



**Future Opportunities for Universities
in the Aviation Industry over the
next 10 years**

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Seminar, Kivi ledenvergadering, Delft – November 29, 2016

TUDelft Challenge the future 1

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2. Automation
3. Information & efficiency
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TUDelft Challenge the future 2

1.

Introduction



Disclaimer; this seminar is not intended to be complete. There are opportunities for research that will not be discussed such as the impact of terrorism on aviation, the impact of long haul low cost airlines, development of frontports, reducing turnaround times to 20 minutes, MRO developments, fleet planning, alliance forming, network and airport development etc.



Where are we today and where do we go from here?

True story, flight attendant on Delta Airways posted this pic with caption "only 1 paying attention to safety demo" 😂

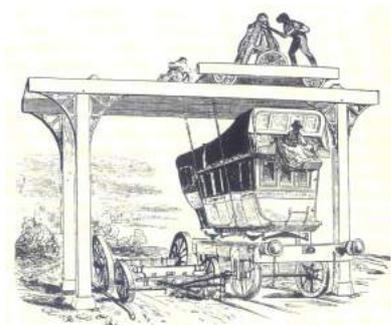


This is a current research topic

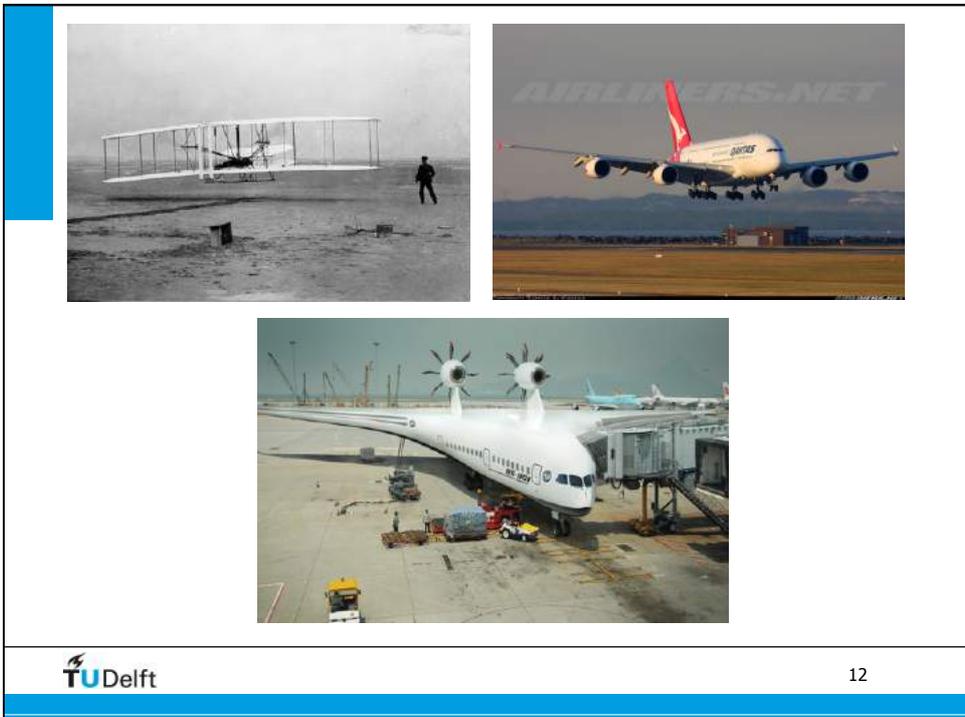
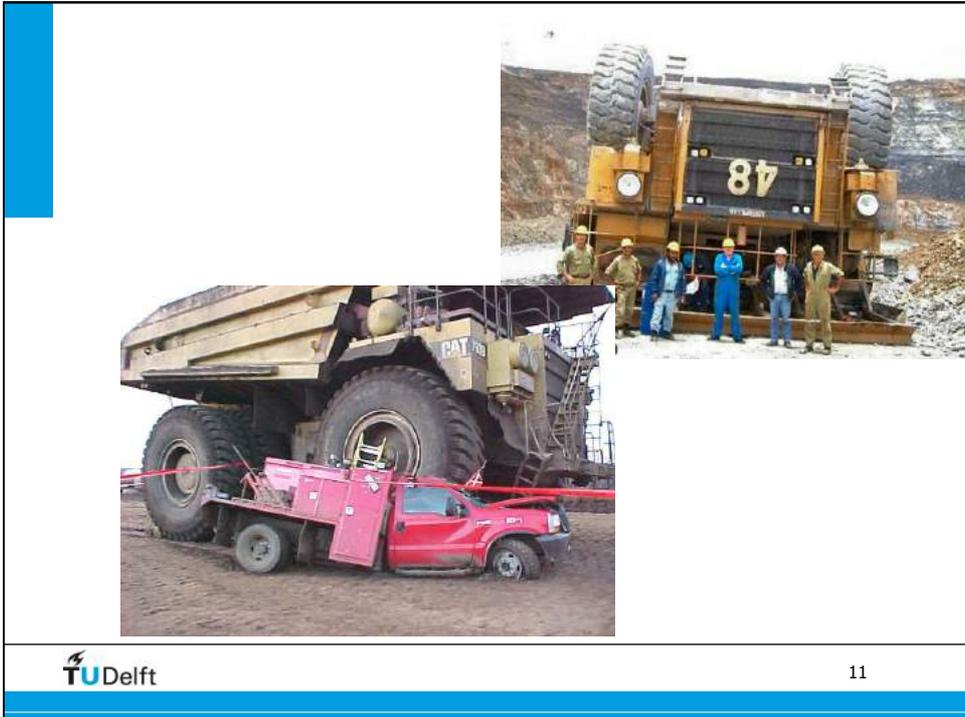
But what is next: Advances in transport technology

- Containerisation
- Hauling ore
- Aviation

Do we still have challenges?









Challenges lie in the interaction between processes, systems, equipment, people and control (management).



2.

Automation

Finding your way around airports



Info system @ SIN



Download from Dreamstime.com

© iStockphoto.com



Robot Spencer assisting people to find their gate @ AMS

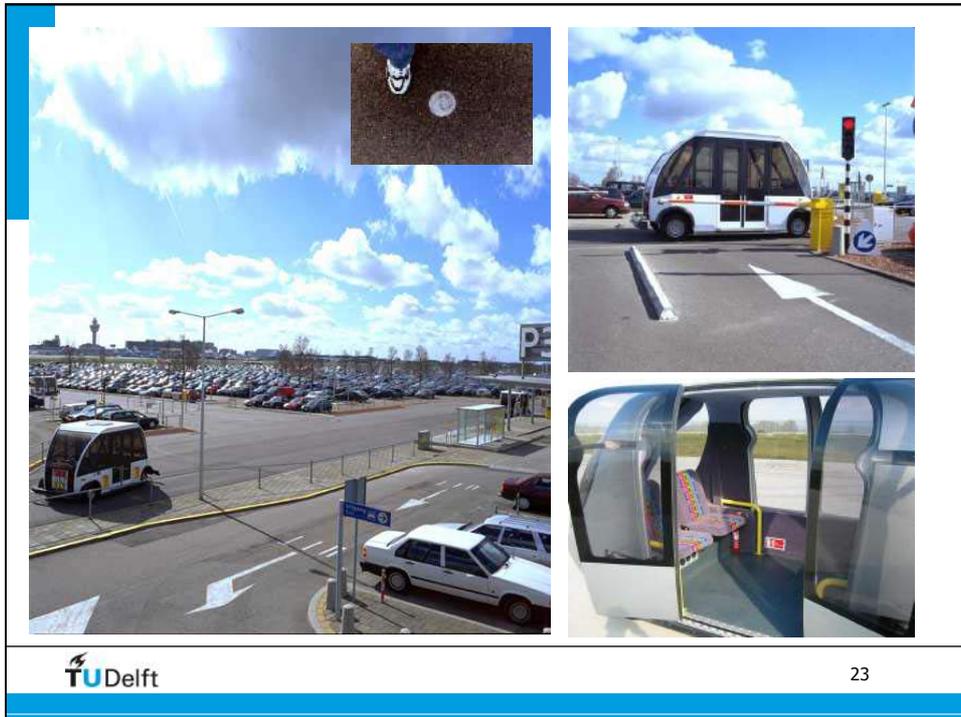




Seamless mobility in aviation

Utilization of automated guided equipment





Routing algorithms based on fundamental studies into pedestrian behavior.

Loop

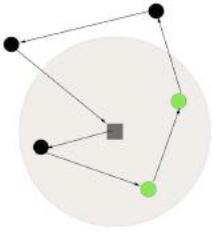
Mesh

Free ranging

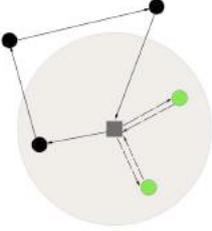


A logistic challenge

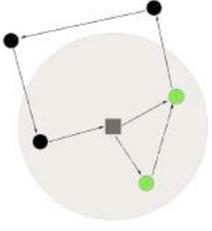
- = Depot/warehouse
- = UAV eligible customer
- = UAV ineligible customer



Travelling salesman routing



Alternative 1



Alternative 2

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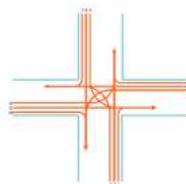





Many other issues: safety, security, environmental impact

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Safety is a special issue



Routing (priority rules), detectability, situation awareness, sensor systems

Next generation baggage loading systems for wide body aircraft



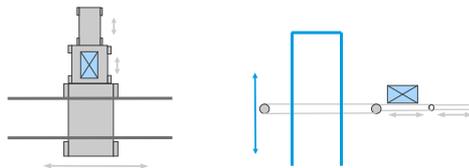


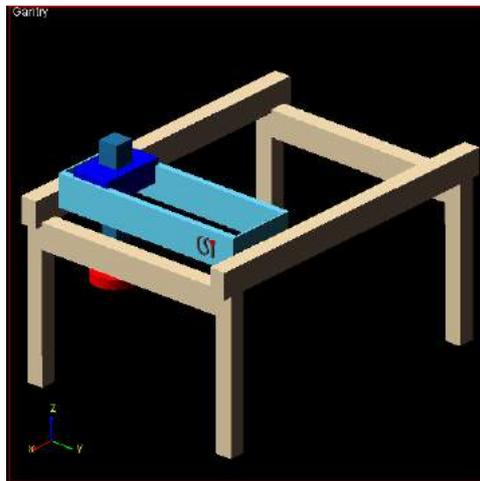
Transport in x-, y-, en z-direction to reach all spots in a ULD

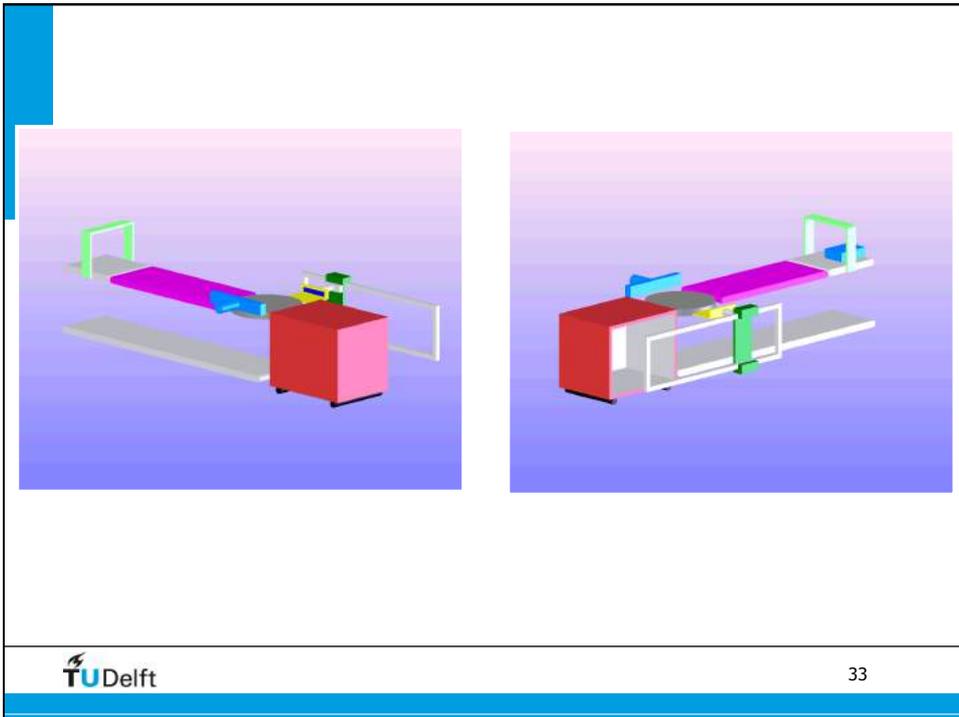
- Gantry-robot
- Scara-robot
- Spherical robot



- Telescopic belt conveyor in portal



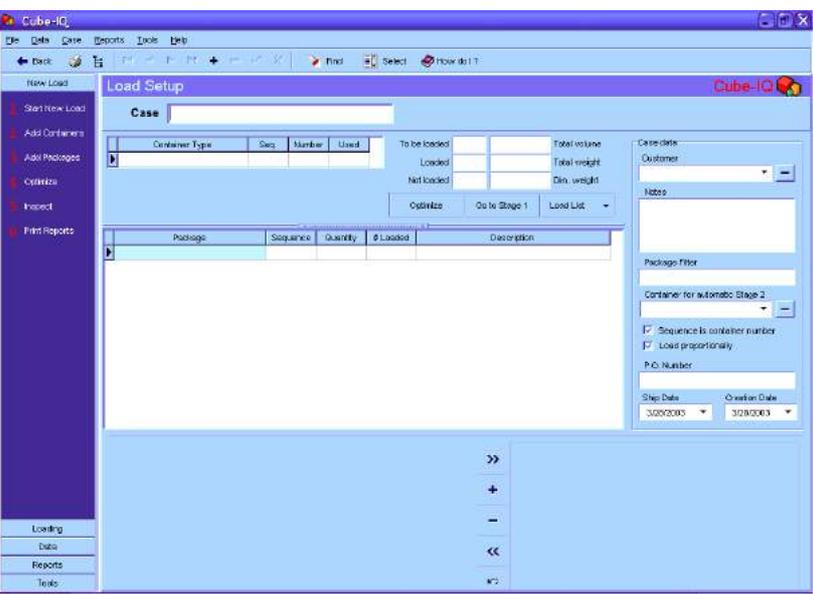




BAGCHECK™: an automated conveyability check

If you know what is coming then you can use that information

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Packing is one thing, automated controlled unpacking is something different...

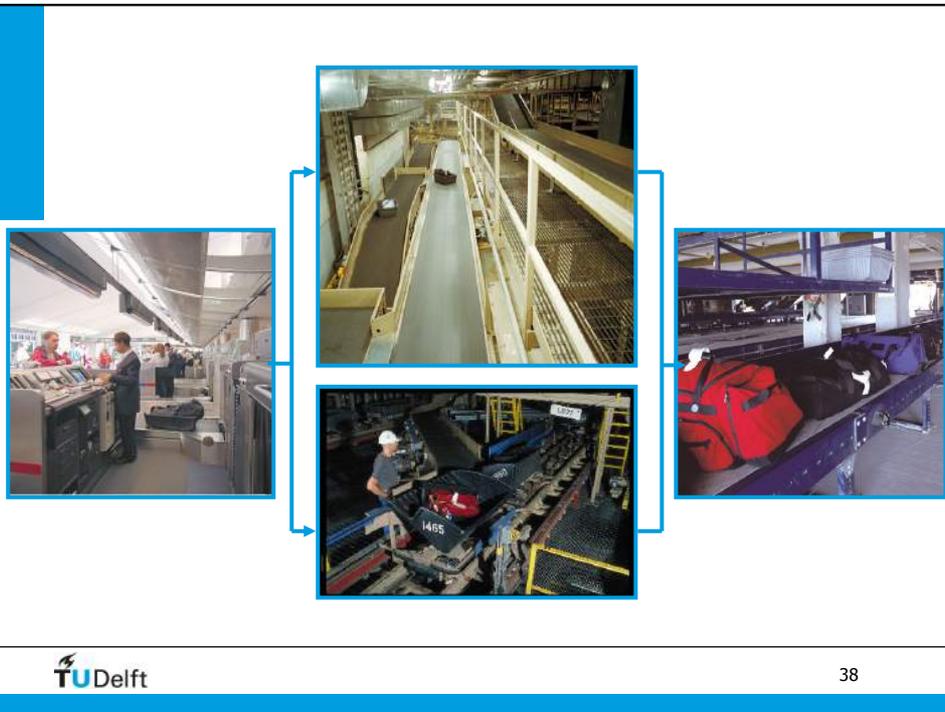
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3.

Information & efficiency

Next generation baggage loading systems for narrow body aircraft





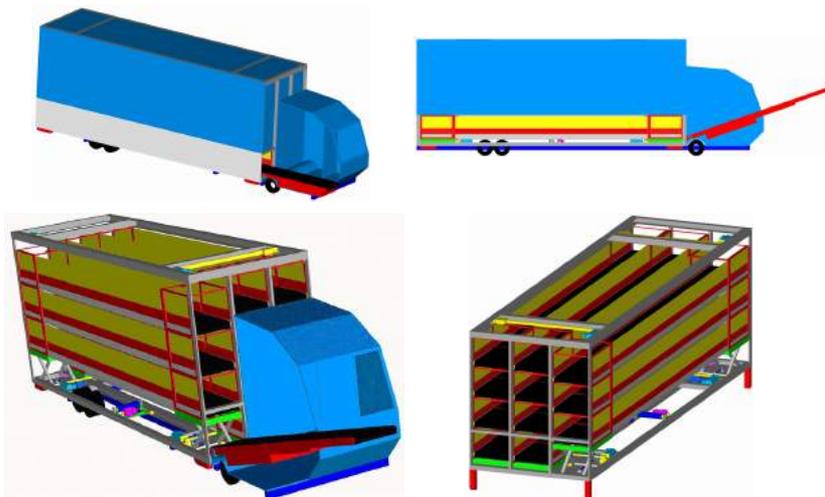
- Bagloader (+/- 1960)

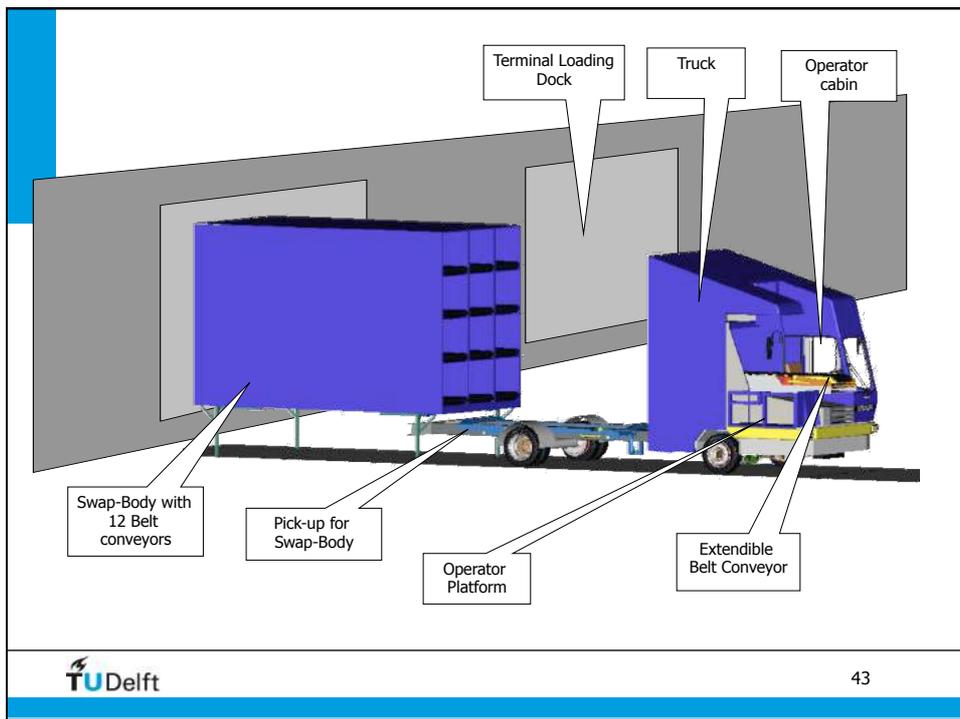


- Conveyor to the plane (Arlanda 1992)



Baggage truck with storage capacity





With built-in Rampsnake®



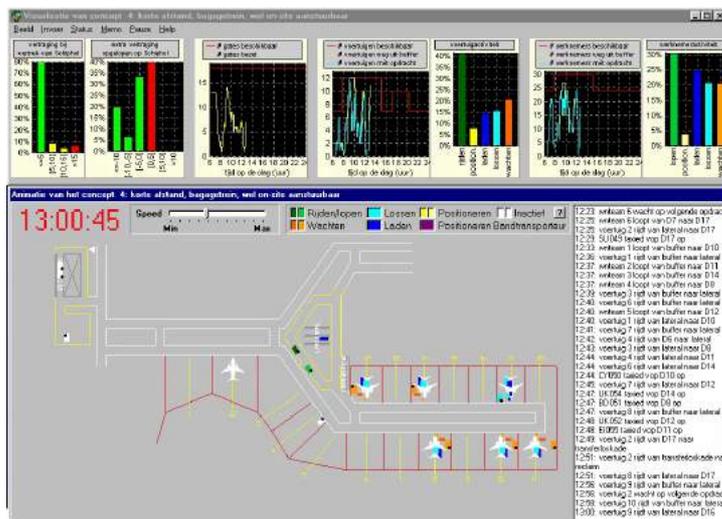
Rampsnake®



Pictures actual Rampsnake®
Now working at Zaventem, Belgium

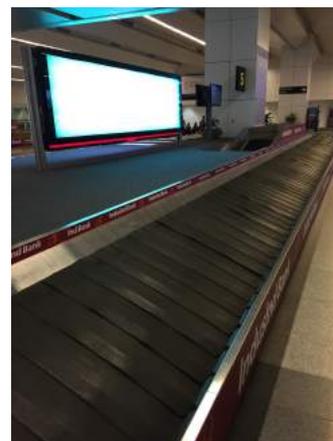


Simulation model for AAS



Technology is great but what is the impact on the operation on the tarmac?

Tracking and tracing – information on the go



The diagram illustrates a network of RFID and sensor nodes. On the left, a close-up of a green PCB with a 'Crossbow' chip is shown. The main network consists of several nodes, each represented by a small grey base with a blue antenna symbol. These nodes are interconnected by blue lines, forming a mesh. On the right, a central system is connected to the network. This system includes a laptop labeled 'PC', a server rack labeled 'server', and a device labeled 'Modbus Master'. The entire system is connected to an 'Enterprise or Automation Network'.

RFID and sensor networks

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TECHNOLOGY ROADMAP: THE INTERNET OF THINGS

The graph plots 'Technology Reach' on the vertical axis against 'Time' on the horizontal axis, with markers for 2000, 2010, and 2020. A red arrow points from the bottom-left towards the top-right, indicating the direction of technological progress.

- 2000:** RFID tags for facilitating routing, inventorying, and loss prevention. *Supply-Chain Helpers*
- 2005:** Demand for expedited logistics. *Vertical-Market Applications*
- 2008:** Surveillance, security, healthcare, transport, food safety, document management. *Vertical-Market Applications*
- 2010:** Cost reduction leading to diffusion into 2nd wave of applications. *Vertical-Market Applications*
- 2012:** Ability of devices located indoors to receive geolocation signals. *Ubiquitous Positioning*
- 2015:** Locating people and everyday objects. *Ubiquitous Positioning*
- 2018:** Teleoperation and telepresence: Ability to monitor and control distant objects. *Physical-World Web*
- 2020:** Miniaturization, power-efficient electronics, and available spectrum. *Physical-World Web*
- 2025:** Software agents and advanced sensor fusion. *Physical-World Web*

IOT and the application of big data

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Passengers

Equipment, components etc.



Big data and service enhancement



Cater to need not to standard

Personalized catering (services)



Food and drink

Did you know your sense of taste changes when you are flying at 30,000 feet? After conducting extensive research we have improved the food and wine we offer, so it tastes even better in the air than it does on the ground.

Not only is the food and drink we offer on board complimentary, it is sourced locally from reputable suppliers before being freshly prepared for your flight. All of this means we know the origin of everything we serve, so go ahead and enjoy.

You can now order your main meal in advance

If you are flying in World Traveller (economy)



For many flights departing from London Heathrow you can now pay for a wider choice of on-board meals from the online menu between 30 days and 24 hours before your flight.

Take a look at the meals you could buy

[View eligible routes](#)

[Book your on-board meal now](#)

If you are flying in First, Club World or World Traveller Plus



For many flights departing from London Heathrow you can now make your meal selection from the on-board menu between 30 days and 24 hours before your flight, for no extra charge.

[View eligible routes](#)

[Book your on-board meal now](#)

Book the cook (SQ)

Pre-order meal (BA)

Why not be proactive and use:



4.

Safety & security

Security of passengers and staff



System, procedure, legal issues

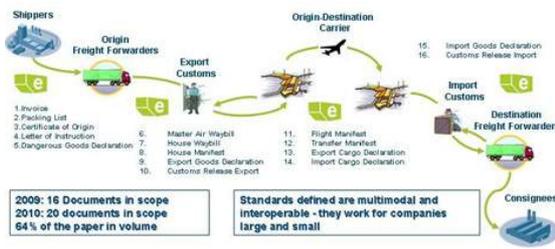
Carry on baggage; system, procedure, reverse logistics





This is not what we want

Security of tax free items, freight (supply chain) etc.



2009: 16 Documents in scope
2010: 20 documents in scope
64% of the paper in volume

Standards defined are multimodal and interoperable - they work for companies large and small

Safety in aviation: fundamental studies

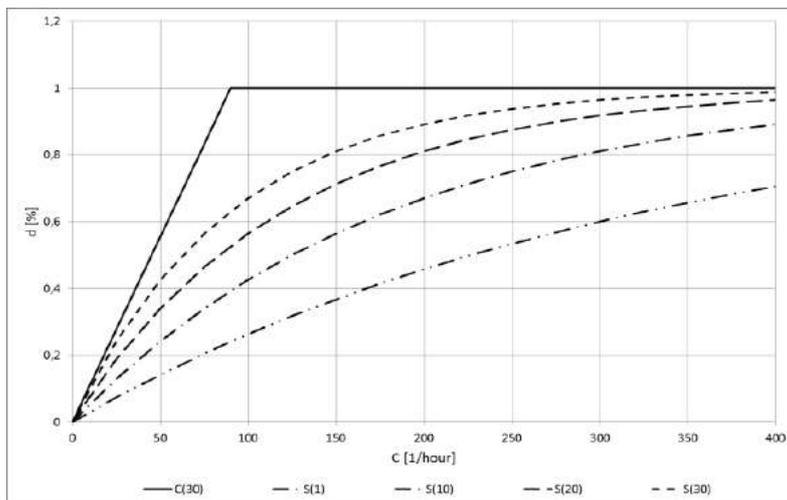


Impact of pilot decisions on operational result.

5.

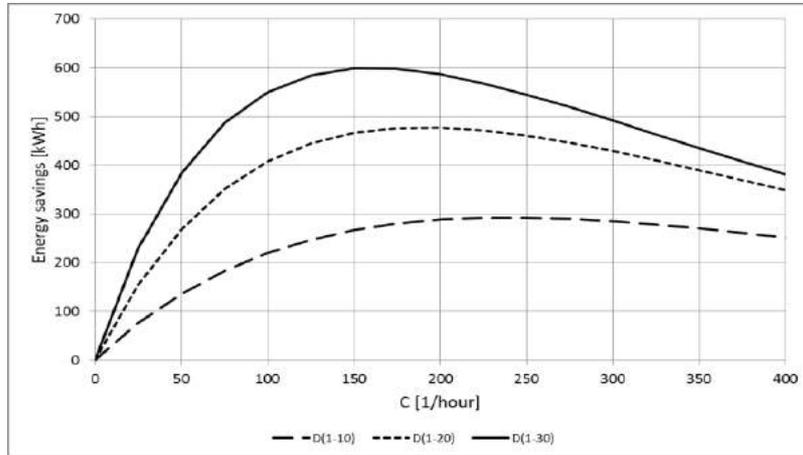
Environmental impact

Energy saving options in baggage handling



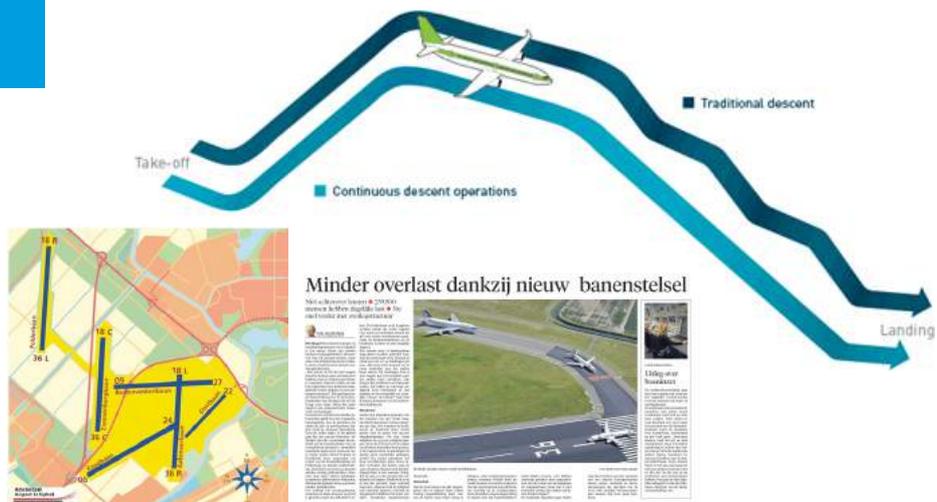
Duty cycles of a belt conveyor as a function of the conveyor's capacity for baggage with constant (C) and stochastic (S) interarrival times.

Results: possible energy savings @ RTM



Possible energy savings obtained when reducing the delay time

Energy saving through continuous descent approach & alternatives





- Landing order negotiations
- dynamic gate allocation
- taxiing options



Energy saving options in people movers



- Individual versus mass transport
- Continue versus discontinue transport



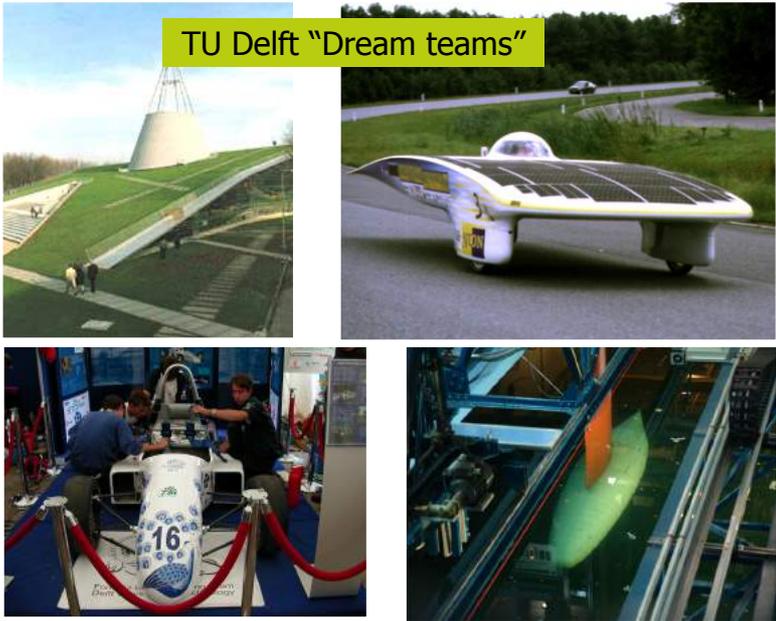


Capacity planning based on requested capacity

6.

Students & living labs

TU Delft "Dream teams"



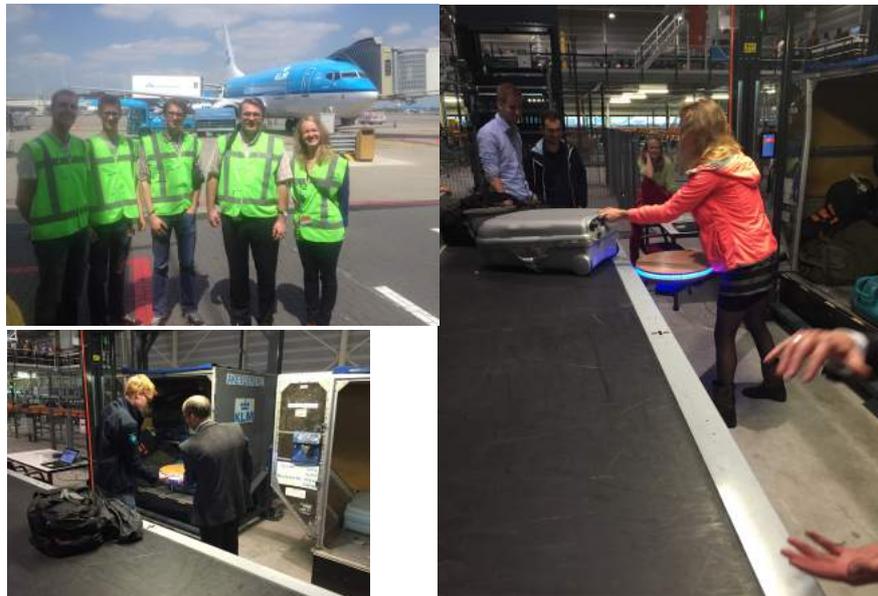
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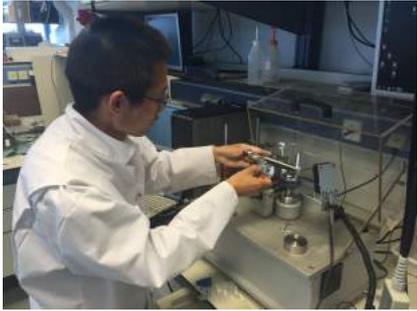


UNSW "Dream teams"

Anything aviation related?

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Living lab



Science

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The top photograph shows a man in a dark suit presenting a red award cup to another man in a dark suit on a stage. The bottom photograph shows three men in academic regalia gathered around a table, looking at a document. To the right is a framed certificate with the text: "Leeghwater Beste MSc teacher 2014-2015 of Transportation Engineering Awarded to Prof. dr. ir. S. Lodewijks Delft, 20 september 2015".

Some results

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To conclude:

ENGINEERING FLOWCHART

```

graph TD
    A[DOES IT MOVE?] -- NO --> B[SHOULD IT?]
    A -- YES --> C[SHOULD IT?]
    B -- NO --> D[NO PROBLEM]
    B -- YES --> E[WD-40]
    C -- YES --> F[NO PROBLEM]
    C -- NO --> G[TAPE]
        
```



The engineering approach, also in aviation.

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Thank you for your attention. Are there any questions?