



DRIVING AEROSPACE

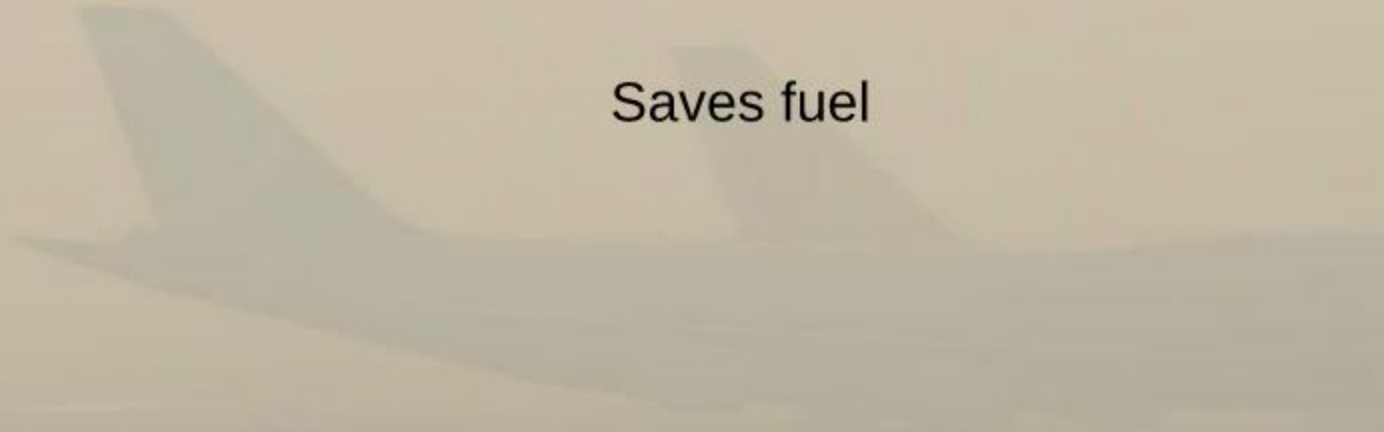
DRIVING AEROSPACE

Environmental Impact?

Cuts engine use

Reducing noise and emissions

Saves fuel



CO₂ Emissions

Dual Engine
Fuel Burn
(35 kg/min)



WheelTug Savings
(29 kg/min)



APU Fuel Burn
(6 kg/min)



Also reduces NOx

The average taxi is about 16 minutes
(excluding engine warm-up and cool-down time)

But not every minute is created equal

High-speed taxi demands high-speed
acceleration - you can't hold up the airport



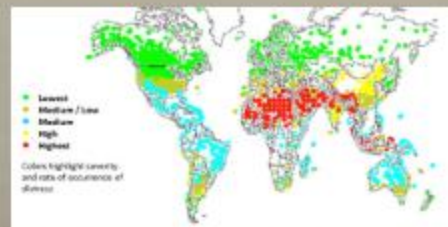
So E-taxi is only for stop-and-go
(more than 3 minutes prior to takeoff)

We estimate an average of 8 min of stop-and-go traffic
Of course, it comes in clumps

This is 232 kg/flight

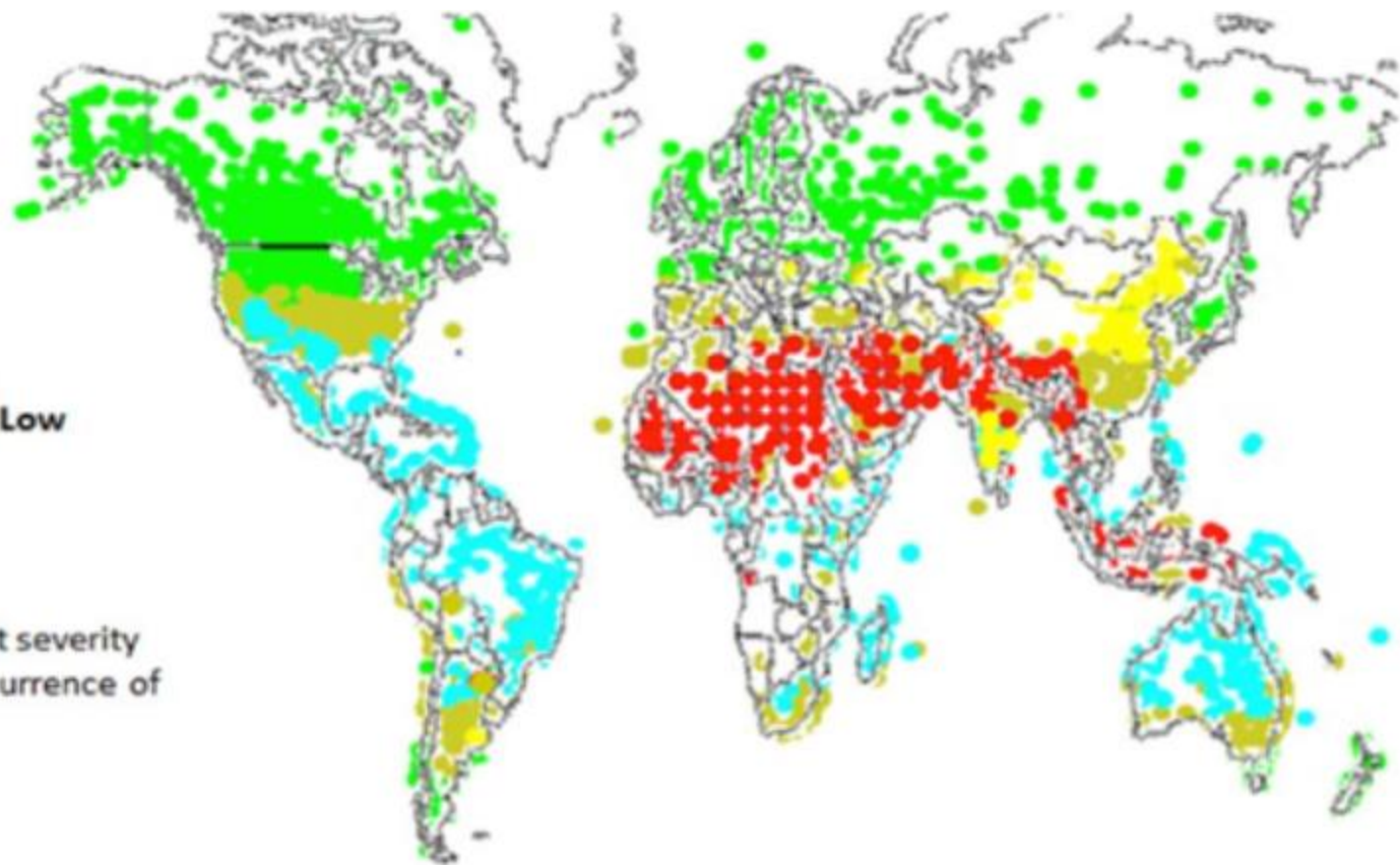
While taxiing, engines ingest
damaging dust and debris.

(In the Persian Gulf,
engines rated for 38,000
hours between overhauls
may last only 13,000 hours)

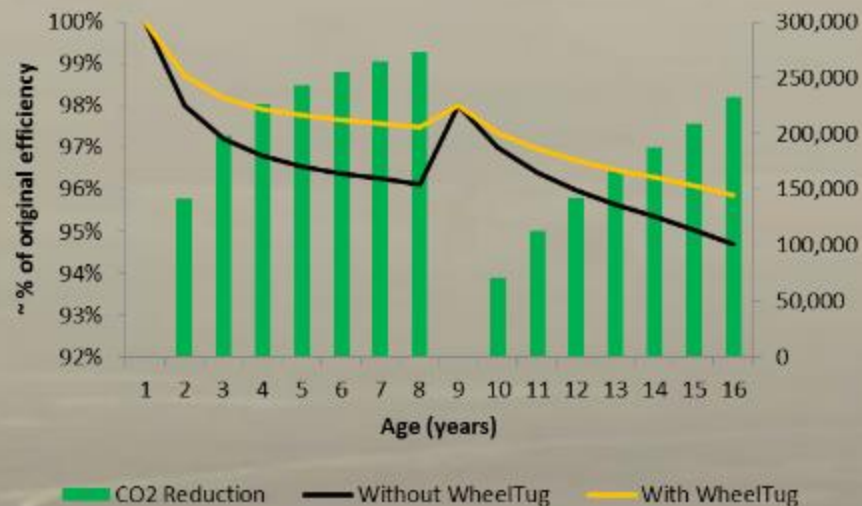


- **Lowest**
- **Medium / Low**
- **Medium**
- **High**
- **Highest**

Colors highlight severity and rate of occurrence of distress



80% of fuel efficiency loss is due to taxi wear



And the vast majority occurs below 10 knots



But it isn't enough

With fuel savings
alone, adoption
would be limited

But E-Taxi can offer so much more

Fue

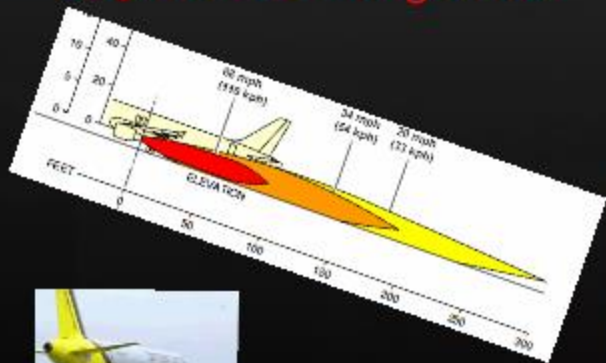
While taxing, e
damaging dust

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engine
hours b
may test o

Keeping the engines off in the apron has other advantages

Engines are dangerous

and expensive



With WheelTug

- There is no jet blast
- Aircraft can turn tighter than with tugs or engines

We can do the Twist



An aerial photograph of an airport construction site, showing a large area of cleared land with various pieces of heavy machinery and infrastructure under development. The site is surrounded by greenery and a body of water in the distance. A large black rectangular overlay covers the center of the image, containing text.



The Twist

- Raises airport throughput
- Improves ramp safety
- Improves the passenger experience
- Helps airlines and airports do more with what they already have


Everybody benefits

engines





The Twist makes WheelTug
very attractive, financially




***The Twist and Twirl will
provide significant savings***


***They will unlock major
environmental benefits
(which the public can see)***

While increasing airport throughput

Procedure changes will be necessary...

But they aren't entirely new.





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ESNA

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ICAO is key:

Encourage and promote cooperation among stakeholders (airlines, airports, ANSPs, OEMs and retrofit technology companies)

Promote cooperation among National Aviation Authorities on multilateral recognition of STCs

Recognize the incredible benefits **retrofit** technologies can offer.

And further demonstrate its dedication to combating climate change.





With ***existing*** backlog, will
reduce CO₂ emissions by
350 million kg/yr