AIRCRAFT JOURNEY

Our vision: fully coordinated aircraft turnaround processes, using the latest in automation, safety and environmentally friendly technologies to increase predictability.

00 – THROUGHOUT THE JOURNEY

SITUATIONAL AWARENESS

The philosophy of A-CDM (Airport Collaborative Decision Making) and platforms for information exchange provide a foundation and integrated approach for all operational data. With contribution from multiple sources, stakeholders are able to work from a single Airport Operations Plan. This plan incorporates both arrival and departures flows. It is utilized for seasonal planning of resources right down to real-time decisions and all the time horizons in-between.

All parties shall have access to the relevant real-time information that is shared by the most reliable source. The entity capturing/creating each specific data item is used as the trusted, single source to provide updates to all. This requires a data link communication between aircraft, pilots, operations control centers and ATC (Air Traffic Control) supplementing voice communications. This data communication extends to enable those on the ground to receive information directly from the aircraft systems such as fuel and water requirements. Equally, passengers and cargo customers will receive consistent information pulled from the trusted source. They also contribute directly to the accuracy of real-time information with updates they make regarding their status, preferences and orders. The turnaround can be planned in great detail prior to the aircraft arrival.

Digital and cloud based tools, using this real-time information gives awareness of the virtual capacity of infrastructure when facilities and staff assignments are dynamically adjusted to optimize the use of available resources, the efficiency of the overall operation and ensure a optimized customer experience. By providing greater visibility and flexibility, these tools assist in pre-empting delays and a swift recovery from weather impacts, system failures or uncontrollable events.

As a prerequisite, communications networks (terrestrial and satellite) provide the necessary coverage and capacity to connect with all fixed and mobile devices involved in the exchange of real-time information.

These networks have the appropriate resilience, redundancy, security, prioritizing capabilities and 24/7 reliability for mission-critical systems to maintain safe and efficient operations.

SUSTAINABLE OPERATIONS

Along with operational efficiency, environmental aspects are paramount for an aircraft turnaround. For every part of this journey, technology deployments and process change lead to a significant reduction in noise, emissions, energy consumption and waste. This is not simply a response to address the global challenge of climate change, it is also securing the future growth of the industry in a manner that is sustainable.

01 – OFF-AIRPORT

ARRIVAL MANAGEMENT

Through data telemetry, ground handlers, airline and airport staff are all using consistent information, with everyone aware of the predicted time of arrival and assigned gate. Timely preparations can be made on the ground as the relevant parties access real-time information regarding the aircraft's servicing needs (including any maintenance issues, fuel uplift, water, catering and air conditioning). Preparations are made for all the passengers' arrival needs. The details known to facilitate this include passenger connections (and the demographics of those passengers), nature of assistance for those with restricted mobility and any other special requirements. Information about the load on-board (both baggage and cargo) means that provisions are made on the ground for an efficient transfer of these items to their next processing point.

The predicted load to be uplifted is known and dynamically updated so that an increasingly refined load plan, weight and balance, fuel and water calculations are made for the next flight. Using trajectory based operations the aircraft arrives at the airport without the need for holding. The aircraft follows the most efficient route and takes a continuous descent approach path, in an optimum landing sequence. This is made possible with data link communications between pilots and controllers.

ON APPROACH

Newer aircraft and engine designs (or modifications to existing aircraft flaps, slats and landing gear) have substantially reduced the amount of noise generated by aircraft.

Separated more by time rather than distance, the approach is guided by satellite based navigation with less reliance on ground based navigation aids, such that in any weather condition the runway utilization is optimized and noise impact minimized.

REMOTE TOWERS

A combination of motion tracking, high resolution cameras, microphones and sensors provides air traffic control (ATC) with augmented reality vision of the aircraft and surrounding situation. The ATC need not be in a tower or even at the airport and may serve multiple locations.

02 – GROUND MOVEMENTS

AIRCRAFT TAXI-IN

The aircraft leaves the runway via the exit which optimizes the time spent on the runway and the speed to arrive at the assigned gate/ stand.

Using advanced surface movement guidance and control systems where needed, the airfield capacity is maximized even when visibility is very poor. An on-board moving map displays surrounding traffic, alerts, warnings and the current airport layout including restrictions (temporary or permanent). These dynamic A-SMGCS can also adjust taxi center line lighting, stop bars and no-entry bars depending on vehicle and aircraft movements, enhancing safety for all.

Enhanced taxiing systems (electric landing gear drives or remotely controlled tugs) avoid jet fuel burn, noise and pollution whilst the aircraft moves on the ground. Taxiing at the optimal speed and route, the aircraft then arrives at the gate/stand using the visual docking guidance system. Its arrival synchronized with all the required ground support equipment.

GROUND SUPPORT EQUIPMENT (GSE)

The aircraft arrival time is now highly predictable and known through use of the Airport Operations Plan. The availability and movement of GSE are synchronized to match. All GSE is tracked and monitored to provide input data for the GSE management systems. These systems are responsible for routing and task allocation for each piece of equipment. Servicing requirements for each aircraft in terms of type and quantity of GSE and the duration of the task are precisely estimated. Machine learning (artificial intelligence) enhances the decisions to deploy equipment and staff. Optimal times for predictive maintenance and recharging of equipment are also built into these allocation plans.

Monitoring and data-connected GSE serves a customer requirement. As GSE embarks or completes a process, the status record relating to passengers and loads are updated accordingly. For example, when a vehicle leaves the cargo facility on route to the aircraft gate, the record for each shipment being transported reflects this status.

Predominantly this GSE moves autonomously, running on electricity with charging infrastructure distributed across the airfield. Location and context information regarding all airside vehicles is included in the A-SMGCS.

With a precisely scheduled turnaround and more standardized turnaround procedures, it is possible to plan the exact arrival and departure times of the various GSE at the stand. This reduces cluttering of the stand (making for easier and safer ground operations) and optimizing the utilization of all GSE.

03 – AT THE STAND

DATA COMMUNICATIONS

Aircraft communicate with a range of ground services, operations control (air traffic, airline and airport) and maintenance facilities. A planned and coordinated turnaround is possible because load-planning, or weight and balance, can occur in real-time. This combines aspects such as special cargo (heavy, long, etc.), cargo loading system status as well as advance knowledge of the next flight's requirements. To facilitate this precision turnaround operation, it is necessary to have links between passenger, baggage and cargo systems and airport systems. This Total Airport Management approach enables scheduling of exact times for gate open, pushback and apron, taxiway and runway use etc.

UTILITIES: POWER, WATER & AIR

Service connections (refueling, ground power, air, water, waste water) and maintenance access points will be optimized to allow shorter processes and ergonomic improvements.

All airport stands will be equipped with combined ground power and cabin air supply connectors, with cooling and heating functions whenever climatic conditions require it.

Sensors and data monitoring of water consumption coupled with flight and load planning enables precision, optimal loading of fresh water.

CLEANING, TOILETS & WASTE MANAGEMENT

Cabin and toilet cleaning times are reduced as furnishings are made from dirt-repellent nano-coatings.

Standard processes for waste collection maximize the reuse and recycling potential for all waste removed from the aircraft. This zero-cabin waste concept requires containers on board each aircraft for waste segregation and compaction. Airport processes for cabin waste removal will be adapted, including standardized color coding for segregated waste.

HOLD UNLOADING/LOADING

The unloading and subsequent loading of the hold is largely an automated process.

As the aircraft is loaded, weight and balance records are simultaneously updated. Once the load is in position the cargo loading system locks are confirmed to be operative and that the load is correctly secured, Alerts are triggered if any locks are missing or inoperative.

BAGGAGE HANDLING

Piece-level tracking enables push notifications to each arriving passenger and other relevant parties confirming their bag has been off-loaded. The onward destination for the bag and timing requirements are clearly identified within the baggage tracking system. The handling sequence was accounted for in the order the bags were loaded, such that rush and priority bags are off-loaded first.

Similarly, bags for the next flight are uniquely identified, tracked and loaded to reflect the prioritization at their destination. The status is duly updated in the baggage record and linked to the passenger status so passengers, ground handlers and pilots alike can be informed of the all the bags relevant to their operational process.

CARGO & MAIL HANDLING

Regulatory/customs pre-clearance of inbound goods has occurred as a virtual process with any items requiring inspection identified and reported. Handlers on the ground are prepared for this and divert any item upon arrival to the relevant authority.

As shipments for the next flight are loaded, the shipment records are updated and status notifications automatically shared with the relevant parties. The pilot is informed of the loading locations and recommended settings (e.g. temperature). Monitoring is enabled utilizing sensors on the loads, aircraft data and comparisons with the recommended settings. This ensures that the shipment health is maintained throughout its time on the aircraft, with mitigating actions implemented in the event of any adjustment and alarms triggered if necessary.

FUELING

The management of fueling the aircraft is fully digitized. Drawing on real-time information from the Airport Operations Plan, airline requirements, payload needed for the next flight and data from the aircraft's gauges, the volume of fuel required is accurately estimated before the aircraft even lands. The precise time and location for fueling is known. Coupled with electronic signatures and the ability for the fueling operator to communicate directly and in real-time with the cockpit ensures accurate fueling information and records. These capabilities also enable the into-plane companies to make best use of their resources leading to reduced costs and better environmental performance.

INSPECTIONS

A diverse range of aspects of the aircraft are continually monitored which reduces the requirements for inspection activities at the turnaround. While at the gate, a drone checks over the entire aircraft either confirming that there are no defects or pinpointing, recording and alerting maintenance/repair resources of the defect encountered. Evaluation of the data from the various sensors on the aircraft and other monitored factors (such as exposure to lighting) may provide sufficient confidence that inspections are not required during every turnaround.

MAINTENANCE

Aircraft maintenance for the most part is a predicted and planned activity. Big data analytics across an airline's network and/or the aircraft type, combined with the array of data collected from the aircraft itself determines the corrective and preventative maintenance. It is also then possible to ensure that these maintenance activities are scheduled to happen in the location and at a time which optimizes the period the aircraft is out of service. Advanced notification of the maintenance required, improves the ability to conduct some maintenance activities during the standard aircraft turnaround. The right tools and parts are ordered in advance and the logistics arranged to match with the Airport Operations Plan.

CATERING

Greater availability of pre-ordering by passengers and improved predictability of what is likely to be consumed improves customer service whilst minimizing excess load and waste on the aircraft. Passengers, catering service providers and airlines automatically share information regarding orders and fulfillment of them. This data is linked to the Airport Operations Plan which reflects the passenger manifest and aircraft status.

Scheduling of catering trucks uses real-time aircraft servicing schedules so that food loads for multiple flights are on one vehicle with a coordinated drop-off / pick-up plan.

CREW & PASSENGERS

Enhanced communications between ground handling agents, passengers and crew makes boarding a smooth-flowing, queue-free process. The status of boarding and loading is digitally monitored providing real-time updates to the Airport Operations Plan. The pilot and others will be made aware if any passengers (or crew) are delayed. Action to handle this delay shall be a collaborative decision with communications facilitated by the Airport Operations Control Centre (AOCC).

Additionally the design of boarding bridges and aircraft interiors have further improved, making for easier and faster boarding. Access routes are easy even for those with restricted mobility. Ergonomically designed access to locations for the storage of cabin baggage speeds up the passenger process.

04 – STAND DEPARTURE

DEPARTURE MANAGEMENT

As with the arrival, the departure of the aircraft is managed by all parties accessing consistent, reliable, live information as contained within the Airport Operations Plan. This incorporates data from multiple sources reflecting the status of passenger boarding, cargo and baggage loading, ground servicing, estimated taxi times and optimal take-off sequence. The Target Off-Block Time (TOBT) is managed to ensure optimum taxi time without holding to achieve the planned departure time.

PUSH BACK

Enhanced taxiing systems (electric landing gear drives or remotely controlled tugs) will make a push-back service unnecessary.

DE-ICING/ANTI-ICING

Anti-ice adhesion nanomaterial coating of the aircraft make the pre-departure de-icing process unnecessary in many cases. This results in considerable reduction of delays in winter conditions and avoidance of environmental damage by de-icing fluid or costly precautions to prevent it.

When required, de-icing is a targeted and automated process using drones which can easily access the entire surface of the aircraft. This reduces the volumes of fluid required. With precision application to the aircraft, run-off is better contained and easily collected, avoiding contamination to the local area.

05 – DEPARTURE

AIRCRAFT TAXI-OUT

The aircraft is not held at any point but taxis directly to the runway in the assigned sequence.

Using the same enhanced taxiing systems as on the arrival, noise and emissions are minimized. The aircraft will automatically run engine warm-up procedure so the engines are ready for take-off when it arrives at the runway.

A-SMGCS again will provide guidance in any weather conditions including alerts to ensure safety and efficiency.

TAKE-OFF

Information exchanges with the aircraft are maintained after take-off. The take-off time is synchronized with airspace access en route and arrival time at destination. The departure path is guided by satellite based navigation with less reliance on ground based navigation aids, such that in any weather condition the climb phase is optimized and noise impact minimized.