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How **AI-enabled video analytics** can improve aircraft turnaround operation

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Summary

COVID-19 has changed the dynamics in the aviation sector. Airlines are facing tremendous pressure to increase profit without compromising the safety and passenger experience. One way airlines can increase profitability is by increasing utilization of aircraft. While the aircraft utilization depends on various factors, one of the most important areas for the airlines to focus on is the turnaround operation.

The turnaround of an aircraft is the time that elapses from its landing until the next take off. It is the time between on-block and off-block. Aircraft turnaround operation is a series of coordinated activities, e.g., positioning jet bridge, deplane passengers, baggage/cargo unloading/loading, fueling, boarding passenger, catering, etc.

The airline company does not make money when its aircraft are on the ground. The longer the time an aircraft spends on the ground, it loses out on the opportunity of serving more money-making routes.

By making the turnaround operation faster and more efficient, the airline can generate more money. A small reduction in turnaround time can increase aircraft utilization, particularly for a short-haul carrier.

> *Using the utilization/ turn-time model for a point-to-point carrier with an average turn-time of 40 minutes gives an estimated utilization level of 2,304 trips per year with an average mission length of 500 nautical miles. Reducing the average turn-time by just 10 minutes — from 40 to 30 minutes — improves the utilization level to 2,491 trips per year, an increase of 8.1 percent.*
> *(Source: Boeing)*

In this whitepaper, we will discuss how an AI-enabled video analytics engine can help the airline to make better decisions and optimize turnaround operations.
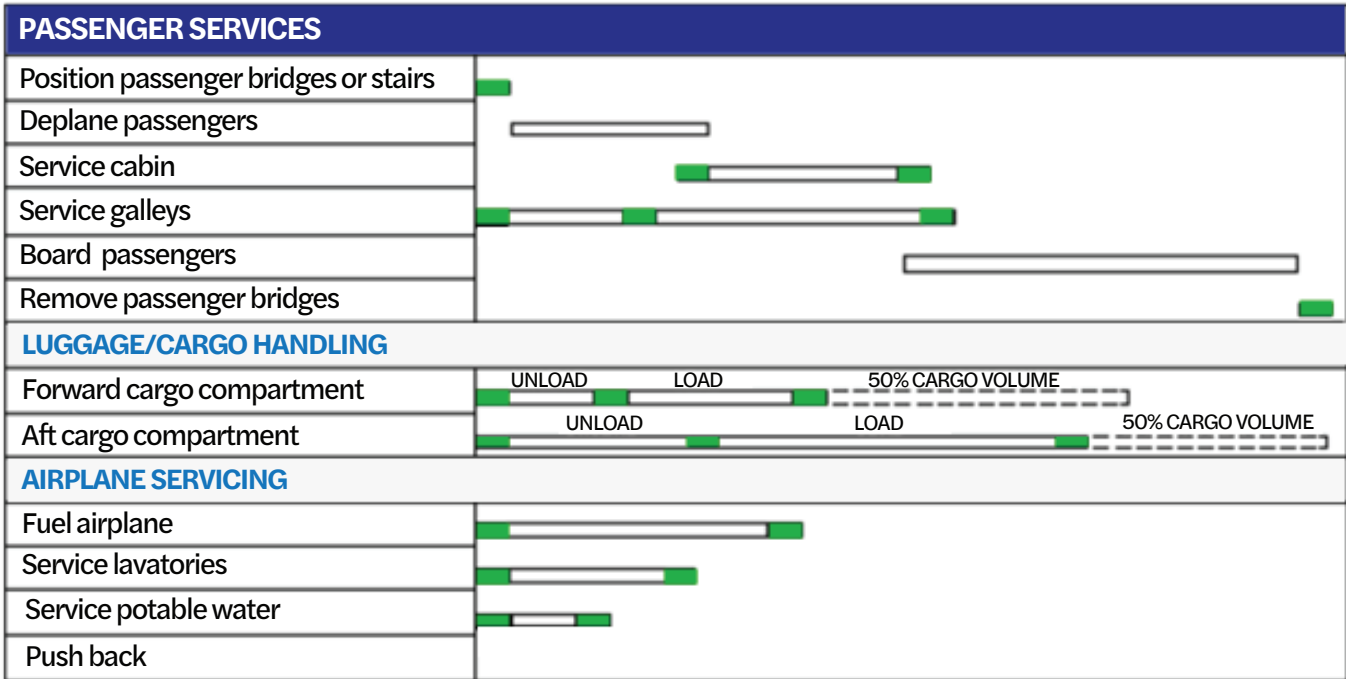
Turnaround activities

The turnaround process comprises of multiple activities (see figure 1)

- Position Passenger Bridges or Stairs
- Deplane passengers
- Service cabin
- Unloading baggage and cargo
- Fueling
- Loading baggage and cargo
- Catering
- Board Passengers
- Remove Passenger Bridges

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Figure 1: Standard turnaround activities (Source: Boeing)

🟩 Position Equipment

PASSENGER SERVICES	
Position passenger bridges or stairs	
Deplane passengers	
Service cabin	
Service galleys	
Board passengers	
Remove passenger bridges	
LUGGAGE/CARGO HANDLING	
Forward cargo compartment	UNLOAD LOAD 50% CARGO VOLUME
Aft cargo compartment	UNLOAD LOAD 50% CARGO VOLUME
AIRPLANE SERVICING	
Fuel airplane	
Service lavatories	
Service potable water	
Push back	

How to optimize the turnaround time

Defining the turnaround schedule for every flight is the starting point to understand and monitor the turnaround activities. It can be compared to a project schedule with a predefined start and an end time against each task. In actual operations, the turnaround schedule is dynamic in nature and should be adjusted based on factors that cause deviation from the original schedule, e.g., delay in the arrival of incoming aircraft.

Just as in a project schedule, there should be a predefined critical path clearly laid out in the turnaround chart. The critical path may be changed over time depending on the current status of activities. For e.g., fueling an airplane may not be part of the original critical path, but non-availability of the fuel track within a predefined time may put the fueling activity in the critical path.

In many cases, what is going on at the gate during the turnaround operation is completely unknown to the airlines. In order to optimize, it is imperative to know what is exactly going on against each activity. This awareness will help to identify potential delays so that airlines can take proactive action.
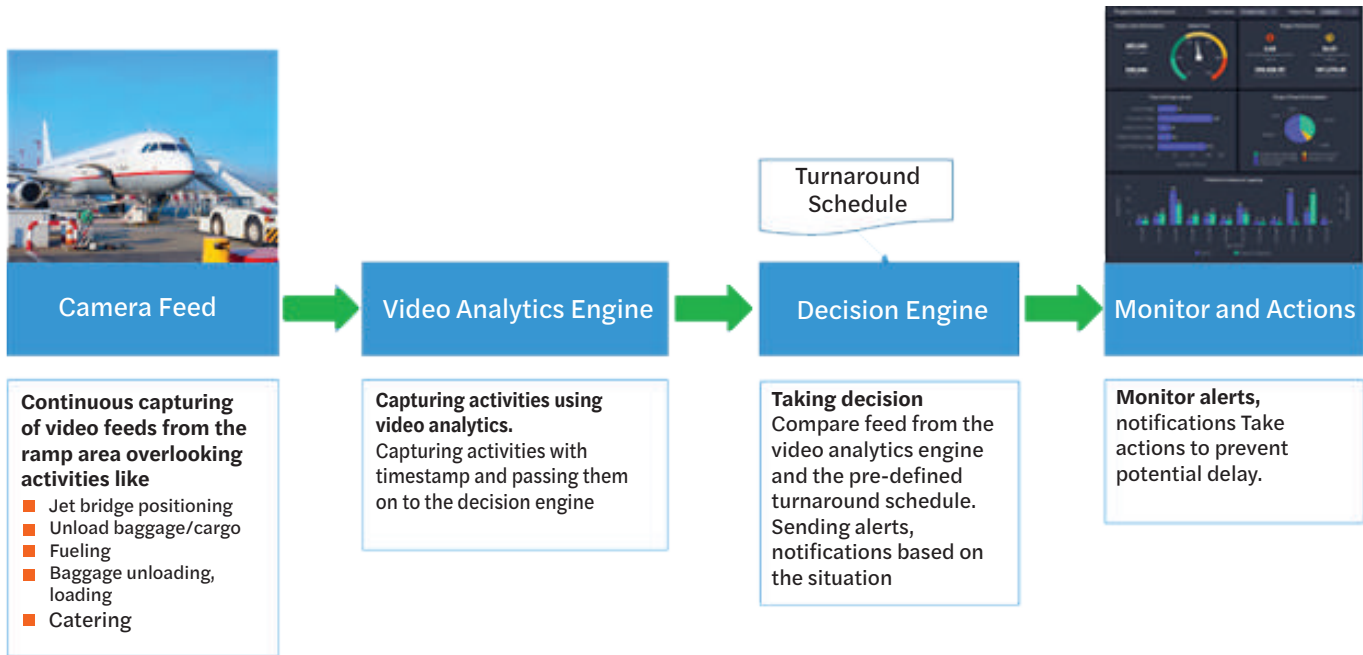
How AI-enabled video analytics can help to optimize the process

The airline has to rely on the data collected manually and that sourced through multiple standalone systems to track all the different activities. This approach leads to errors, provides misleading insights, and leaves limited options for corrective measures.

Video analytics enables real-time capturing of all that is going on at the gate during a turnaround operation. This turns the video stream into valuable structured data, and helps to monitor the functions in a way that allows the stakeholders to take proactive measures before any delay happens.

Figure 2 describes the framework that will help to understand the standard process that may be followed.
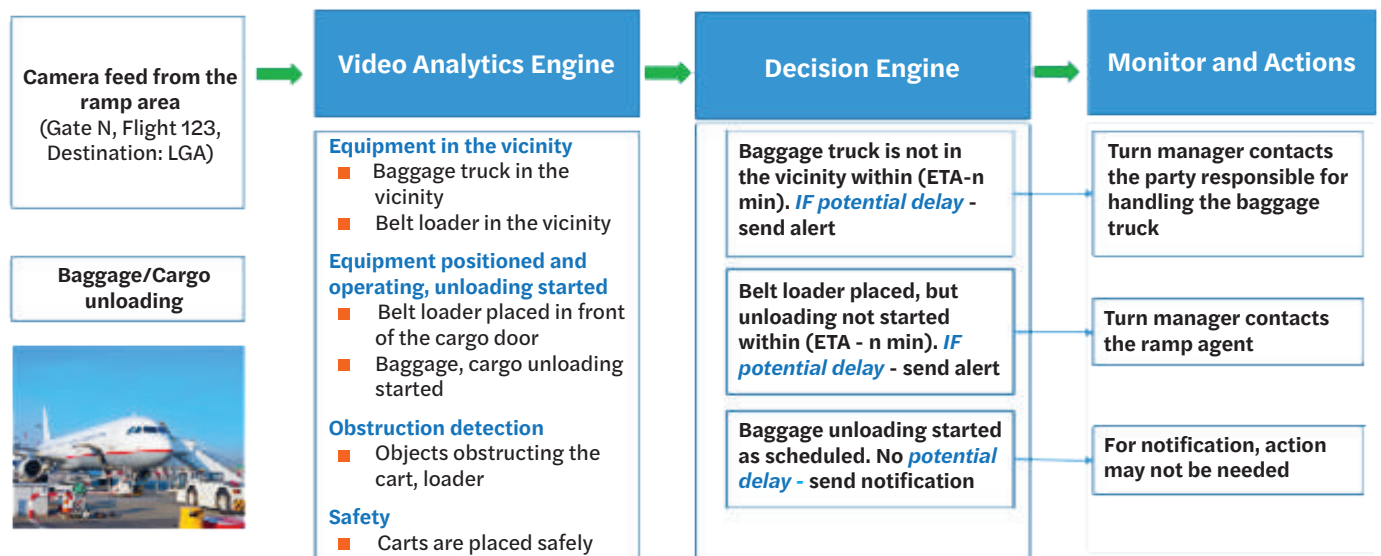
(Figure 2: Video analytics engine – process/framework)

Camera Feed	Video Analytics Engine	Decision Engine	Monitor and Actions
Continuous capturing of video feeds from the ramp area overlooking activities like ■ Jet bridge positioning ■ Unload baggage/cargo ■ Fueling ■ Baggage unloading, loading ■ Catering	**Capturing activities using video analytics.** Capturing activities with timestamp and passing them on to the decision engine	**Taking decision** Compare feed from the video analytics engine and the pre-defined turnaround schedule. Sending alerts, notifications based on the situation	**Monitor alerts,** notifications Take actions to prevent potential delay.

Turnaround Schedule

A case in point – monitoring baggage/cargo unloading

Let's take the example of baggage/cargo unloading. The video stream coming from the camera is fed to the Video analytics engine. The algorithm running in the analytics engine determines the objects (baggage truck, belt loader) and the state of the object (in motion or static - bags are moving on the belt loader). It passes this data along with the timestamp to the decision engine. The decision engine will compare the activity status with the latest turnaround schedule and take action. Refer to figure 3 for the logical flow.

(Figure 3: Monitoring baggage/cargo unloading using AI-enabled video analytics)

Camera feed from the ramp area (Gate N, Flight 123, Destination: LGA)	Video Analytics Engine	Decision Engine	Monitor and Actions
Baggage/Cargo unloading	**Equipment in the vicinity** ▪ Baggage truck in the vicinity ▪ Belt loader in the vicinity	Baggage truck is not in the vicinity within (ETA-n min). *IF potential delay* - send alert	Turn manager contacts the party responsible for handling the baggage truck
	Equipment positioned and operating, unloading started ▪ Belt loader placed in front of the cargo door ▪ Baggage, cargo unloading started	Belt loader placed, but unloading not started within (ETA - n min). *IF potential delay* - send alert	Turn manager contacts the ramp agent
	Obstruction detection ▪ Objects obstructing the cart, loader **Safety** ▪ Carts are placed safely	Baggage unloading started as scheduled. No *potential delay* - send notification	For notification, action may not be needed

Conclusion

While AI-enabled video analytics opens up uncharted territories, true power lies in the airlines being able to utilize full AI potential by making a proactive decision to prevent potential delay or minimize the impact of the delay. In the long run, deriving insightful information from the historical data will enable airlines to find out the root causes of recurring problems, take corrective actions, and utilize opportunities for optimizing turnaround activities. The optimized, secure, and transparent operation will create an environment where all stakeholders, including Airline, Airports, Ground Handler, and Passengers, will enjoy the benefits.

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In addition to our Digital Transformation practices, by using our tcgmcube, enterprises are extracting highly actionable insights from their invaluable data assets, and achieving Velocity to Value with our award-winning advanced analytics platform, which democratizes data science with scalability, performance, and flexibility. For more information please visit our website at www.tcgdigital.com

Get in touch with us at contact@tcgdigital.com for a robust digital strategy and powerful demonstrations of this easily deployable platform.