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Implementation of A-SMGCS Routing and Airport Safety Support Service on Fraport Apron

SESAR Deployment Manager
Brussels, 25 April 2019

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Ieyasu Sugimoto (ADB SAFEGATE)

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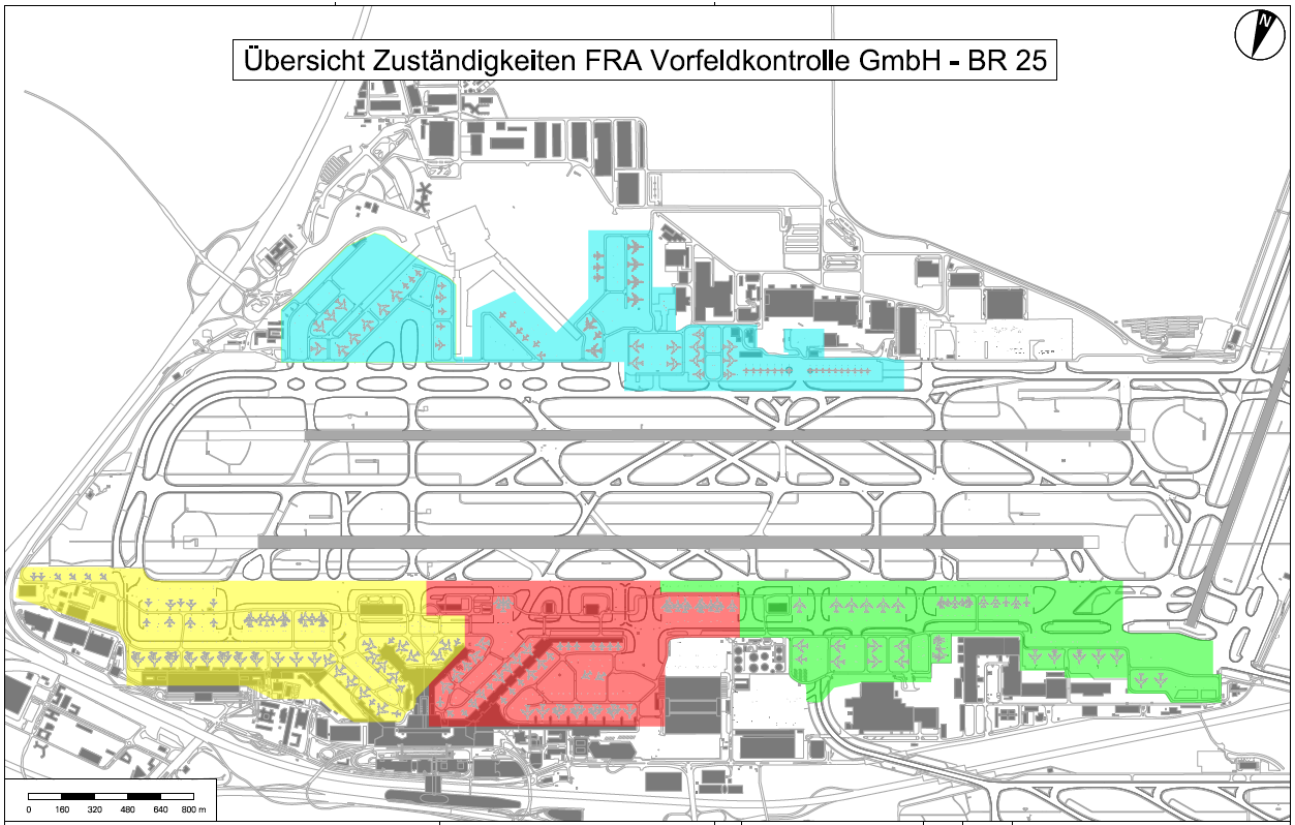
Project Objectives

Übersicht Zuständigkeiten FRA Vorfeldkontrolle GmbH - BR 25



Legende, Frequenzen:

- Frankfurt Apron West; P/B- & Taxifrequenz; 121,755 MHz
- Frankfurt Apron Center; P/B- & Taxifrequenz; 121,855 MHz
- Frankfurt Apron East; P/B- & Taxifrequenz; 121,955 MHz
- Frankfurt Apron South; P/B- & Taxifrequenz; 121,655 MHz

Tower-Frequenzen:

TWR-Centerbahn:	118,780
TWR-Südbahn:	119,905
TWR RWY 18:	124.855
TWR LBNW:	136.500
TWR Ground:	121,805
TWR Start Up:	121,905

Index	Änderung	Datum	Name
05	Neue Frequenzen	25.09.18	B. Sexton
04	Neuer Bereich Apron South	11.07.17	B. Sexton
03	Apron Center Inkl. V135 & V136	21.02.17	B. Sexton

Dateiname: Betriebsunterlagen und Übersichten\Übersicht Zuständigkeiten VFK

Maßstab	1 : 16000	Datum	11.07.2017
Bearbeitet	B. Sexton / FTU-FB1	Format	DIN A3
		Geprüft	E. Kleiser / FTU-FB1

Fraport — Flugbetriebs- und Terminalmanagement, Unternehmenssicherheit
Flugbetriebsmanagement
Entwicklung luftseitige Infrastruktur

Planinhalt:
Übersicht Zuständigkeiten Vorfeldkontrolle
Übergabe und Frequenzen

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Tender Specification

Frankfurt/Main was the first airport to specify and publish a tender for an A-SMGCS fulfilling the routing and planning functionality according to Implementing Regulation (IR) 716/2014

- Requirements as written in IR 716/2014 are very vague
- Operating contexts at airports differ considerably; Frankfurt/Main is an airport with “grown infrastructure”
- General implementation guideline for industry was not available in 2016

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Project Objectives

- Compliance with IR 716/2014
- Highly integrated working environment for apron controllers with high usability on a single screen solution
- Reduced workload for controllers
- Reduced frequency usage
- Enhanced situational awareness for controllers (plus pilots and vehicles drivers)
- Operations ideally independent of weather operations
- “Optimal” routing
- Detection of (potential) conflicts
- Foundation for automated guidance

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Product Goals

- **Intuitivity** – simple and intuitive user interaction
- **Configurability** – highly configurable with parameters
- **Modularity** – system is based on different services based on modules
- **Interoperability** – interfaces are future proof, less use of proprietary interfaces
- **Automation** – high, but configurable level of automation; controller as supervisor
- **Focus** – only relevant information is displayed, additional information can be easily retrieved
- **Expandability** – services and other components have to be expandable
- **Flexibility in role concept** – system has to support current and future controller roles and responsibilities

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How did we proceed?

2016-2017	Bid process, evaluation phase (five days per bidder)
2017	Tender award
2017 onwards	Realisation (industrialisation) in two phases

Phase 1: Focus on IR 716/2014 compliance

Mid 2019:	Start apron simulator integration
End of 2019:	Start training
End of 2020:	Go-live

Phase 2: Enhancements beyond IR 716/2014 (e.g. guidance functionality)

Lessons learned so far…

- Even though **SESAR validation** for routing and planning functionalities was successfully executed, none of the products tested during the evaluation phase was mature enough to be deployable out of the box at Frankfurt/Main. All products required further development (**industrialisation**).
- SESAR focuses rather on **technical solutions** rather than **operational challenges** and **user interfaces** or **user experience**.
- Basic routing and planning functionality was available, but support for operations at **airports with complex infrastructure/layouts and high-density operations** was not mature.

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Joint Project/Product Development Process

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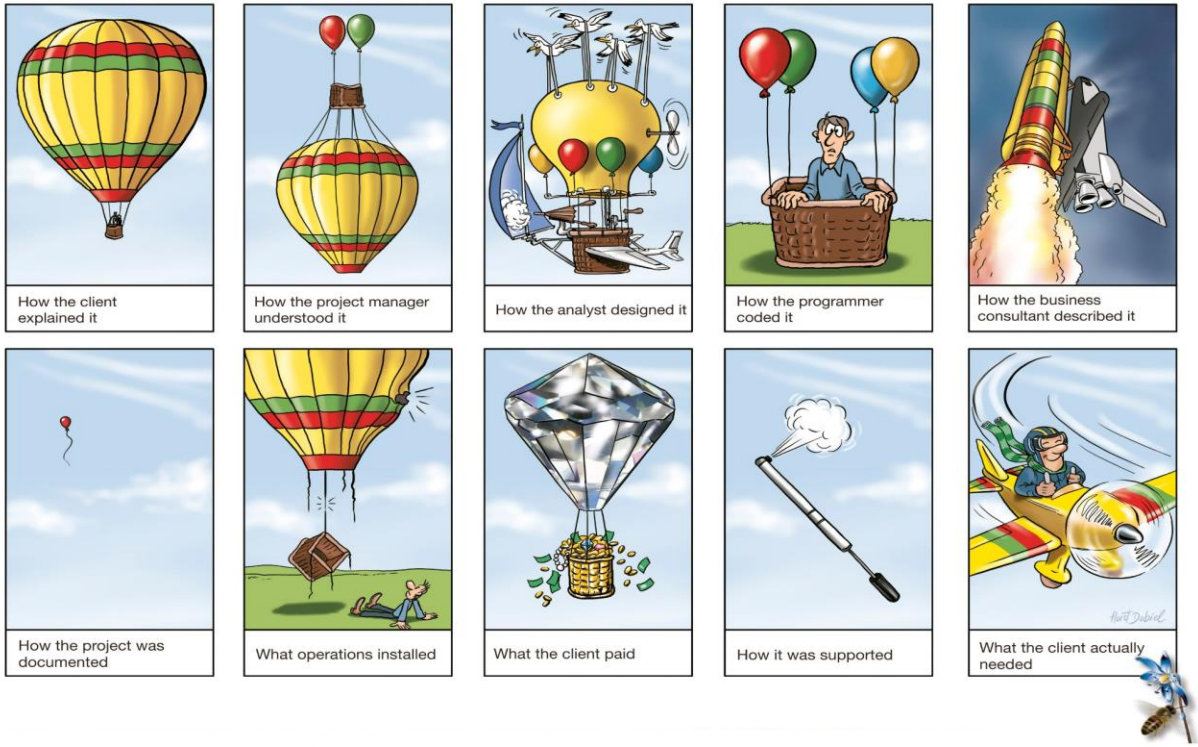
Software Development How We All Know It…



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Iterative Development Using Scrum

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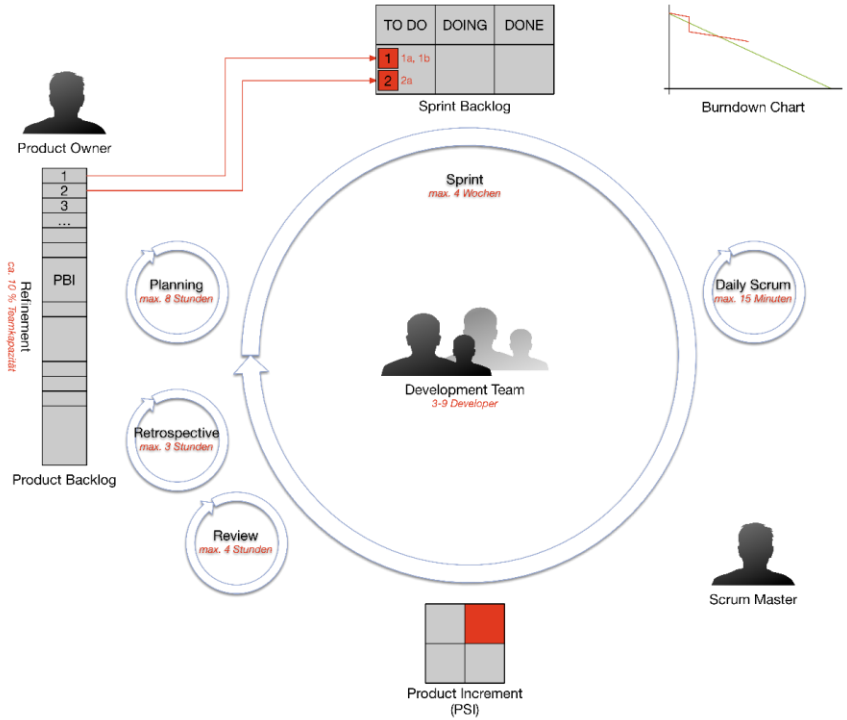
Scrum Methodology



Change Management

The implementation of the jointly developed Apron Controller Working Position (ACWP) at Frankfurt/Main will **significantly change the working environment and the actual work of apron controllers**. Proper change management is paramount to ensure a **smooth transition**! What does this mean in practice?

- Apron controllers are involved in development and implementation processes
- We have two demo systems showing the current state of the system at two apron control towers.
- Apron controllers are part of the project team reviewing sprint results and planning upcoming sprints.
- …

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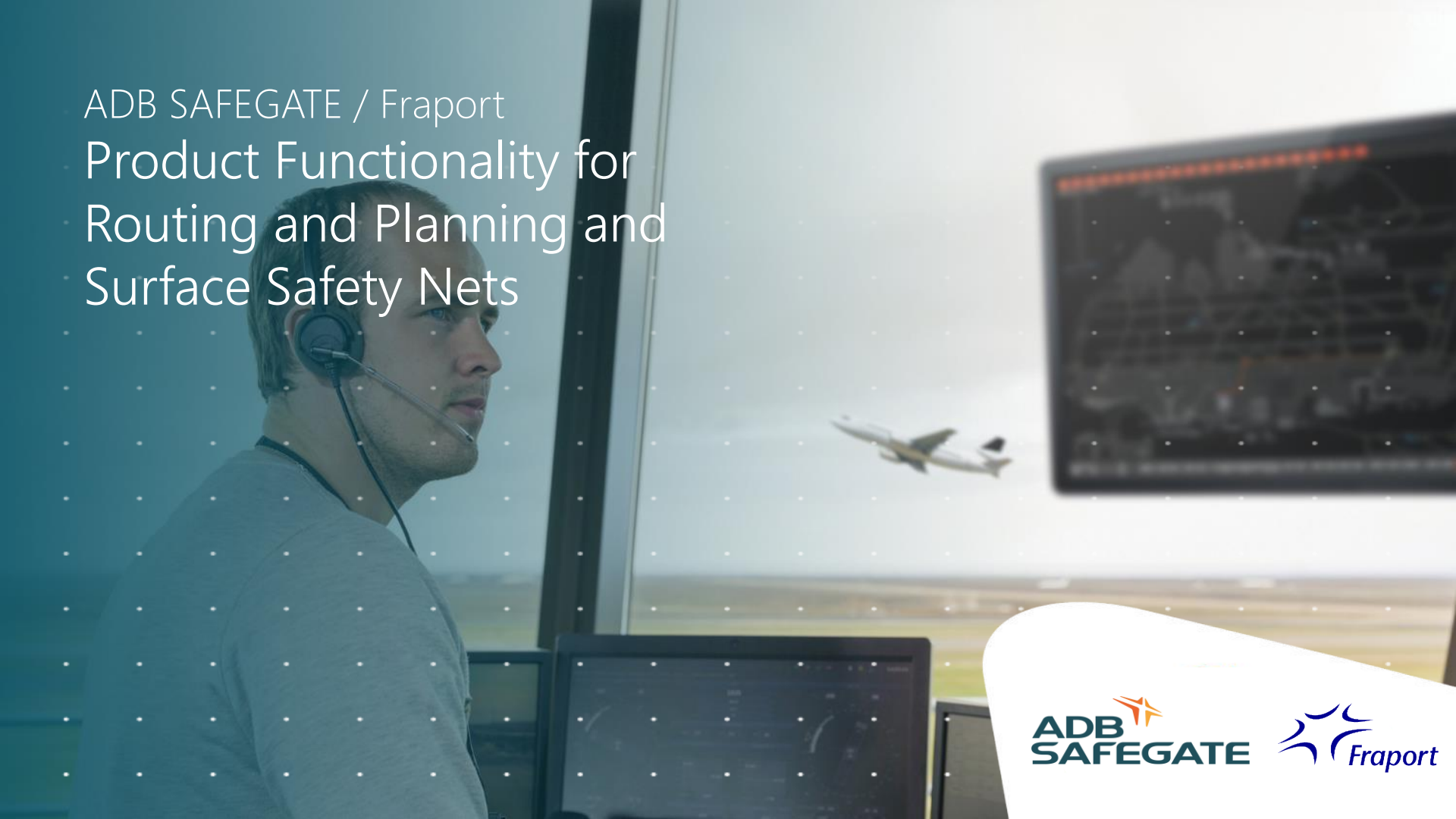
Product Functionality for Routing and Planning and Surface Safety Nets



Surveillance Service

Routing and Safety Support Service demand a higher surveillance performance, also in areas that are close to terminal buildings

- Otherwise nuisance alerts irritate controllers
  - Route deviation alerts caused by wrong detection
  - Wrong safety net alerts (e.g. Push without Clearance)

- More interaction with the target label => needs to be steady

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Electronic Clearance Input

Fundamental for support of Safety Support Service and Routing Service

Tight Integration with Routing Service

- Routing Service calculates the handover points
- Workflow Service calculates clearance input based on handover points

Either input via target label or via electronic flight strips

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Electronic Clearance Input

Example Workflow – Routing Integration

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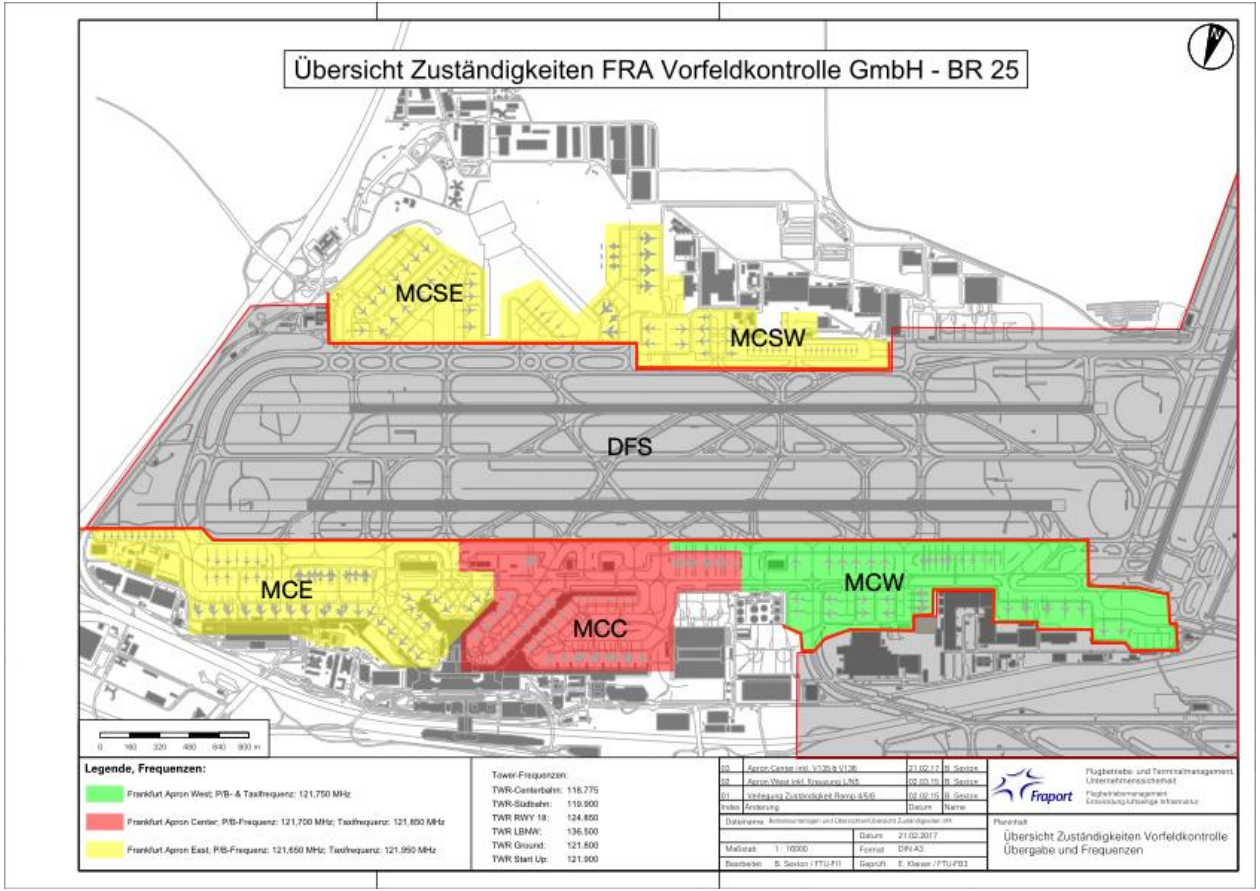

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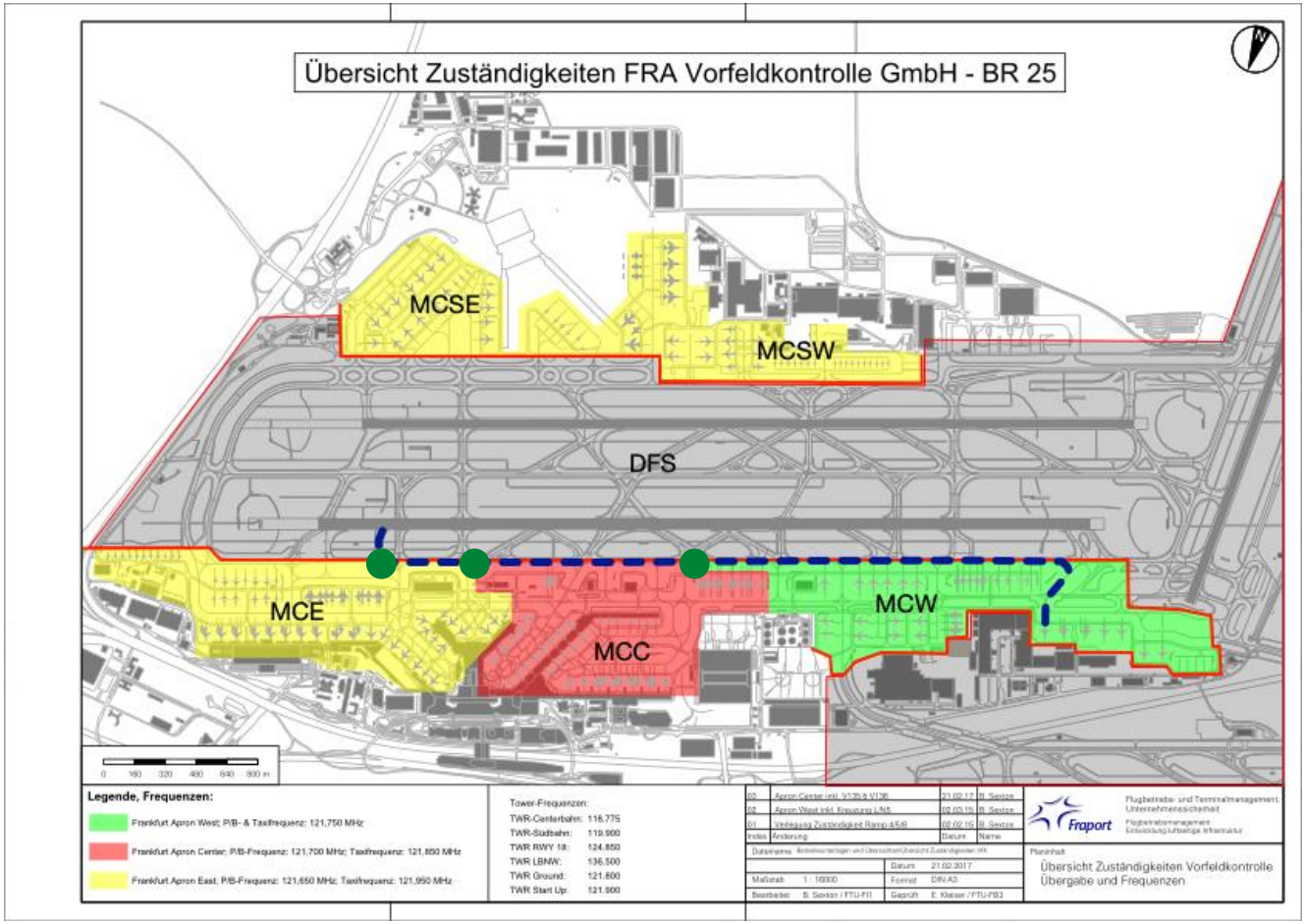
Übersicht Zuständigkeiten FRA Vorfeldkontrolle GmbH - BR 25
MCSE
MCSW
DFS
MCE
MCC
MCW
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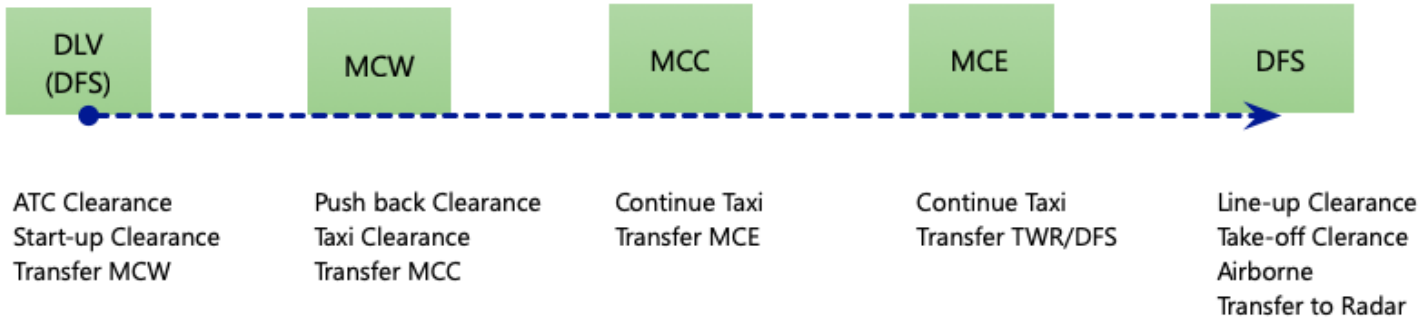
Übersicht Zuständigkeiten Vorfeldkontrolle
Übergabe und Frequenzen

Electronic Clearance Input



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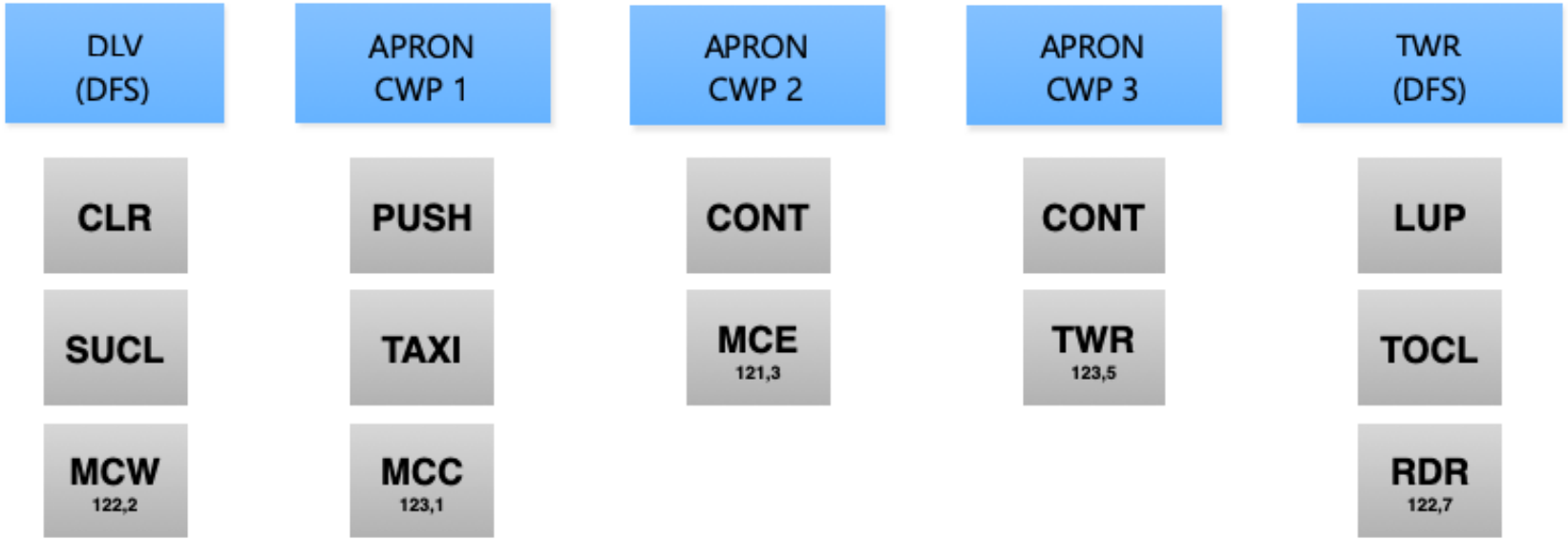
Electronic Clearance Input



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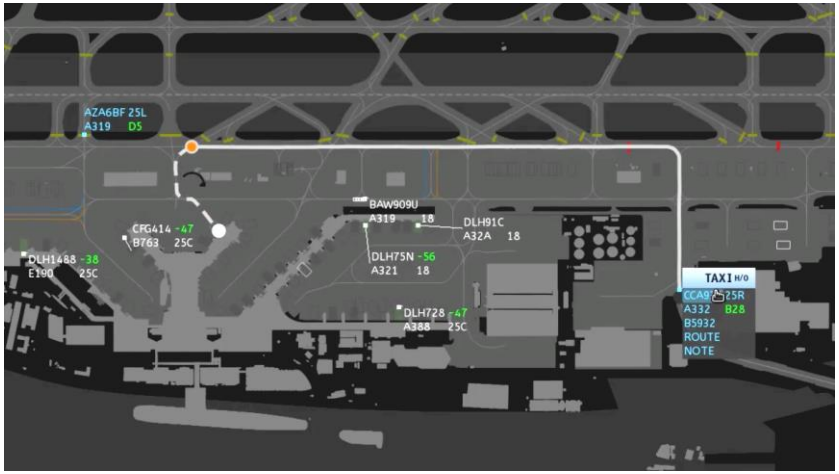
Electronic Clearance Input

Clearance in label instead of flight plan supports stripless working

Synchronized with electronic flight strip supports both ways

Route Proposal and Modification

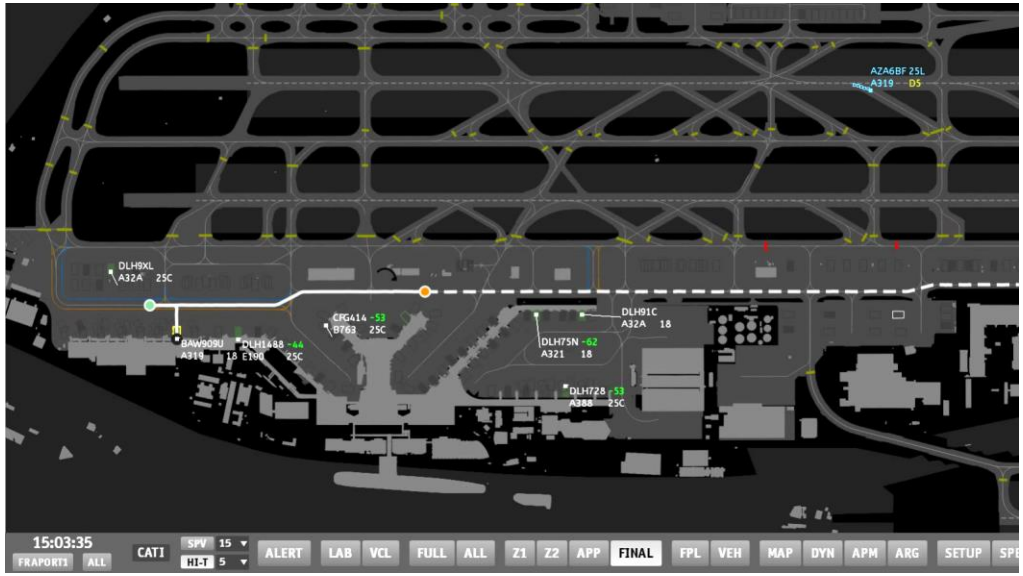
- Aircraft (CCA935) is assigned a route based on configuration parameter
  - Standard route patterns depending on
    - Position and Destination,
    - Runway Configuration,
    - Visibility,
    - Aircraft Class and Type.
    - Taxiway availability (closures)



- Controller can change the route proposal
- Route is cleared (grey => green)

Area of responsibility

- Route proposal (BAW909U) automatically includes handover point (red dot)
- Clearance automatically only up to handover point
- Route modifications only in own AoR



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Handover of Responsibility

- When aircraft reaches handover point, controller transfers.
- Next controller will clear clear next segment with “CONTINUE”
- Route indication shows clearance

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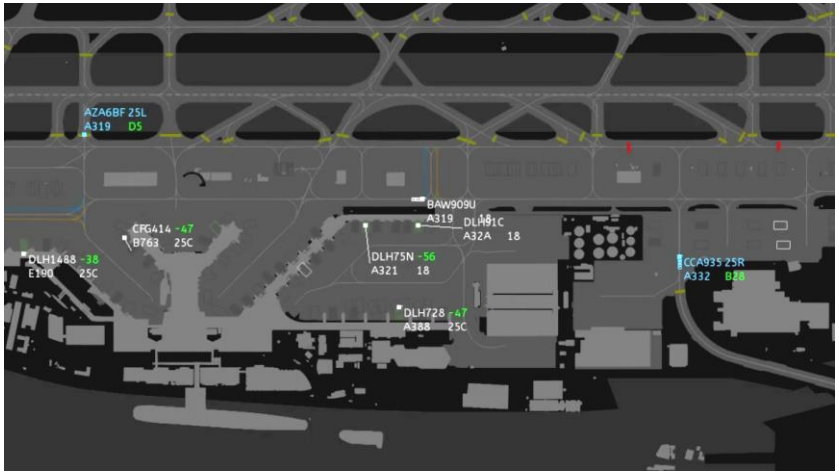
Routing Clearance Limit

- Controller can add clearance limit
- Different representation (solid => dashed)
- Continue action to clear rest of route



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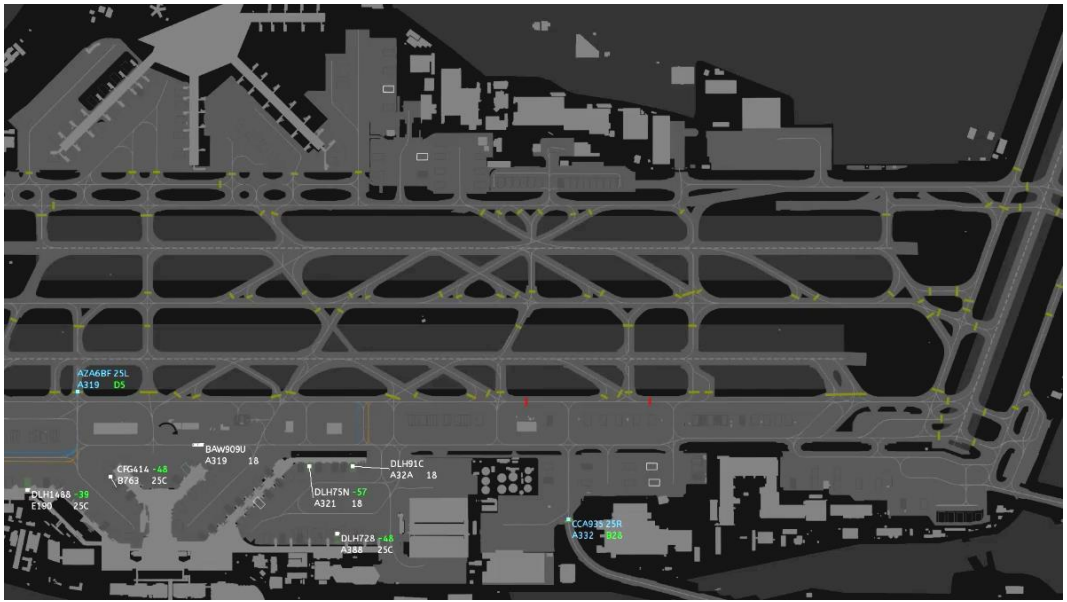
Pushback as Part of Routing Service

- Default standard PB Procedure depends on position, aircraft type or wing span category, runway configuration, visibility (Area 2, taxi via N7)
- Other standard PB procedures can be displayed and selected
- Proposed route will change accordingly (Area 7, taxi via N8)



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Free Pushback as Part of Routing Service

- Free Pushback can be entered
- Change from Area 7 to non-standard point on N8, nose facing west
- Route is adapted accordingly

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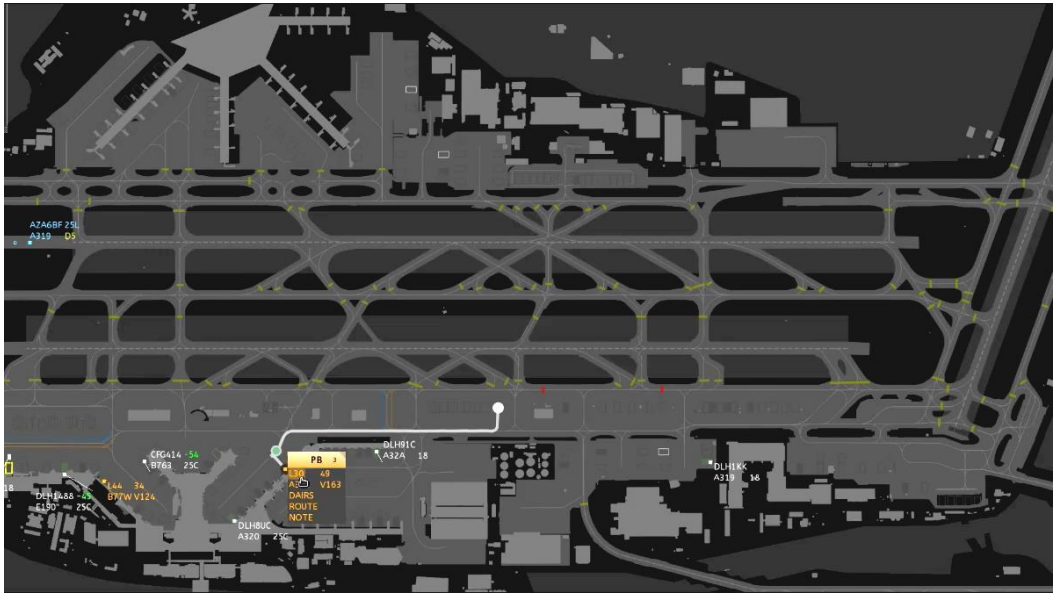
Tow Routing as Part of Routing Service

- Same routing functionality as for aircraft also applies for tows
- PB procedure can be selected
- Different standard route configuration compared to aircraft
- Note: Vehicles not part of routing service



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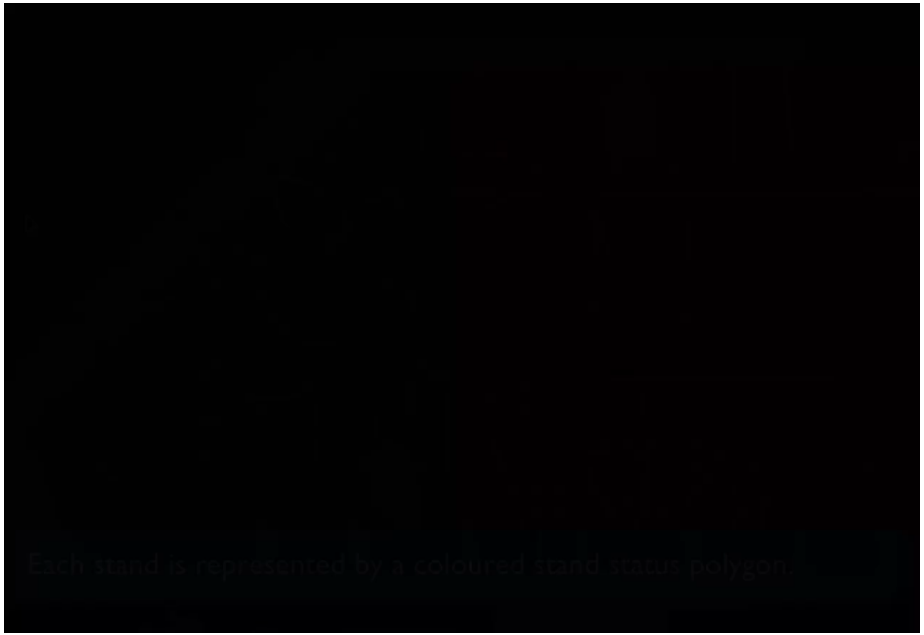
Stand Status as part of Planning Service

Indicate the status of the stand visualized on the a Airport map

- Show state of positions (free, occupied, etc.)
- Show next flights/tows at gate
- Safety logic to avoid A/C conflicts
- Display A-CDM Information



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Airport Safety Support Service - CMAC

Taxi without Clearance

- Movement detected
- No ECI

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Airport Safety Support Service – CATC

Conflicting ATC Clearance

- ECI Input
- Conflict detected

Case shown

- Controller gives Take-Off Clearance
- ASSS detects that a vehicle is on the runway
- Warning is displayed

Note: not part of delivery in Fraport project

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Usability and User Acceptance

A-SMGCS used to be a support screen

- User interaction with the system used to be limited
- Users log on to screen, set their window preferences, and will interact rarely

A-SMCGS becomes an operational tool

- Much more interaction on A-SMGCS (Electronic Clearance Input, Route modifications)

Integrated Controller Working Position in general

- More information is shown on screen => abstraction needed to avoid overflow
- More user interaction with elements shown on screen => more focus on UI/UX

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Interim Results

Interim Results/1

- As software development is based on SCRUM we have a **pretty good idea on the state of the system** and, thus, the project. In addition to this, we have regular releases (“potentially shipable increments”) on two demo systems in our apron control towers to allow for continuous and fast feedback.
- The **inauguration of the new system** was initially planned for 30 June 2019. We will incur significant delay.
- Clearly a **huge gap between validation and industrialisation of technology exists**.

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Interim Results/2

- Frankfurt/Main employed a **multi-stage supplier selection process following EU rules**. As we wanted to be sure to select the best supplier we included 5 day test installations in Frankfurt/Main in the selection process and weighed functional capabilities and price roughly equal.
- The **design of the supplier selection process** made sure that the most suitable supplier for our operating context was selected.