

Memo

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Literature Review on Proposals for a Turnaround and Ground Handling Optimized Aircraft

1 Introduction

The present memo summarizes some proposals for a turnaround and ground handling (GH) optimized aircraft that has been found out in several projects from Stuttgart University and TU Delft. In addition, the most important ideas of each project are listed.

2 Universität Stuttgart: Flugzeugentwurfsseminar No 8

The students of the *Flugzeugentwurfsseminar No 8 (Universität Stuttgart, Institut für Flugzeugbau, Aircraft Design, 26.06.2007 to 13.02.2008)* worked on a project where they have to find ideas and designs for a “Turnaround and Ground Handling Optimized Aircraft”. The students were grouped in five teams and were awarded a placement for the quality of their work (place 1 to 5). The main ideas and innovations suggested by the students to optimise the turnaround process are summarized below. It appears that students ideas were guided by a lecture from an Airbus engineer that introduced the students to the idea of a Turnaround and Ground Handling Optimized Aircraft.

2.1 Place 1: StarXpress (Stuttgart 2008a)

Authors: Bastian Freese, Ruben Schäfer, Thomas Schlegat, Hannah Seliger, Daniel Steiling

Main ideas and innovations suggested:

- Continuous cargo hold for a simultaneous loading and unloading of cargo through one side of the aircraft (see Figure 2.1)
- Twin-aisle layout (see Figure 2.2)
- Simultaneous catering and embarking/dis-embarking processes (see Figure 2.2)
- Separate Baby-Wickel/Still-Raum
- No passenger traffic through the business class
- Elliptical fuselage
- Shoulder wing

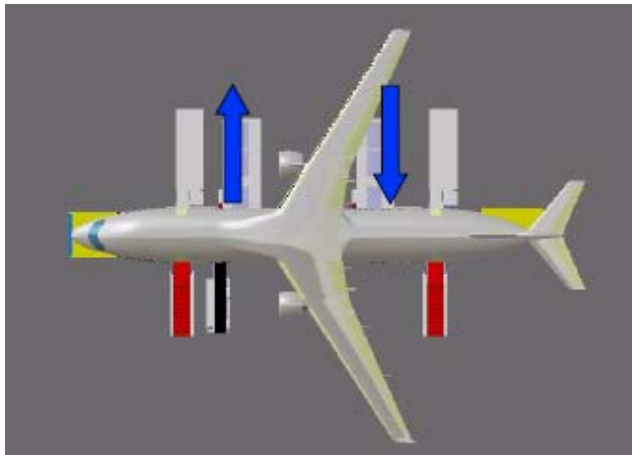


Figure 2.1 Continuous cargo hold (Stuttgart 2008a)

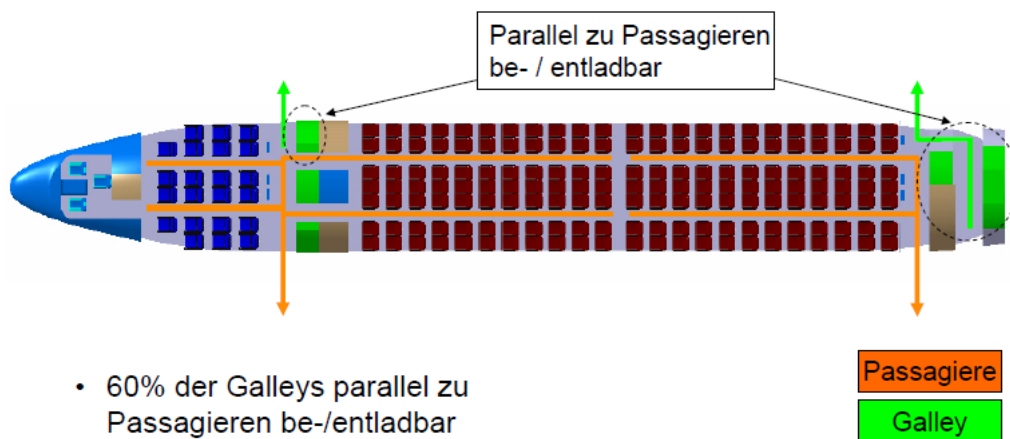


Figure 2.2 Simultaneous catering and embarking/dis-embarking processes (Stuttgart 2008a)

2.2 Place 2: ORCA (Stuttgart 2008b)

Authors: Andreas Knoll, Florian Mutschler, Thomas Rechin, Mirko Röder, Timo Schleicher

Main ideas and innovations suggested:

- Continuous cargo hold for a simultaneous loading and unloading of cargo through the two sides of the aircraft (see Figure 2.3)
- Twin-aisle layout (see Figure 2.4)
- Foldable passenger seats (see Figure 2.4)
- Embarking/Dis-embarking through two stairs at the rear of the aircraft (see Figure 2.5)
- On board water treatment system
- Catering replaced by trolley-lift system (see Figure 2.6)
- Engines mounted at the rear. H-Tail (see Figure 2.5 and 2.7)

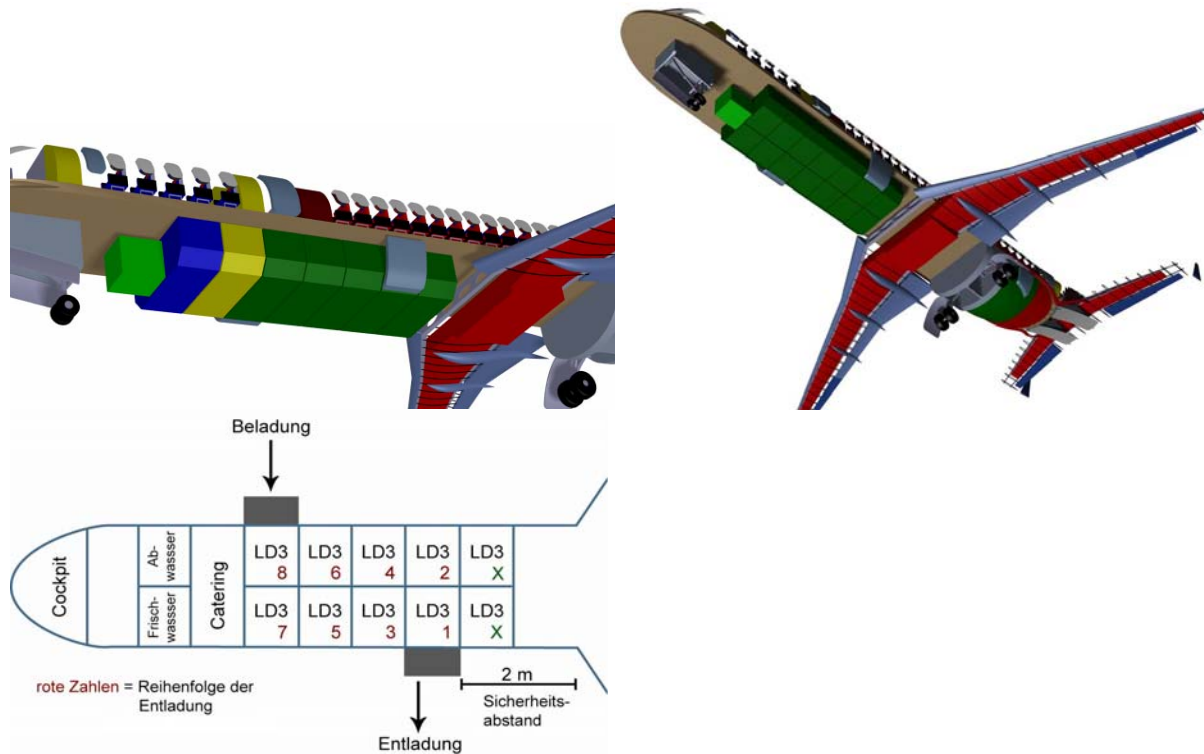


Figure 2.3 Continuous cargo hold through the two sides of the aircraft (Stuttgart 2008b)



Figure 2.4 Twin-aisle layout and foldable passenger seat (Stuttgart 2008b)



Figure 2.5 Two stairs at the rear of the aircraft (Stuttgart 2008b)



Figure 2.6 Trolley-lift system (Stuttgart 2008b)

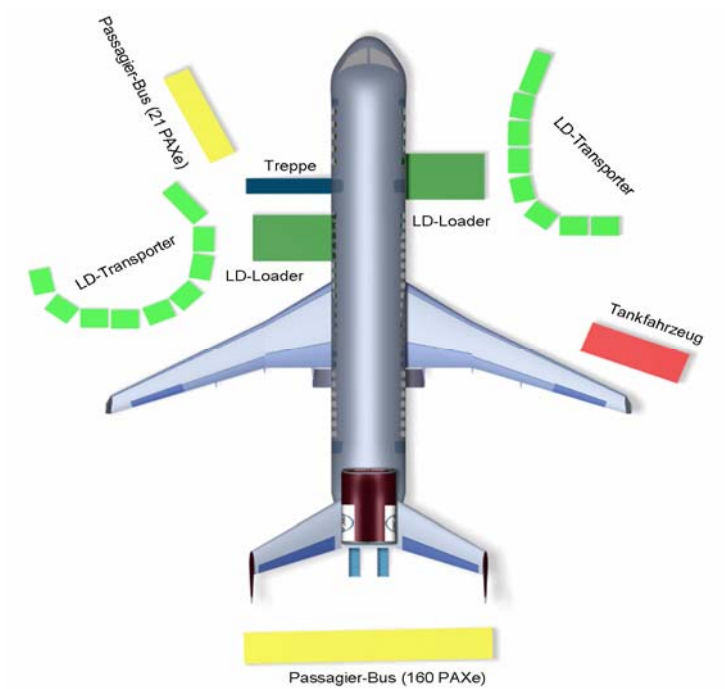


Figure 2.7 ORCA turnaround scenario (Stuttgart 2008b)

2.3 Place 3: LARUS (Stuttgart 2008c)

Authors: Christian Böhler, Felix Grygier, Waldemar Richter, Jan Steiner

Main ideas and innovations suggested:

- Elliptical fuselage cross-section (see Figure 2.8)
- Twin-aisle layout (see Figure 2.9)
- Sill height of 70 cm achieved by kneeling the aircraft (see Figure 2.10 and 2.11)
- Three doors per side (see Figure 2.12)
- Forward-swept wing (see Figure 2.12)
- APU fuel cell. On board water generation
- Engines mounted at the rear. T-tail (see Figure 2.12)

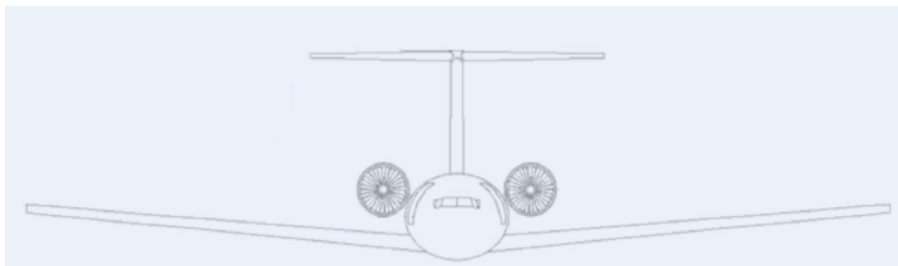


Figure 2.8 Elliptical fuselage cross-section (Stuttgart 2008c)

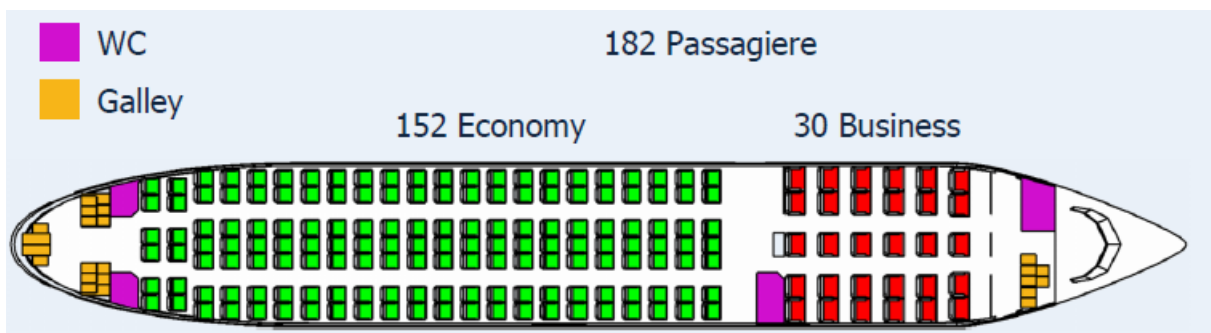


Figure 2.9 Twin-aisle layout (Stuttgart 2008c)

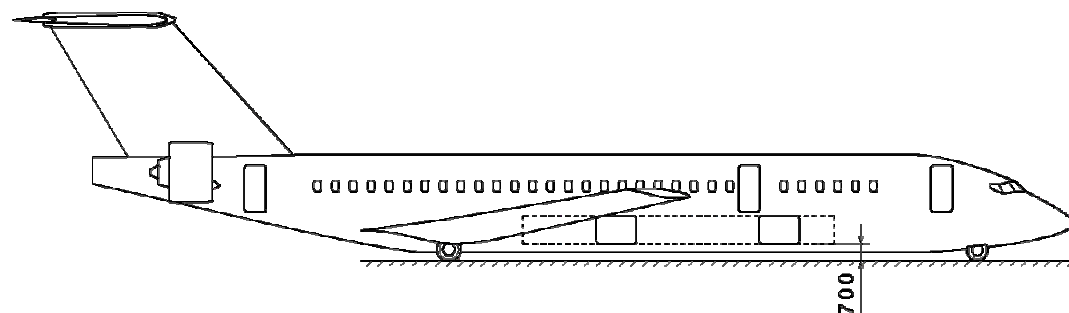


Figure 2.10 Low sill height (Stuttgart 2008c)

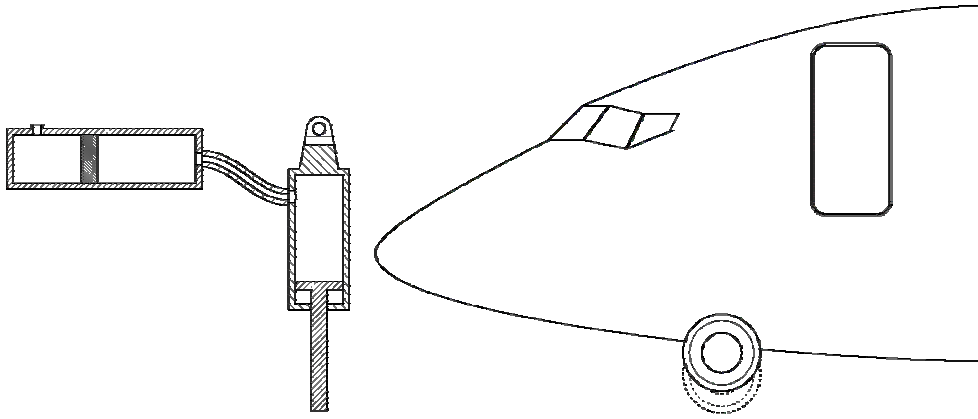


Figure 2.11 Kneeling the aircraft (Stuttgart 2008c)



Figure 2.12 Three doors per side and forward-swept wing (Stuttgart 2008c)

2.4 Place 4: GlobalSpirit (Stuttgart 2008d)

Authors: Richard Prüter, Vincent Mariathasan, Thorsten Scholz, Philipp Bendele, Renate Stump

Main ideas and innovations suggested:

- Continuous cargo hold for a simultaneous loading and unloading of cargo through one side of the aircraft
- Foldable passenger seat (see Figure 2.13)
- Twin-aisle layout (see Figure 2.14)
- Lower sill height
- Three doors per side (see Figure 2.16)
- On board stairs (see Figure 2.15)
- Shoulder wing (see Figure 2.16)
- T-tail (see Figure 2.16)



Figure 2.13 Foldable passenger seat (Stuttgart 2008d)



Figure 2.14 Twin-aisle layout (Stuttgart 2008d)



Figure 2.15 On-board stairs (Stuttgart 2008d)



Figure 2.16 Three doors per side and shoulder wing (Stuttgart 2008d)

2.5 Place 5: Gastornis (Stuttgart 2008e)

Authors: Eric Begenau, Steffen Hammel, Housseem Hayouni, Philipp Kunze, Ian Petersen

Main ideas and innovations suggested:

- Elliptical fuselage cross-section (see Figure 2.17)
- Single-aisle layout (Figure 2.18)
- Foldable passenger seat (see Figure 2.19)
- Three doors per side (see Figure 2.20)
- Fuel cell. On board water generation
- All electrical design. No hydraulics systems
- Engines mounted at the rear. U-tail (see Figure 2.20)

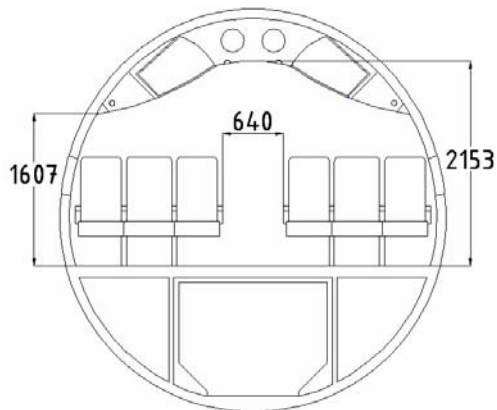


Figure 2.17 Elliptical cross-section (Stuttgart 2008e)

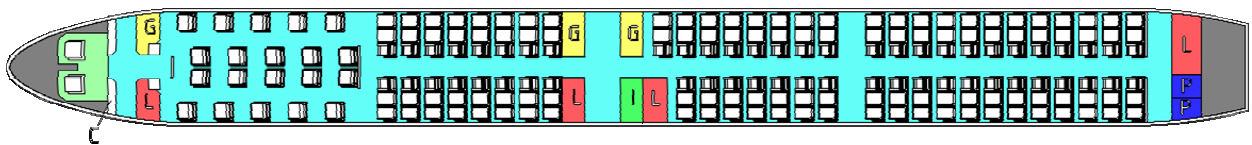


Figure 2.18 One-aisle layout (Stuttgart 2008e)

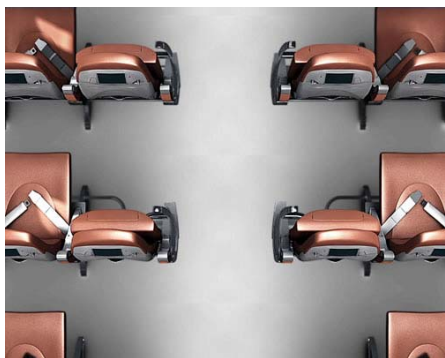


Figure 2.19 Foldable passenger seat (Stuttgart 2008e)



Figure 2.20 Three doors per side and U-Tail (Stuttgart 2008e)

3 TU Delft: Design Synthesis Exercise AE3-001. Low Fare Airline Optimized Aircraft (Delft 2007)

This is the final report of a group of students for the Design Synthesis Exercise 2007, Faculty of Aerospace Engineering, Delft University of Technology. The exercise consists on design and aircraft optimized for low fare operations as a successor of the Boeing 737 and Airbus A320. The main ideas and innovations suggested to optimise the turnaround process are summarized bellow.

Authors: M. Bouchareb, T. Ghobar, J.N. Vlastuin, G. Penin, C.J.C. Wever, R.P van Drooge, J. Eijmers, J.T.J.E. Lemmens, K.T.P. van Bennekom

Main ideas and innovations suggested:

- Shoulder wing (see Figure 3.1)
- Double-bubble fuselage cross section (see Figure 3.2)
- Lower sill height
- Single-aisle layout (Figure 3.3)
- Foldable passenger seat (see Figure 3.4)
- Staggered seating: more shoulder space and the armrests can overlap (see Figure 3.5)
- Triangular shape of the toilets (see Figure 3.6)
- Integrated stairs (see Figure 3.7)
- Autonomous pushback (see Figure 3.8)



Figure 3.1 Shoulder Wing (Delft 2007)



Figure 3.2 Double-Bubble cross section (Delft 2007)

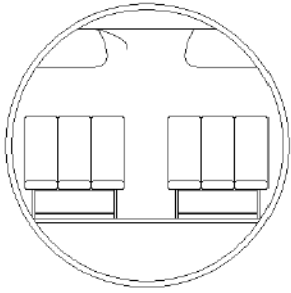


Figure 3.3 Single-aisle layout (Delft 2007)

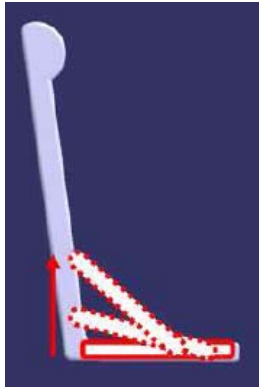


Figure 3.4 Foldable passenger seat (Delft 2007)

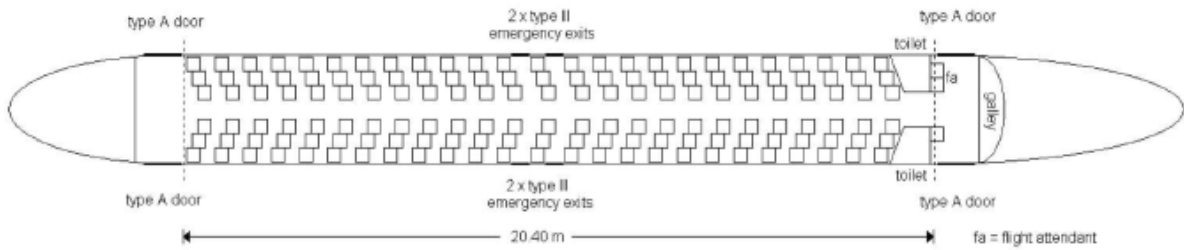


Figure 3.5 Staggered seating (Delft 2007)

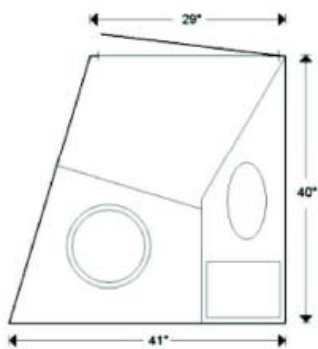


Figure 3.6 Triangular shape of the lavatory (Delft 2007)

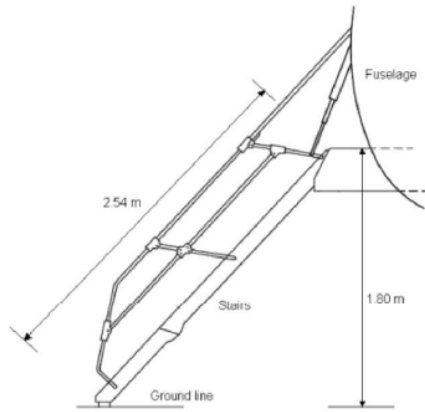


Figure 3.7 Integrated Stairs (Delft 2007)

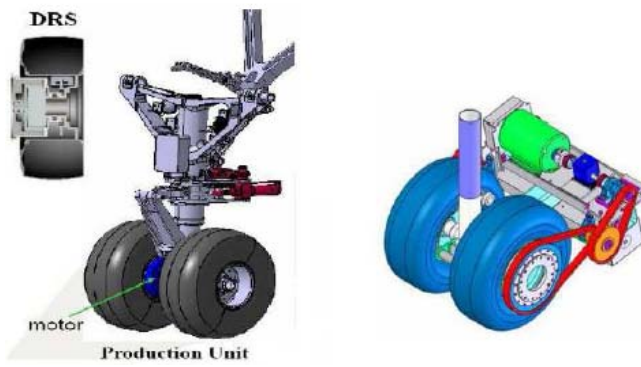


Figure 3.8 Autonomous pushback (Delft 2007)

References

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- Stuttgart 2008e** BEGENAU, Eric; HAMMEL, Steffen; et. al.: *Turnaround & Groundhandling Optimized Aircraft : Team 5*. Universität Stuttgart, Institut für Flugzeugbau, Student Projekt, 2008