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Airside Capacity Enhancement using Airport Collaborative Decision Making (A-CDM) method

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Abstract

Airside capacity improvement is a critical challenge for airports worldwide, especially in the face of increasing air traffic demand. This paper explores the application of Airport Collaborative Decision Making (A-CDM) as a method to enhance airside capacity. A-CDM facilitates collaborative planning and real-time information sharing among airport stakeholders, including airlines, air traffic control, and ground handlers. This paper aimed to discussed, how A-CDM can optimize aircraft turnaround processes, improve aircraft sequencing and scheduling, enhance situational awareness, and enable more efficient use of airside resources. The benefits of A-CDM for airside capacity improvement are discussed, including reduced delays, improved punctuality, increased throughput, and enhanced safety. Case studies and examples are presented to illustrate successful implementation of A-CDM in improving airside capacity at airports. The paper concludes with recommendations for implementing A-CDM to enhance airside capacity and improve overall airport operations efficiency.

Keywords: Airside, Capacity, Airport Collaborative Decision Making.

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Introduction

Airport operations are typically divided into airside and landside operations, effective coordination between airside and landside operations is essential to ensure smooth and efficient airport operations. Airlines, airport authorities, ground handlers, and other stakeholders work together to provide a seamless travel experience for passengers while maintaining safety and security standards. The combination of infrastructure development, technological innovation, environmental stewardship, and collaborative planning to maximize airport capacity while ensuring sustainable growth in the aviation industry.

Investing in airport infrastructure to accommodate increasing passenger numbers and larger aircraft is crucial. This includes runway and taxiway, aircraft parking area accommodation together with terminal upgrades, and improved ground transportation access. Efficient management of airspace is essential to accommodate more flights without compromising safety. This includes optimizing flight paths, improving air traffic control systems, and implementing new technologies like ADS-B (Automatic Dependent Surveillance-Broadcast). Implementing advanced technologies for terminal operations such as automated check-in systems, biometric security screening, and smart baggage handling can enhance airport efficiency and capacity. On the other hand, the regulatory framework plays a crucial role in balancing airport capacity and growth. Regulations should support infrastructure development while ensuring safety, security, and environmental protection. Balancing growth with environmental sustainability is critical. This involves minimizing the environmental impact of aviation operations through measures like carbon offsetting, sustainable fuel use, and noise reduction initiatives.

The modernizing infrastructure and optimizing air traffic management systems are key strategies for maximizing airport capacity and accommodating future growth in the aviation industry. By focusing on modernizing infrastructure and optimizing airport and air traffic management systems, the aviation industry can improve efficiency, increase capacity utilization, and accommodate future growth in a sustainable manner. Implementing strategies to optimize the use of existing capacity, such as slot management, dynamic pricing, and demand management, can help airports accommodate more flights and passengers without the need for

significant infrastructure expansion. Implementing collaborative decision-making processes involving airlines, airports, air traffic control, and other stakeholders can improve the overall efficiency of airport operations. This can include coordinating schedules, sharing data, and implementing common performance metrics to improve the predictability and reliability of airport operations.

Objective

By investigating the integration of Airport – Collaborative Decision Making (A-CDM) with airside capacity management, this paper can contribute valuable insights to the aviation industry and help airports enhance their operational efficiency and capacity.

These efforts can contribute to increased efficiency and capacity utilization:

Airside capacity management is a crucial aspect of airport operations, involving the efficient management of aircraft movements, ground handling services, and other activities on the airside of the airport. Airside Operations includes,

Runways and Taxiways: Airside operations involve the management of runways, taxiways, and apron areas where aircraft are parked, loaded, and unloaded.

Air Traffic Control (ATC): ATC is responsible for managing the movement of aircraft on the ground and in the airspace around the airport to ensure safe and efficient operations (Doc 4444, 2016)

Aircraft Servicing: This includes refueling, catering, and maintenance services provided to aircraft while they are on the ground.

Ground Handling: Ground handling services involve activities such as baggage handling, aircraft marshaling, and passenger boarding.

Safety and Security: Airside operations also include safety and security measures to protect aircraft, passengers, and airport personnel.

Here are some ways these efforts can contribute to increased efficiency and capacity utilization of airside capacity:

Runway Capacity: The primary factor influencing airside capacity is the number of aircraft movements that can be accommodated on the airport's runways. Factors such as runway configuration, aircraft mix, and separation requirements between aircraft influence runway capacity.

Taxiway Capacity: Taxiways are essential for aircraft movement between runways, terminals, and parking areas. Efficient taxiway design and management are critical for optimizing airside capacity.

Apron Capacity: The apron area, where aircraft are parked, loaded, and unloaded, also plays a significant role in airside capacity. Efficient use of apron space and ground handling services is essential for minimizing turnaround times and maximizing capacity

Gate Capacity: Gate availability and utilization are important for managing aircraft arrivals and departures. Efficient gate allocation and turnaround processes are essential for maximizing airside capacity.

Aircraft Stand Management: Efficient management of aircraft stands, including allocation, scheduling, and maintenance, is crucial for optimizing airside capacity and minimizing congestion.

Air Traffic Control: Air traffic control plays a key role in managing aircraft movements on the airside. Coordination between air traffic control and airport operations is essential for maximizing capacity and ensuring safety.

Integrated Planning: Integrated planning involving airlines, airport operators, air traffic control, and other stakeholders is essential for optimizing airside capacity. Collaboration and data sharing are key elements of integrated planning for efficient airside operations.

Technology and Automation: The use of technology and automation, such as automated aircraft docking systems, remote stand management, and digital twin technology, can help optimize airside capacity and improve operational efficiency.

Environmental Considerations: Airside capacity management should also consider environmental factors, such as noise and emissions, and implement measures to minimize the environmental impact of airport operations.

By focusing on these key aspects of airside capacity management, airports can improve efficiency, enhance safety, and accommodate future growth in air traffic demand. The airport

congestion brings the need to manage airport capacity more efficiently in order to increasing airside capacity. Regulatory frameworks, Airport – Collaborative Decision Making (A-CDM) can be used to encourage airside operations to support the increasing of air traffic management also the investing in fuel-efficient aircraft can be reduced alternative fuels. The improved of maximizing capacity of airport potentials for future growth with the accompanying negative impacts of airport operations by modernizing infrastructure, improving technology and optimizing air traffic management systems which can contribute to increased efficiency and capacity utilization using Airport – Collaborative Decision Making (A-CDM) Method (Jeeradist, 2023). The challenges associated with airport capacity and air traffic growth requires a multifaceted approach that involves collaboration among governments, regulatory bodies, airports, airlines, and the broader aviation industry.

Maximizing airport capacity plan

The modernize airport infrastructure and optimizing air traffic management systems are key strategies for maximizing airport capacity and accommodating future growth in the aviation industry by,

Upgrading airport infrastructure, including runways, taxiways, terminals, and air traffic control facilities, can increase operational efficiency and accommodate larger aircraft. This can be achieved through expansion projects, technology upgrades, and improved facilities for passengers and aircraft (Shafabakhsh G, Kashi E, and Tahani M., 2018).

Air Traffic Management Optimization: Optimizing air traffic management systems can reduce delays, improve airspace utilization, and enhance safety. This can be done through the implementation of advanced technologies such as ADS-B, which allows for more precise tracking of aircraft, and the use of data analytics to optimize flight paths and improve traffic flow (Annex 11, 2018).

Airport - Collaborative Decision Making (A-CDM): Implementing collaborative decision-making processes involving airlines, airports, air traffic control, and other stakeholders can improve the overall efficiency of airport operations. This can include coordinating schedules, sharing data,

and implementing common performance metrics to improve the predictability and reliability of airport operations.

Airport - Collaborative Decision Making (A-CDM) Overview:

Airport Collaborative Decision Making (A-CDM) is a holistic approach to airport operations that aims to optimize efficiency, improve performance, and enhance the overall passenger experience through collaboration and data sharing among airport stakeholders. Airport Collaborative Decision Making (A-CDM) is a collaborative approach to airport operations that aims to improve efficiency, predictability, and overall performance by enhancing the flow of information and coordination among airport stakeholders. Here's an overview of A-CDM:

The primary objectives of A-CDM are to improve the overall efficiency of airport operations, reduce delays, and enhance the passenger experience. By improving the predictability of events and optimizing the use of airport resources, A-CDM aims to make airport operations more efficient and cost-effective.

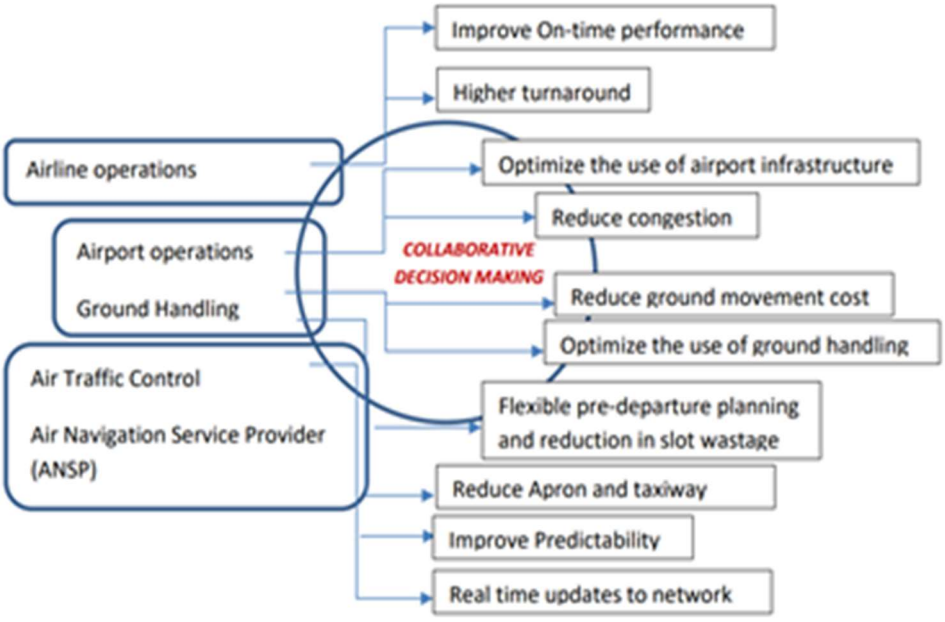

Figure 1. Airport Collaborative Decision Making enables the network to share information and work together (Distribution Lab Analysis, Eurocontrol referred in Jeeradist, 2023).

A-CDM is based on several key principles, including collaborative decision making, data sharing, and real-time information exchange. It involves all airport stakeholders, including airlines, ground handlers, air traffic control, and airport operators, working together to optimize airport operations.

A-CDM consists of several key components, including:

Common Situational Awareness: All stakeholders share a common view of the airport's operational status, including aircraft movements, gate availability, and ground handling activities.

Target Times: A-CDM defines target times for key airport processes, such as aircraft arrival, turnaround, and departure. These target times are agreed upon by all stakeholders and used to measure performance.

Collaborative Decision Making: A-CDM encourages collaborative decision making among stakeholders to optimize airport operations. This includes sharing information, coordinating activities, and making joint decisions to improve efficiency.

Real-time Information Exchange: A-CDM relies on real-time information exchange between stakeholders to ensure that everyone has access to the most up-to-date information on airport operations.

Implementing A-CDM requires collaboration and coordination among airport stakeholders. It often involves the deployment of technology solutions, such as collaborative decision-making tools and real-time data sharing platforms, to support information exchange and decision making.

The implementation of A-CDM can lead to several benefits

The benefits of Airport Collaborative Decision Making (A-CDM) are significant and can positively impact various aspects of airport operations. Some key benefits include (Doc 9971, 2018):

Reduced Delays: A-CDM helps reduce delays by improving the predictability of airport operations. By sharing real-time information and coordinating activities, stakeholders can better manage resources and mitigate potential delays.

Improved Punctuality: By setting and adhering to target times for key processes such as aircraft arrival, turnaround, and departure, A-CDM helps improve punctuality and on-time performance.

Increased Capacity: A-CDM can help increase airport capacity by optimizing the use of airport resources, reducing turnaround times, and improving the flow of aircraft and passengers through the airport.

Better Resource Utilization: A-CDM enables better utilization of airport resources, such as gates, stands, and ground handling services, by coordinating activities and avoiding conflicts.

Enhanced Safety and Security: By improving situational awareness and coordination among stakeholders, A-CDM can enhance safety and security at the airport.

Improved Passenger Experience: A-CDM can lead to a more seamless and efficient passenger experience by reducing wait times, minimizing delays, and ensuring smoother operations.

Cost Savings: A-CDM can help reduce operational costs by optimizing resource utilization, minimizing delays, and improving overall efficiency.

Overall, A-CDM offers a range of benefits that can improve the efficiency, performance, and overall effectiveness of airport operations, leading to a better experience for both airlines and passengers CANSO (2016).

Discussion and Conclusion

Airside capacity enhancement using Airport Collaborative Decision Making (A-CDM) is a fascinating topic with significant implications for airport operations. A-CDM is a concept that aims to improve the overall efficiency of airport operations by optimizing the use of resources and sharing timely information among all stakeholders, including airlines, airport operators, air traffic control, and ground handlers.

A-CDM is the integration of real-time data and collaborative decision-making processes. By sharing information about flight schedules, resource availability, and other relevant factors, stakeholders can work together to anticipate and mitigate potential disruptions, such as delays or congestion on the airside (Capgemini, 2020).

A-CDM can enhance airside capacity as follow:

Improved Predictability: By sharing accurate and timely information, stakeholders can better anticipate demand and allocate resources more efficiently, reducing the likelihood of congestion and delays.

Optimized Resource Management: A-CDM enables stakeholders to better coordinate the use of airside resources, such as runways, taxiways, and gates, leading to more efficient use of capacity (B Griefahn et al., 2004).

Enhanced Situational Awareness: By providing stakeholders with a comprehensive view of the airside operations, A-CDM helps them identify potential bottlenecks and proactively address them, minimizing disruptions.

Streamlined Turnaround Processes: A-CDM can facilitate smoother aircraft turnaround processes by ensuring that all stakeholders are aware of the status of each flight and can coordinate their activities accordingly.

Reduced Environmental Impact: By optimizing operations and reducing delays, A-CDM can help minimize the environmental impact of air travel, such as emissions from aircraft waiting on the ground.

In Conclusion, A-CDM offers a promising approach to enhancing airside capacity and improving the efficiency of airport operations. However, successful implementation requires close collaboration among all stakeholders and the use of advanced technologies to support real-time data sharing and decision-making.

Suggestion

Improving airside capacity using Airport Collaborative Decision Making (A-CDM) involves implementing strategies that enhance the efficiency of aircraft movements, reduce delays, and optimize the use of resources. Here are some suggestions:

Real-time Data Sharing: Implement a robust data-sharing system that provides stakeholders with real-time information on flight schedules, resource availability, and operational constraints. This will enable stakeholders to make informed decisions and better coordinate their activities.

Predictive Analytics: Use predictive analytics to forecast demand, identify potential bottlenecks, and optimize resource allocation. This can help airlines and airport operators anticipate issues and take proactive measures to avoid delays.

Collaborative Decision-Making Processes: Establish collaborative decision-making processes that involve all stakeholders in the planning and execution of airside operations. This can help streamline processes, improve communication, and reduce conflicts.

Optimized Turnaround Processes: Implement measures to streamline aircraft turnaround processes, such as improved ground handling procedures, optimized gate assignments, and efficient use of ground support equipment. This can reduce turnaround times and increase aircraft throughput (Simon et al., 2017).

Dynamic Resource Allocation: Use A-CDM to dynamically allocate resources, such as runways, taxiways, and gates, based on real-time demand and operational constraints. This can help maximize the use of available capacity and reduce delays.

Performance Monitoring and Optimization: Continuously monitor the performance of airside operations and use the data to identify areas for improvement. Implement measures to optimize operations based on performance metrics, such as on-time performance and throughput.

Integration with Air Traffic Management: Coordinate airside operations with air traffic management to optimize aircraft sequencing and reduce airborne holding. This can help minimize delays and improve overall efficiency.

Stakeholder Training and Awareness: Provide training and raise awareness among stakeholders about the benefits of A-CDM and the importance of collaboration in improving airside capacity. This can help ensure that all parties are committed to the success of A-CDM initiatives.

Implementing these suggestions can help airports and airlines enhance airside capacity, improve operational efficiency, and provide a better experience for passengers.

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