FAKULTÄT TECHNIK UND INFORMATIK
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Calculating Aircraft Utilization

Aircraft utilization is defined as the hours an aircraft is airborne during the year. It is the productivity of an aircraft and the basis for its economic success.

Utilization is part of Direct Operating Costs (DOC) calculation. As such, utilization is already calculated during aircraft design, which uses DOC as the objective function. Passenger aircraft are bought based on DOC. Utilization is key to airline profitability. An aircraft on ground (AOG) incident is the worst that can happen, because it ruins utilization. Some DOC methods (e.g. from American Airlines, Association of European Airlines, or Airbus) contain the same equation to calculate aircraft utilization but apply different values for two parameters in the equation: The block time supplement (taxi time plus turnaround time) and the annual operation time (annual potential operation time minus annual downtime). Downtime is caused by scheduled maintenance (A, B, C, D checks), unscheduled maintenance (repairs), and night curfew.

PURPOSE

This project introduces the equation for calculating aircraft utilization and describes the parameters in the equation. Aim is also to point out differences in the notation used in the literature.

METHODOLOGY

Aircraft utilization is explained based on the chapter "Design Evaluation / DOC" from the lecture notes "Aircraft Design" by Scholz [1]. Parameters that are kept generic in this reference, are mapped to reality with definitions from Thorbeck's DOC method [2] from TU Berlin. Statistics of these parameters are obtained from a literature review.

FINDINGS

Aircraft utilization depends on two parameters. The block time supplement (taxi time plus turnaround time) and the annual operation time (annual potential operation time minus annual downtime). Downtime is caused by scheduled maintenance (A, B, C, D checks), un-scheduled maintenance (repairs), and night curfew. Practical values are given. Taxi time (in and out) is together about 20 minutes.

RESEARCH LIMITATIONS

Turnaround time (Figure 1) can vary widely (both among aircraft types and airline philosophies). Delays can change turnaround and taxi time (Figure 2). Maintenance programs are structured differently among airlines, and night flying regulations are much different at different airports. Fixed values do not exist for these parameters.

PRACTICAL IMPLICATIONS

It is essential for airlines to keep utilization high. The project shows how this can be achieved.

SOCIAL IMPLICATIONS

Public and airline interests clash when discussing night curfew. Noise versus profit. Utilization is the parameter in question.

ORIGINALITY

A comparable report with a review of aircraft utilization was not found.

$$U_{a,f} = n_{t,a} \cdot t_f \qquad U_{a,f} = t_f \frac{t_{OPS}}{t_f + t_{BS}} \qquad U_{a,f} = \frac{t_{OPS}}{1 + \frac{v_{av}}{R_{av}} \cdot t_{BS}} \qquad t_{BS} = t_{T\_out} + t_{TA} + t_{T\_in}$$

$$t_{OPS} = t_{PO} - t_D \qquad t_{PO} = 365 \cdot 24\ \mathrm{h} = 8760\ \mathrm{h} \qquad t_D = t_{Checks,a} + t_{Repair,a} + t_{Curfew,a}$$

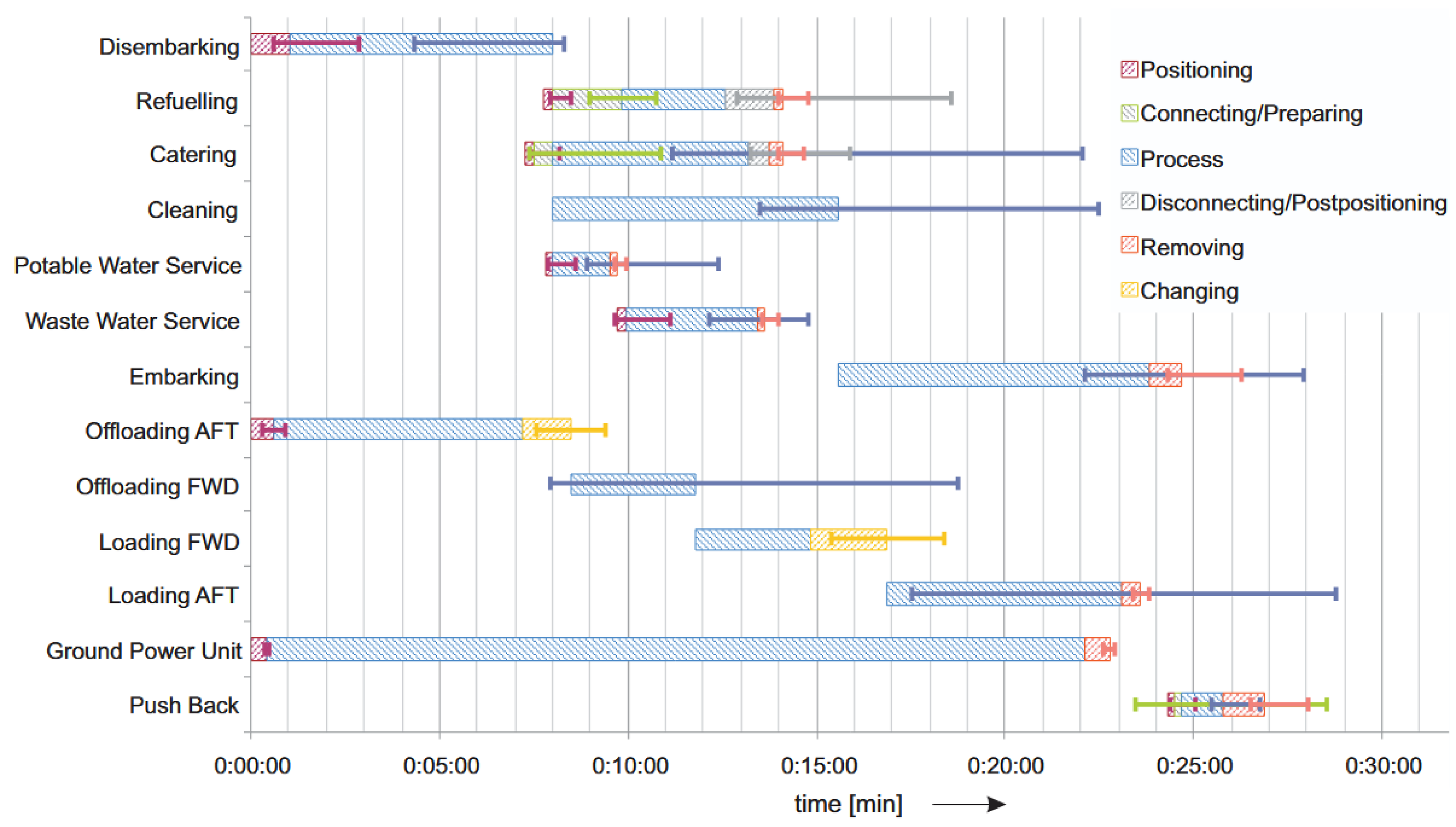

Figure 1: Turnaround (t_TA) Gantt chart for ground handling. Conventional low cost airline. Lines represent standard deviations. Based on statistical evaluation. Source: https://bit.ly/3Ofujj1.

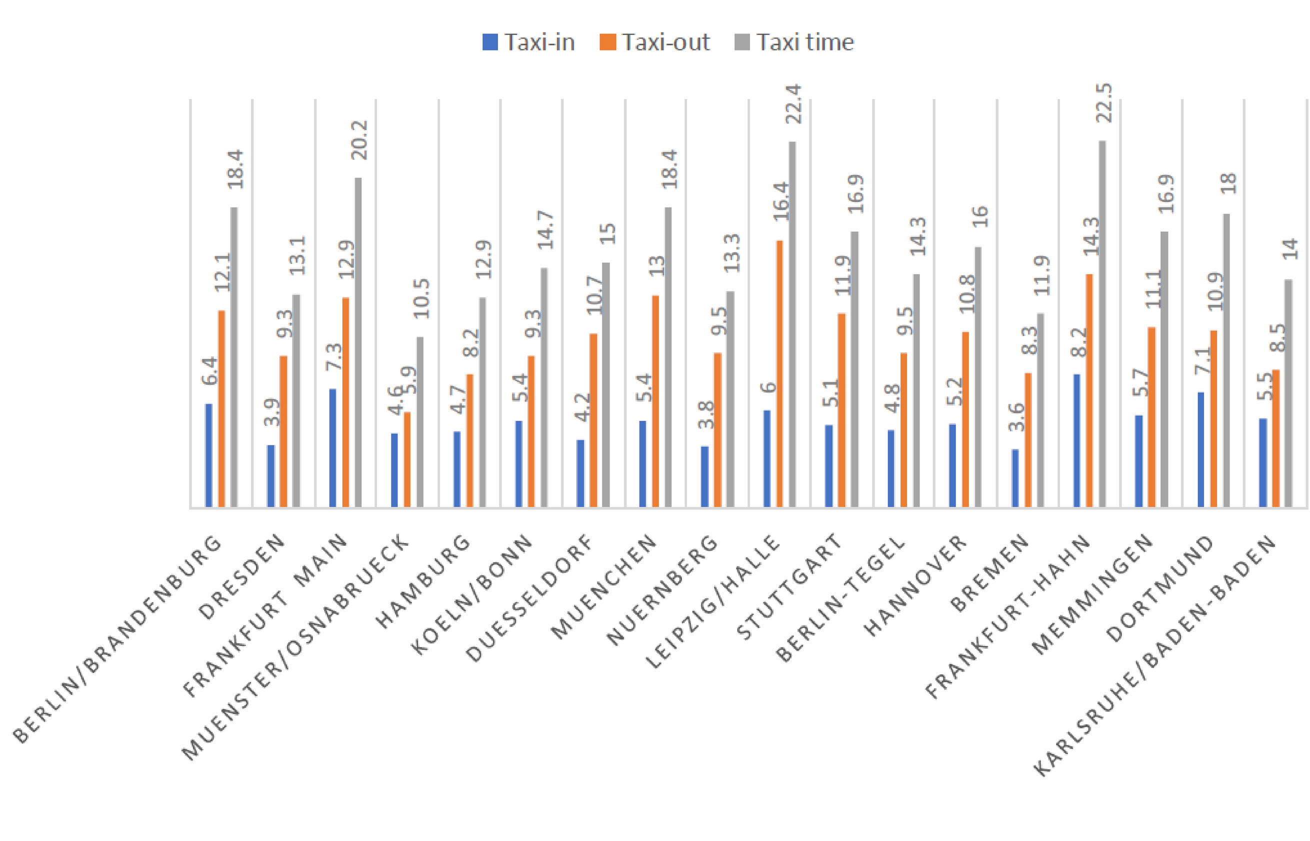

Figure 2: Average taxi time (t_T) at German airports. Source: https://bit.ly/4plj5fN.

References

[1] http://LectureNotes.AircraftDesign.org

[2] https://purl.org/aero/PRE2013-09-19

All details in the Bachelor Project of Bazldost (2022):
https://nbn-resolving.org/urn:nbn:de:gbv:18302-aero2022-06-07.017

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