

Dynamic Operations Integration

6:37 a.m.

The update I received this morning when I checked in sounded positive. The predicted bad weather along the east coast didn't materialize. The first group of flights from the hub cities departed with only a few minor delays, and even the time lost to delays is being made up in flight. The early morning originator on-time performance scores are above 90 percent.

Excellent. The only problem so far is one delayed flight due to an overnight mechanical problem. But even that delay is expected to be only an hour. As movement controller, I checked the new estimated departure time and verified that this one hour will not cause any additional delays at the down-line station. And since it is still early morning, crewmember schedules remain intact.

It's going to be a good day.



10:59 a.m.

Well, the mechanical estimation proved to be optimistic. The aircraft was actually delayed three hours. When I plotted the new departure times for this flight, I quickly noticed that the remaining flights using this aircraft would now be delayed throughout the day. I began to manually swap aircraft from one flight to another until I had devised the best plan possible under the present conditions. But, I was so focused on this problem, I forgot to notify anyone else of the pending problems.

So, later this morning, I posted the new delay and associated aircraft swaps and flight delays, which alerted the crew controllers and dispatchers. Of course, they had no previous information about the problem, so they are now quickly re-planning their crew schedules and flight plans to meet the new flight schedule.

Almost immediately, crew control identified several crews that will become illegal during the day due to the new flight times. But they have the situation under control; new crews are being called out to fly the new schedule.

Meanwhile, our dispatcher determined several of the swaps will not work. Some of the new assigned aircraft have minimum equipment list items, or MEL items, that prohibit them from operating some of the routes. In fact, some of the new assigned aircraft can not handle the forecasted payload for several segments.

Per standard procedure, I received a report on all the problems and a new plan has been devised. It took some time, but working with our crew controller and dispatcher, I have developed a workable plan. It is not the best plan, but under the circumstances, it's the best we can do.

Another report has been placed in my hands. During the time we were working the problems, the down-line airports were given several new flight schedules as we continued to look for the best solutions. They began making the appropriate gate changes to accommodate the aircraft swaps, and a change was miscommunicated to one of the airports. At that airport, an incorrect gate was assigned for an inbound aircraft. As a result, passengers were directed to the wrong gate two concourses away from the correct gate. Correcting this problem caused more delayed flights.

This is going to be a normal day after all.

A high level of systems integration enables SOC controllers to focus on the most critical tasks and problems at hand.

1:17 p.m.

The forecasted bad weather is now a problem. The rapidly moving cold front left a blanket of fog over the northern half of the east coast. With takeoff and landing minimums down and air traffic control ground holds up, our operation came to a halt. Within just a few hours, we were in the midst of chaos due to severe irregular operations. It was time for the SOC staff to come together and take control. But upon arriving at the SOC to get a status, I found that many diversions had occurred; each desk was faced with a new challenge and evaluating different pieces of information generated by their respective SOC or airport departments. Now, crews are illegal or out of position as are aircraft, and passengers and cargo are stranded.

This is turning out to be a very bad day.

Two Days Later

It's been two days since the weather cleared on the east coast, and we're still working to restore normal operations. Cancellations, delays and diversions have been the order of the day for more than 60 hours. Ferrying crews from one airport to another to replace illegal crews and ferrying aircraft that now exceed maintenance hours are the norm. The aftermath of these irregular operations continues to severely impact our bottom line.

It's going to be another long day — and night.

Sound familiar? It's a scenario lived out in many airline system operations control centers today. The job of managing the airline's daily operation is a challenge. Complex networks, an overburdened ATC system and changing weather conditions can combine to apply severe stresses on a fragile balance of aircraft, crews and support resources. In the SOC of today, personnel manage aircraft tracking, crews, maintenance, dispatching and the passenger experience. The specific setup and tools at their disposal determine whether they can share the same information at the same time with each other. The act of managing typically comprises a mixture of automated and manual processes that work well together under ideal conditions. But when a situation occurs, as it almost invariably does, these processes suffer some level of deterioration as the situation becomes progressively more complex. A severe weather event can expose massive flaws in the processes, and lack of integration among departments becomes significantly dramatic when normal operations break down.

Consider An Alternative

Consider an alternative scenario: The flight was delayed three hours due to a maintenance issue but there were minimal down-line affects. Crewmembers were immediately rescheduled and notified of changes in near real time. The airline experienced disruptions, yet the day played out as smoothly as a day without disruption.



In this scenario, integration of the operational control systems provides a significantly different outcome. At the first notification of the maintenance delay to movement control, the information was sent to the crew management system to check crew legality and qualifications when aircraft changes were made. When the delays increased, the movement controller established what-if scenarios, sharing them with crew management to ensure a satisfactory solution. Changes made were automatically inserted in the flight planning, load planning, maintenance and airport resource management systems. And each operational area dealt with the same information in the same timeframe. There were no surprises.

By maintaining order, the SOC is prepared for the unexpected and is able to take proactive steps to keep the airline as close to schedule as possible. Tracking of aircraft and crews is much more exact and corrective actions are easier to identify.

This is the benefit of an integrated systems operations center or SOC.

The Integrated SOC

The integrated SOC enables core departments and systems to manage flight schedules, aircraft, crewmembers, flights, passengers and airports and to work seamlessly

together. In the integrated SOC, powerful solutions help handle irregular operations, enabling managers to evaluate options in a what-if mode and then execute the solution that offers the best options. Rather than reactively playing catch up each time a new challenge occurs, the integrated SOC management team employs tools that enable them to proactively manage their resources. Airlines experiencing success during both normal and irregular operations have identified integrated operational control solutions as key to this success.

If the SOC is able to execute the day's flight schedule and provide sufficient resources to operate the schedules, and if no disruptions occur, operation control can be a routine task. However, disruptions inevitably happen, causing local resource shortages that require corrective action to avoid unacceptable delays or flight cancellations.

While disruptions caused by external factors cannot be prevented, the effective execution of business processes and systems determines how well an airline handles and recovers from these events. SOC personnel must react to the disruptions — whatever the magnitude — to keep the airline running as smoothly as possible. The challenge faced by SOC personnel is that disruptions are caused by many factors such as resource limitations involving aircraft, crewmembers

In an integrated environment, numerous SOC systems rely on the data shared by the movement control system.

and ground personnel; mechanicals; weather; and ATC restrictions. Minimizing the impact on passenger service and maintaining the integrity of the published flight schedule requires close cooperation and communication among the SOC departments.

Often the decisions that must be made by SOC personnel during times of disruption may be affected by factors that are diametrically opposed to one another. The decision to cancel a flight may cause an aircraft to be out of position for a scheduled overnight maintenance check. The decision to operate the flight on a delayed basis to await connecting passengers may cause crewmembers to miss their connecting flights, thus delaying those flights as well.

To make optimum decisions, all functional groups within the center must have access to the same data and information about current situations in a timely manner — integration makes possible fast, effective communication to achieve the optimum solution. A high level of systems integration enables SOC controllers to focus on the most critical tasks and problems at hand.

With the advancements in information technology and integration of automated solutions, the SOC's ability to manage and control an airline's daily operations has been significantly improved. These advancements enable improved exchange of information within the SOC and between the SOC and external operational groups. More efficient data exchange, quicker response times and improved employee productivity follow. Even the human factor, often a problem during critical periods, improves due to decreased errors and

reduced redundant tasks. In addition, more dependable data accuracy helps provide a safer operation and better customer service. And the ability to analyze problems rapidly and more efficiently means better, proactive decision making.

Integration of SOC data during normal operations enables an airline to fly more efficiently and reduce costs associated with flight time, resources, fuel consumption, delays and cancellations. The enhanced operational control environment distributes information to appropriate personnel, providing common situation awareness so they can make informed flight-related decisions. With full integration of automated SOC systems, changes made in one system are immediately reflected across the board. This also means data is only entered once, then shared throughout the SOC as well as forwarded to other affected areas such as maintenance and engineering, crew scheduling and aircraft routing. And since SOC controllers and other airline and airport employees have access to the same updated data available in real time, the risk of miscommunication is substantially reduced.

Integration benefits to the airline include better management of the SOC and operations. In addition, there are realizable economic benefits associated with automation and integration — fuel savings, improved on-time performance, more effective recovery from irregular operations, improved payload through optimized load and flight planning and improved productivity of SOC controllers and dispatchers.



SOC Integration Points

The primary key to the entire integration process is unified data sharing — data entered only once into the SOC system network, ensuring SOC and airport personnel work from the same accurate information. For example, when the movement controller is notified of an aircraft delay, the information entered into the movement control system is automatically provided to crew controllers and dispatchers. All staff members see the same information and results at the same time.

To better understand the benefits derived from the commonality among SOC systems, look at the primary integration points within the core of the SOC. In addition to a comprehensive flight schedule, a fully integrated suite of SOC systems includes:

Movement control enables airlines to successfully monitor and schedule flight operations and maintenance;

Crew management enables airlines to manage their critical crew resources;

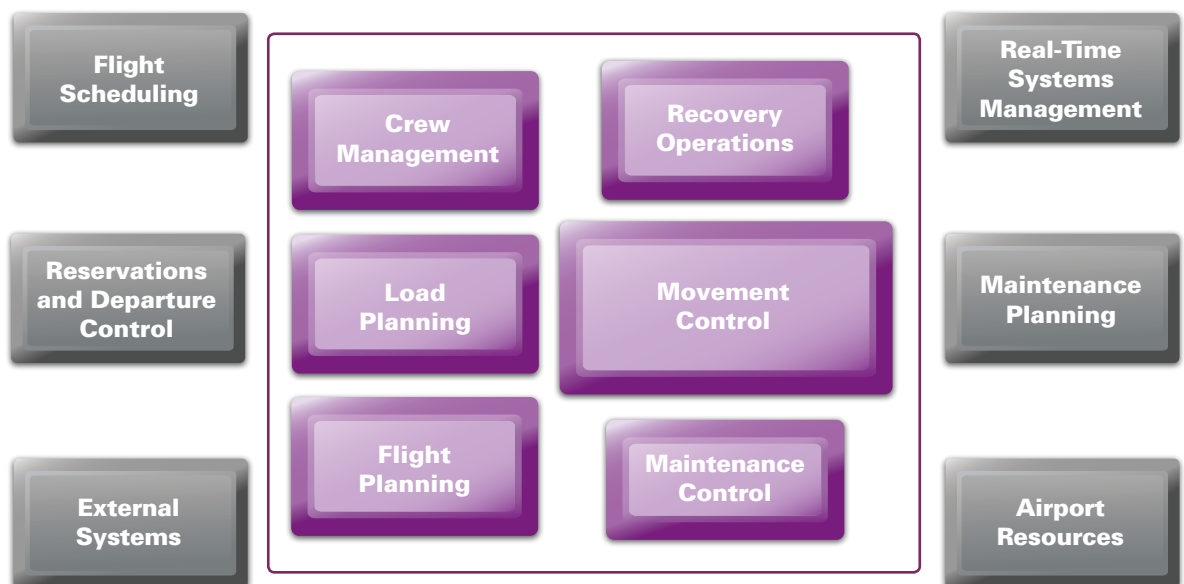
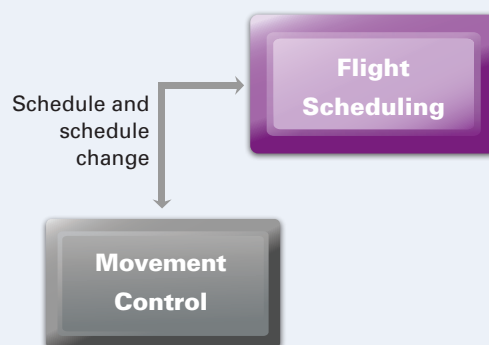


Figure 1 Common data shared across the core applications within the SOC results in reduced labor and fuel costs and minimal operational disruptions — ultimately driving exceptional passenger experience.

The primary key to the entire integration process is unified data sharing.

Figure 2



Flight planning helps coordinate the many components of a comprehensive flight plan such as the weather, route, fuel load, crew, schedule, runway conditions and altitude;

Real-time systems provide up-to-date data such as weather and NOTAMs to the SOC, which uses this data to generate flight schedules, flight changes, alerts and so on and publishes this information to airports, keeping internal airline organization systems current.

Load planning ensures aircraft passenger and cargo loads are balanced through careful calculation of passenger, cargo and fuel weights to navigate safely, efficiently and profitably;

Maintenance and engineering manages the scheduling and completion of required aircraft maintenance activities, both planned and unplanned, during the course of airline operations;

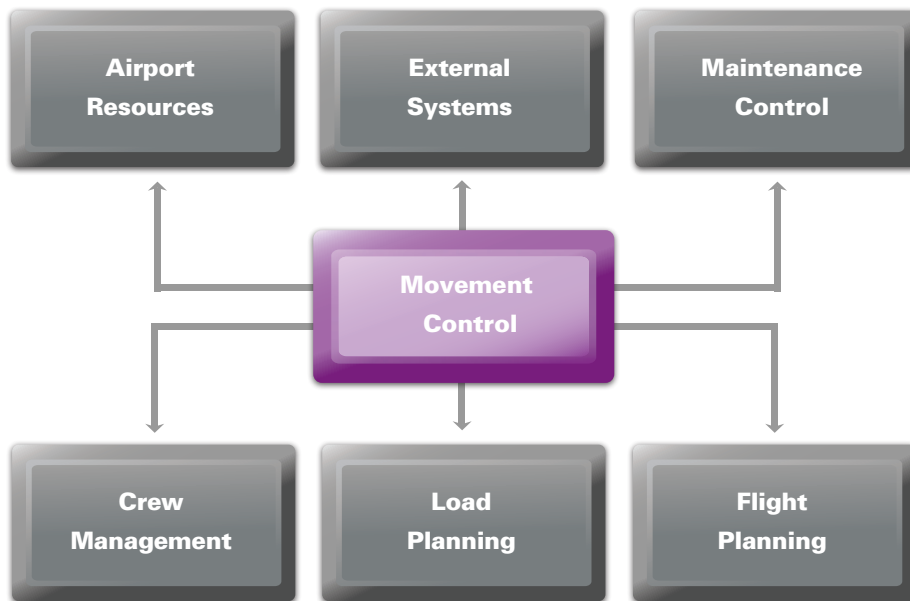
Recovery operations enables airlines to quickly and efficiently recover schedule, aircraft, crew and passengers following an operational disruption;

Airport resource management allocates resources and manages activities.

Promoting Schedule Continuity

The SOC integration process begins with the flight schedule. For successful, daily airline operations, the flight schedule must have schedule continuity or schedule integrity to be effective. Sharing flight schedule data with the core operational control areas provides the basis for promoting data consistency and simplifying schedule maintenance. The integration point of entering the flight schedule into the aircraft movement control system aligns the flight schedule with the assignment of specific aircraft for the flights. It is during this process that checks are made to ensure the assigned aircraft meet the flight schedule requirements and continue to promote schedule continuity. The schedule and assigned aircraft become the foundation for all other activities in the SOC on the day of operations. Additionally, changes to the flight schedule are seamlessly provided to the movement control system so changes can be acted upon quickly.

Figure 3



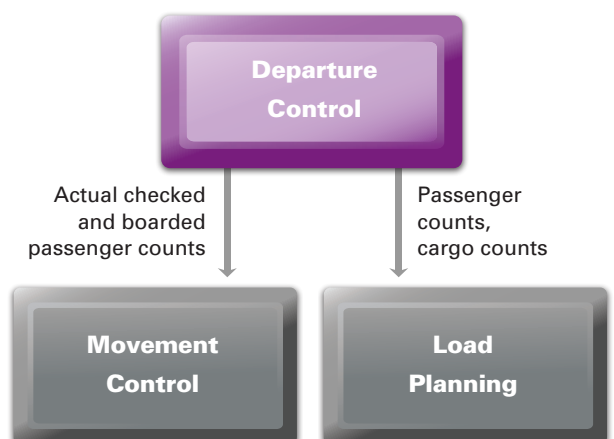
Empowering Movement Control

While the SOC continually manages the integrity of the flight schedule, a primary responsibility of the movement control system is to integrate data among the SOC operational control areas. Numerous systems rely on the data shared by the movement control system — crew management applications, flight planning and flight following solutions, load planning, aircraft maintenance, airport systems, flight information systems for internal and external use, and airport control centers. While the flight schedule is a complex linkage of aircraft, crews and passenger demands, the airline’s movement control system oversees the reporting and monitoring of the actual flight times as compared to the flight schedule. It maintains the operational flight schedule, assigns the individual aircraft to the flights and automatically distributes any subsequent schedule changes to the primary core operational control systems.

When changes to flight times occur, the movement control system ensures that disruptions are identified and corrective action is administered, returning the flight schedule to normal. Schedule changes, aircraft movements and schedule disruptions are automatically communicated to these core systems, maintaining schedule integrity and facilitating optimum decision making.

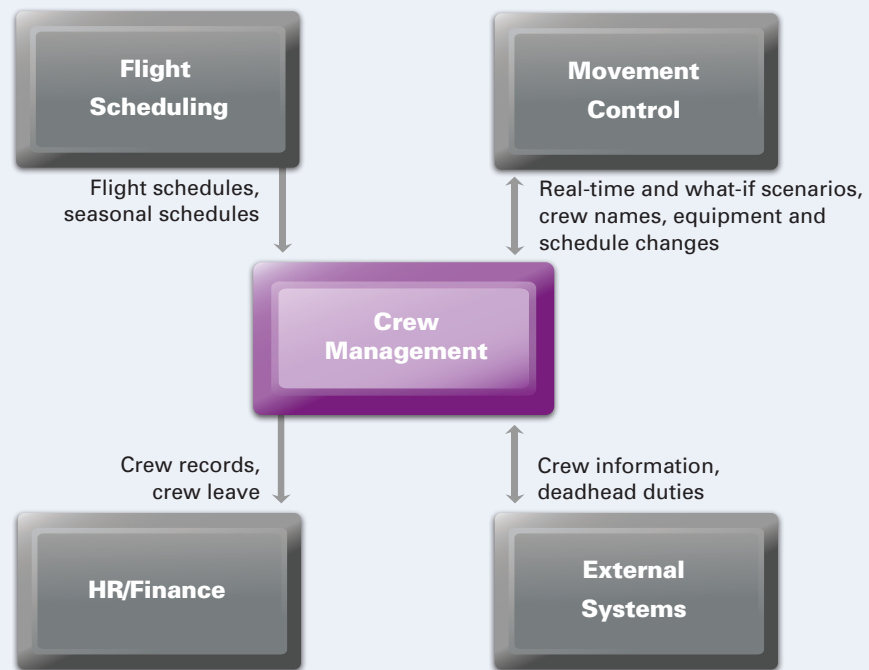
The movement control system also provides a repository for passenger counts. It obtains these counts from the reservations or revenue management systems and receives actual checked-in and boarded counts from the corresponding departure control system. Delivered in real time, this information is distributed to flight planning and load planning systems to be considered in weight calculations for the flights.

Figure 4



Exchange of information between movement control and crew management is key to the success of recovery plans.

Figure 5



Maintaining Crew Efficiency

The crew management system also shares data with the other core systems such as movement control, flight planning and load planning. By seamlessly receiving up-to-date and accurate information about the crew complement, crew qualifications and crewmember names, these systems maintain legal requirements and ensure the accuracy of flight plans and load manifest. Likewise, the movement control system sends the crew management system schedule change information, and aircraft movement updates providing crew controllers real-time information to make modifications to crew assignments, verify legality or call out additional crewmembers when needed for reserve status.

This exchange of information between the movement control system and the crew management system is key to the success of recovery plans during irregular operations. Using what-if scenarios to

explore potential recovery solutions, movement control and crew management coordinators can review multiple scenarios to determine the optimum solution. Because these systems are integrated, the coordinators can simultaneously review these scenarios and be confident they are reviewing the same scenario situations. The best decision can be made from among the various scenarios, approved by the movement control and crew management team and then committed to the "live" day-of-operation schedule.

Following this action, alerts are sent to the flight planning system so modifications to flight plans can be made, the load planning system to ensure weight and balance data is correct and the maintenance and engineering system in case maintenance schedules need to be reworked. As components of an integrated system, these alerts help an airline avoid further unnecessary disruptions due to inaccurate or untimely information.



Optimizing Fuel Consumption

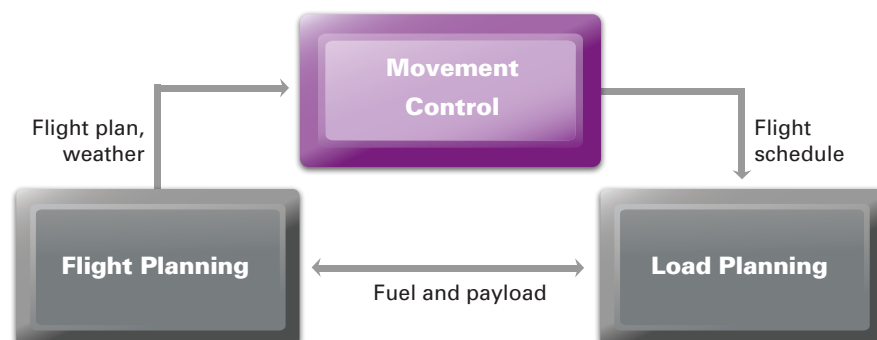
After the movement control system sends data to the flight planning system, flight plans are calculated — including fuel requirements such as minimum fuel and estimated fuel burn-off — to ensure legal and safe flight operation. Flight plan information is then automatically distributed to the load planning system, which has received passenger counts from the departure control system. With this data, the load planner calculates the weight and balance information based on the forecasted payload and the structural limits of the aircraft. These calculations result in fuel parameters such as maximum fuel, which are provided to the flight crew and dispatcher. With the flight planning system, users determine suggested trip fuel based on minimum fuel, maximum fuel and any fuel tankering considerations.

Optimizing Fleet Utilization

To help ensure efficient fleet utilization, the maintenance and engineering system sends maintenance schedules to the movement control system to ensure aircraft are scheduled in the correct locations for planned maintenance checks. It also automatically forwards MEL items to the movement control and flight planning systems to address any aircraft defects that may alter the flight schedule or require flight or load planning changes.

Integrated maintenance helps an airline keep its operations on track by enabling regularly scheduled aircraft maintenance information to be fed into flight scheduling and operations systems, ensuring that only in-service aircraft are scheduled to fly. When the movement control system is integrated with maintenance, repair and overhaul, an airline can be confident that the aircraft is in

Figure 6



Integrated maintenance helps ensure only in-service aircraft are scheduled to fly.

Figure 7

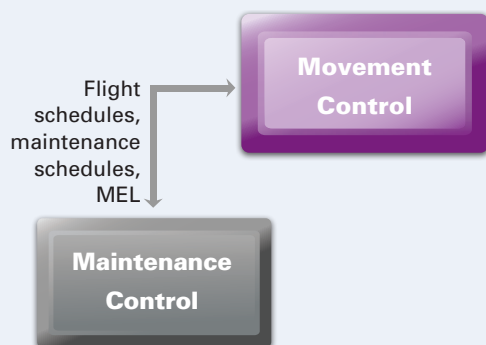
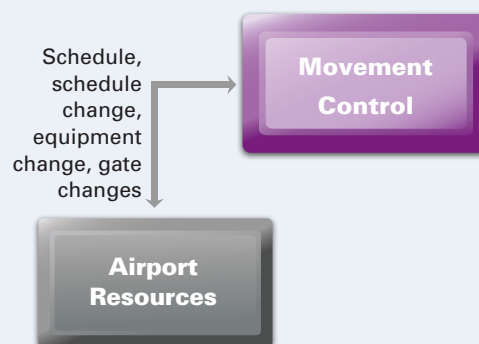


Figure 8



the right place at the correct time to receive its scheduled maintenance. This integration eliminates the possibility of aircraft being grounded and pulled from service as well as violating any governmental regulations and paying associated fines.

Additionally, when unscheduled maintenance needs arise, the M&E system automatically alerts movement control so SOC controllers can make real-time decisions in a dynamic environment to move aircraft and alter flight schedules. This information is then communicated to the other core operational control areas.

Coordinating Airport Resources

Also, the movement control system automatically distributes the flight schedule and flight schedule changes such as delays and cancellations to the resource

management system used by the airports to manage their operational resources. With flight changes highlighted on the screen, resource management planners can quickly identify the changes and determine if action is needed. Alerts from the movement control system generate a series of automatic actions within the resource management system to reposition personnel or equipment to meet the changes in the flights. This integration action enhances resource productivity and minimizes ground delays caused by schedule changes and updates to aircraft movements. The resource management system's gate assignment functions respond to schedule changes and aircraft movements and, if gate changes are required, alert the movement control system for dissemination to other core SOC areas.

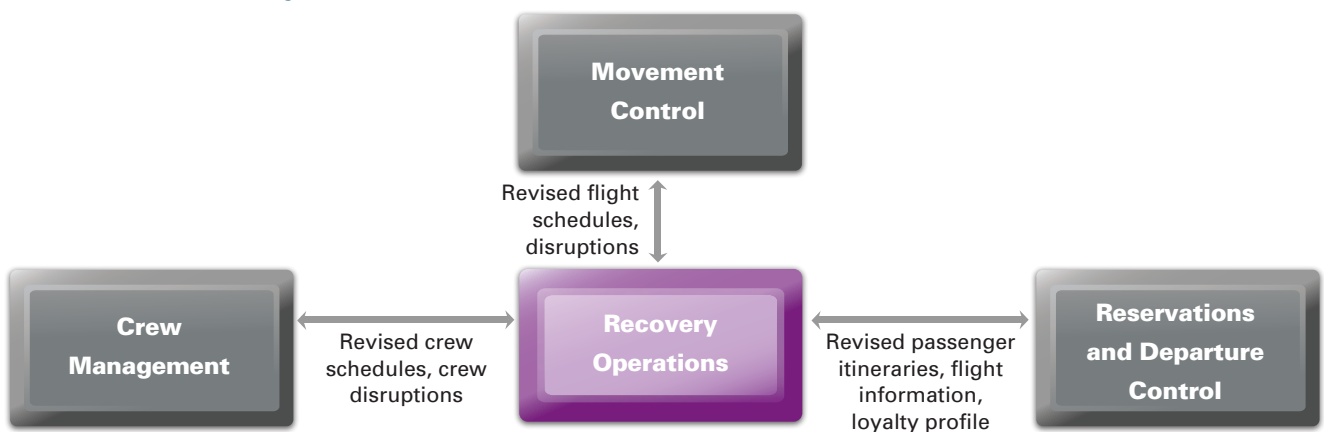


Irregular Operations

Disruptions or irregular operations can occur in many forms and at any time. Integrated SOC solutions are essential during these times to assist the SOC in fulfilling one of its primary roles — to return the airline to its routine schedule as soon as possible and to do so in the most effective, efficient and cost-effective method possible. Many airlines today rely on manual systems or automated, independent systems to manage irregular operations. The recovery time and resulting costs are much greater for these airlines than for those that have an integrated

SOC environment — integrated systems providing shared data and solutions among the entire SOC staff and external departments required to handle disruptions. Relying on integrated systems, SOC controllers and dispatchers have real-time, easy access to information from various airline functional areas, enabling them to enter and maintain data more rapidly and efficiently. As a result, reaction time to irregular operations increases due to instant notification of changing events. With critical information at their fingertips, the SOC team can make the crucial decisions needed to return to normal operations.

Figure 9



Each minute a flight is delayed costs an airline US\$57.08.

Benefits Of Integration

In addition to providing efficient operational control for the airline, systems integrated throughout the SOC also provide other key benefits such as reduced fuel costs, labor costs and delays and cancellations.

Reducing Fuel Costs

Reducing fuel costs is high on an airline's priority list. In fact, fuel is now the number one expense for an airline, accounting for 30 percent of total expenses.¹ An airline can effectively reduce fuel costs by flying the right aircraft on the best route with the most effective flight plan. Advanced planning technology integrated into the operations environment helps airlines avoid unnecessary fuel costs.

Providing the flight planning system with timely, accurate flight and aircraft data through integration with the flight schedule and movement control systems enables the flight planning system to calculate the most fuel-efficient flight plan. Analyzing fuel costs at each airport along the route of flight, the system calculates the costs of tankering additional fuel from one airport to another versus the costs of buying fuel at the destination airport. In many instances, the cost of carrying additional fuel can be lower than the price of purchasing fuel at the destination airport.

By integrating the flight planning system with an aircraft performance system to determine the optimum engine power

setting for takeoff and enroute operation, the flight planning process can have a dynamic economic impact by optimizing route, altitude, speed and payload.

Fuel reductions are realized also through the integration among the flight planning and movement control systems and irregular operations recovery tools. By reducing aircraft ground time when engines are running or extended air time caused by air traffic congestion, fuel can be saved. These tools work together to actively minimize the impact of "fuel burners," aircraft that consume large amounts of fuel inefficiently.

Reducing Labor Costs

Labor costs are the second largest airline expense, averaging 29 percent of total costs.¹ The efficiency of the crew management system — a complex tool designed to manage day-to-day crew operations and tracking — directly depends on the accuracy of information it provides. For top efficiency, successful airlines rely on integration among the flight scheduling, movement control and crew management systems to enhance their decision-making process. Integrated communication enables crew management personnel to quickly react to changes in the flight schedule and any operational disruptions, reducing costs associated with crew illegality caused by delays and cancellations.

¹"Optimized Flight Operations Delay Management," presentation given at 2007 AGIFORS Operations Conference



Airport resources such as gate staff and ground handlers are also critical to an airline's operations. Integration with flight operations, planning, scheduling and passenger systems provides airlines with real-time data to make timely adjustments to airport resources based on the current need at a given location, ensuring that an airline not only meets but exceeds its customers' expectations.

The effect of reducing labor costs through better management of resources and increased productivity can be seen downstream as the entire integrated operational environment is poised to react quickly and make sound decisions in an ever-changing environment.

Reduce Delays and Cancellations

Each minute a flight is delayed costs an airline US\$57.08.² With the average delay increasing to 56 minutes, the cost of delays quickly escalates.³ An integrated day-of-departure operations control center helps handle operational disruptions as well

as avoids costs associated with those disruptions. Decision-support tools coupled with integrated business processes can make unplanned events more manageable for the airline and crew and, most importantly, more tolerable by passengers.

When weather, mechanical, crew and even slot-request issues threaten to derail operations, an integrated movement control system alerts operations environments and other affected departments and assists in evaluating problems and determining cost-effective solutions such as aircraft swaps and changes to flight and maintenance schedules. An integrated system also publishes subsequent changes within and outside an airline. In an integrated environment, a real-time notification system notifies reaccommodated passengers of changes via PDA or mobile phone, enabling an airline to maintain a high-level of customer service. Optimizing the changes made helps reduce an airline's revenue loss and helps maintain customer satisfaction.

²"Optimized Flight Operations Delay Management," presentation given at 2007 AGIFORS Operations Conference

³<http://www.thenewstribune.com/business/aerospace/story/267705.html>

In an integrated SOC environment, reaction time to irregular operations increases due to instant notification of changing events.

Collaborative Effort

An airline may take months to create a solid flight schedule backed with complete crew rosters and specific aircraft tail numbers; but often the airline has only hours, if not minutes, to perform real-time planning in response to disruptions and delays. These challenges are managed through processes that encourage alignment among different airline departments, information sharing and collaborative teamwork toward the same goals.

With current market challenges, airlines diligently strive to identify and implement cost-saving measures in their flight operations. An integrated operational solution helps airlines make timely and, often, critical decisions correctly because they have accurate information readily available. Integrated business processes along with data sharing among various SOC and airport departments responsible for managing an airline's day of operations delivers real-time access to higher quality information, vital for making better decisions.

The introduction of integration into the SOC and its core functions has brought about more efficient airline operations and reduced operating costs. Automation together with integration assists airlines

by increasing aircraft utilization through improved flight operations. Additionally, more efficient utilization of the operational control tools now automated within the SOC made it possible for an aircraft to fly more flights. Further benefits have been realized through the integration of SOC tools so each automated system simultaneously shares and utilizes the same data sets as other SOC or airport systems.

An integrated SOC helps airline personnel perform many transactions that otherwise would result in loss of data integrity, data corruption, data duplication, multiple and conflicting reports, improper synchronization and poor real-time performance — all problems that can affect an airline's ability to make efficient and profitable decisions.

The SOC of the future is here today — an enhanced operational control environment that distributes information to appropriate personnel, providing common situation awareness for informed flight-related decision making. Fully integrated SOC systems facilitate system-wide communication, with changes in one system reflected almost immediately across the board. And compatible system requirements enable data to be entered once and shared throughout the SOC as well as forwarded to other affected areas.

Partnering For Success

Identifying the appropriate operations solution for your airline and putting it in place can be a daunting undertaking. Partnering with a company that offers consulting expertise coupled with a broad portfolio of integrated operations solutions helps ensure a successful outcome. At *Sabre Airline Solutions*[®], we advocate a phased

approach to operations transformation, reducing solution complexity and lowering associated risks. Our staff can assist you in identifying operations objectives, communicating the message across your organization and implementing the solution in a phased approach, minimizing disruption to your business. Working alongside your team, we can help you establish an SOC of the future — today.

Consulting Expertise

Our consultants have worked for airlines and airports in executive capacities and understand business dynamics and their implications on strategic decisions. Our aviation consultants provide a full range of business consulting services helping airlines and airports of all sizes reach their performance targets while our experienced industry professionals help travel and transportation companies all around the globe improve their profit position by leveraging our pacesetter software products, technology and data. Using best-practice techniques designed to address organizational challenges, regardless of size or business model, our consultants can provide results-oriented solutions ranging from carefully crafted strategic alternatives to improving commercial or operational results.

Technology That Sets You Free

Our high-performance Software as a Service platform, our unique solutions and technology free you to focus on your core mission while we handle the IT infrastructure. With our unparalleled technology platform, you can

use real-time data throughout your operation to ensure everyone has the same information exactly when it's needed to make the best possible decisions. Our SaaS solutions integrate well with each other or with your airline's applications, so you can execute your technology the best way for your business.

Your technology shouldn't be a constraint. With our service-oriented architecture and *Sabre*[®] *ASx*[™] *Airline Services Exchange* platform, you have the flexibility to adapt your business to meet changing requirements and more efficiently incorporate new technology.

Service Excellence

Through our service excellence commitment, we are dedicated to your success. We offer value-added solutions to drive exceptional business results for you. With our unmatched depth of industry experience, we focus on eight key areas to help you reduce cost, grow revenue and improve your competitive advantage — airline business consulting, solution design and delivery, knowledge transfer, quality assurance, customer community, global service centers and customer care.

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