**Airport Think Tank of ENAC Alumni** | Chair: Gaël Le Bris, C.M., P.E.

**Managing Uncertainty Task Force** | Coordinators: Elena Djakovitch (CMA CGM) & Romain Hericher (consultant)

**Participants (Alumni):** Pierre Bougeard (United Airlines), Philippe Fonta (SCRUM-Consult), Loup-Giang Nguyen (WSP USA), Victor Nguyen (Groupe ADP), Vincent Zonco (Groupe ADP), Mathilde Bécourt (Vinci Airport)

**Participants (Non-Alumni):** Antoine Thebault (Memorial Park Conservancy), Andy Brooker-Tormey (Air Arabia)

**Version 1 of February 12, 2023**

# Managing Disruptions in Airport Operations
## Lessons Learned for Enhancing Real-Time Response & Operational Resilience

*The aviation industry's interest in understanding how to deal with uncertainty and develop resilience has grown significantly since the 1990s, when airspace and airport systems started experiencing capacity and delay issues, airlines punctuality went down, and forecasts indicated that this situation was going to worsen without a radical change in operational practices as well as airport/airspace infrastructure enhancements. Also, in a world where air transportation systems are interconnected, a single event at one airport can impact thousands of passengers and cost millions. With rising passenger expectations, commercial and legislative pressures, airports that demonstrate an ability to prepare, mitigate, and expedite recovery from disruptions have a competitive advantage.*

*This white paper offers guidance for the development of tactical disruption mitigation plans and strategies to improve their response to adverse conditions and enhance their operational resilience. This guidance is largely based on lessons learned from members of the Airport Think Tank, success stories shared by other airport practitioners, as well as publications from institutions, professional organizations, and aviation stakeholders that we reference throughout the paper.*

*This document discusses a broad range of disruptions. It does not specifically address emergency situations that might trigger additional, non-aviation layers of command and response driven by specialized governmental bodies. However, the lessons learned and guidance provided in this paper can be helpful to airports seeking a more holistic approach to emergency management.*

*Over the past two years, COVID-19 has been the prime concern of most airport stakeholders when it comes to managing adverse conditions. The emergence of the pandemic itself was an unforeseen disruption that brought operations down in an unprecedented way. As the recovery is under way, it is important to learn from this crisis, and reflect upon previous pandemics as well, in order to prepare and make our aviation systems more resilient.*

## 1. What Should Airports Prepare for?

### 1.1 Uncertainty and Predictability

Adverse conditions can be characterized by their magnitude, duration, and recovery (Le Bris et. al, 2020). Another important consideration is the concept of predictability–the extent to which uncertainty can be anticipated and planned for. While it is possible to provide forecasts for most adverse conditions, all cannot be predicted with the same accuracy and certainty. A high uncertainty on severe potential conditions typically leads to preventative and conservative measures that are resource-demanding, impacting operational efficiency.

For instance, security threats are very severe. But it is often difficult to predict accurately when and where a terrorist action will happen. This uncertainty warrants permanent measures, such as passenger screening and access control, which can be scaled up based on intelligence and threat assessments. On the other hand, adverse weather conditions such as snowfalls are typically forecasted with high accuracy and enough notice to mobilize adequate resources ahead of their occurrence. However, seasonal forecast is still in its infancy, which means that winter operations plans need to be active for extended periods of time including, at many airports, early fall and late spring when the likelihood for winter conditions is low.

Some disruptions can be anticipated and mitigated through incremental proactive response, while others are very tactical in nature with a response that will likely be reactive. In either case, developing a resilient system and a culture of preparedness and responsiveness will help mitigate and address both planned and unplanned adverse events. Learning about these conditions, developing ways to predict them, and implementing tools for monitoring and assessing them, and preparing the airport stakeholders to respond when they occur, is key to successfully managing uncertainty.

## 1.2 Prioritizing and Categorizing Disruptive Events

Identifying and planning for every kind of disruptions that can occur at the airport would come at a significant expense in terms of time and resources. Prioritization is key when doing operations planning. These priorities should be based on a risk assessment that should be reviewed and revised regularly to make sure that existing risks are moved up or down accordingly, and that new risks are included when relevant, as risks change over time.

Carrying out a robust risk assessment and keeping a detailed risk register is vital to prepare for uncertainty. Extensive guidance is already available to help organizations categorize their risk and classify them in terms of frequency and severity.[1]

Using a holistic approach can be useful to extend the traditional conversation on operational risks, and explore other indirect risk factors, for example:

- Economic: airline fuel saving strategies (cost index can impact punctuality), understaffing, etc.
- Social: protests, strikes, reluctance to follow public health rules, etc.
- Technical and technological: system failures, power outages, etc.
- Systemic: "snowball" effect on disruptions at other airports or other modes (ground access), en-route, etc.
- Environmental: volcanic eruptions, flooding, etc.
- Legal and regulatory: new regulations e.g., health & safety screening regime, noise mitigation, etc.
- Geopolitical: airspace closures leading to extended block times impacting punctuality, etc.

Airports usually focus on developing plans and procedures for adverse events of higher severity, but they may not always prepare for mitigable adverse conditions of lower severity but higher frequency that generate recurring impacts. There is an expectation that "the field" can deal with it–and it does as much as it can. But a moderate effort supported by reasonable resources may result in significant gains of efficiency and resilience, with so many more days ending smoothly. For example, ask yourself, and then with your stakeholders[2], if procedures and processes are in place at your airport and across the stakeholders to deal with the following:

- Tactical runway and airspace management: How do you prioritize flights in case of reduced arrival or departure capacity? How do you prioritize repositioning for flights impacted by a massive diversion?
- Last minute cancellation: Are there procedures in place to provide information and welfare to passengers at your airport? How will you avoid potentially unsafe situations due to congestion?

---

[1] See ACRP reports 65, 93, and 229 referenced at the end of the paper.

[2] It is not because these issues are driven or under the direct responsibility of one single stakeholder that others will not be impacted.

Adequate categorization helps characterize adverse events, facilitate discussions in operations planning, and enhance access to the documentation. Corporate functions (e.g., risk assurance) may operate using a particular approach, while operations leaders may prefer to categorize them differently to help develop accountability, supporting processes, and enabling document management that makes sense for their activity. **Figure 1** below provides an example of risk categorization.
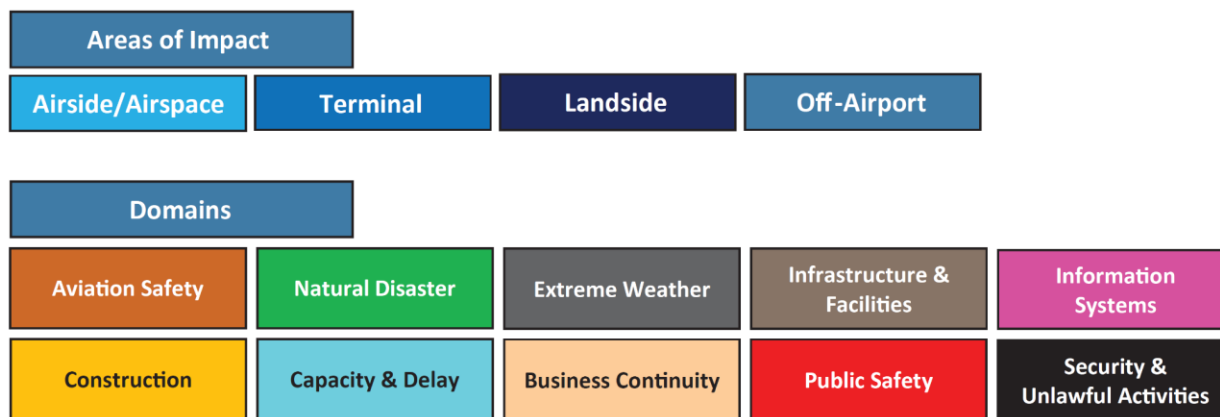
| Areas of Impact | | | |
|---|---|---|---|
| Airside/Airspace | Terminal | Landside | Off-Airport |

| Domains | | | | |
|---|---|---|---|---|
| Aviation Safety | Natural Disaster | Extreme Weather | Infrastructure & Facilities | Information Systems |
| Construction | Capacity & Delay | Business Continuity | Public Safety | Security & Unlawful Activities |

**Figure 1. Example of adverse event categorization**
*Source: ACRP Research Report 229 (2021)*

### 1.3   Airports as Part of Broader Systems

It is important to consider airports as part of both geographically and functionally integrated systems: operations at an individual aviation facility can be impacted by events occurring on the other side of the world, or by conditions faced by local non-traditional and non-aviation stakeholders. In return, the ability of an airport to "save the day" and successfully mitigate an emerging crisis at the local level can prevent significant impacts beyond the limit of the airport property. "Thinking global" should be a key consideration for organizations that wish to develop a truly resilient organization, and aviation systems bringing together broader communities of stakeholders must prepare themselves together to ensure the readiness of the infrastructure, processes, and organization.

## 2. Key Challenges Faced by Airports in Managing Disruptions

"What went wrong?" While disruptions are a very diverse group of events, and that their causes, consequences, and mitigations can be very different, the challenges faced can generally be categorized as followed:

- Lack of preparedness and readiness:
  - Unclear activation/escalation mechanism.
  - Absence of Standard Operating Procedure (SOP) to deal with specific events.
  - Lack of awareness or familiarity with the existing SOPs.
- Accuracy and relevance of the Information received:
  - Unstructured situational reports, no systematic way to provide updates especially from the field.
  - Unreliable operational information (poor accuracy, already outdated when received).
  - No common understanding on the terminology used (e.g., does flight "ready to go" include ATC slot and tug attached?).
  - Poor communication processes impacting situational awareness.

- Urgency to act conflicting with the need to coordinate:
  - Legitimate desire to act fast, with individual initiatives started in haste or in an isolated manner which can hinder the coordinated response.
  - Absence of shared strategy and coordination with the other stakeholders impacted.
- Slow-burn effect:
  - Early symptoms/minor issues are not recognized and addressed on time, leading to escalation into larger disruptive events that warrant a larger response.
- Analysis paralysis:
  - Indecision to select a course of action while waiting for better information and/or involvement of other stakeholders.
- Uncoordinated response:
  - Well-organized teams do not always adhere to the procedure in the presence of the upper management as local culture may tend to defer to seniority/authority for decision making.
- No holistic thinking:
  - Each stakeholder tries to optimize its own operation with conflicting actions that just make things worse.
  - Too much focus on the "now" while too little resources are dedicated to assessing the impact of disruption in the mid- to long-term and preparing for recovering.
- No lessons learned process:
  - No systematic review of events to capture what went great, what went wrong, and what could get better. This process is vital to develop operational maturity and resilience.
- Multiple concurrent disruptions (**Figure 2**):
  - Operations are not designed and staffed to address simultaneous disruptions.
  - Airports facing simultaneous disruptions in different locations either due to the nature of their operations or the size of their facilities may need to prioritize their efforts and/or isolate an event to maintain business continuity in other areas.



**Figure 2. The continuum of disruptions**
*Source: ACRP Research Report 229 (2021)*

## 3. Best Practices for Managing Disruptions in Real-Time

*This section presents guidance to help airports and aviation systems develop capabilities to manage disruptions in real-time and expedite the recovery process to get back to regular operations as soon as possible.*

### 3.1 Organizations

Effective response is enabled by a strong organizational structure. Akin to a military organization, it should display several important characteristics:

- Clear accountabilities and transparent operating principles:
  - Clear activation protocols based on early warning indicators.
  - The members should be empowered to make recommendations and decisions on behalf of their organization, and capable of making decisions with sometimes incomplete, unreliable, and outdated information.
  - Pre-defined roles and responsibilities: who focuses on managing the disruption, on running the rest of the operation, or on planning the recovery phase? The development of a simple RACI will usually trigger important questions.
  - Clear communication channels and tools, considering features such as ease of access, security, record keeping.

- Right sized and flexible:
  - The organizational culture will play a role in deciding how small or large the group should be, key decision factors include how decisions are made, but also the level of understanding (and access to information) of the people present.
  - Specialist skills available on-demand: airports should anticipate specialist (i.e., non-operational) resources that may be required at various notice, for example schedule coordination, capacity analysis, etc.
  - Volunteers available on-demand: when a large number of passengers is impacted, it is important to ensure a physical presence to communicate and provide limited welfare on site.

- Self-sufficient:
  - Based on the expected duration of an incident the response team should think about how long the team may be activated for and may need to rotate people to ensure sufficient representation is maintained throughout the duration of the disruption.
  - Welfare should also be planned for as extended disruption will often result in individuals exceeding traditional working hours, accumulating fatigue. In such cases, offering accommodation locally may save a potentially commute home.

- Physical colocation:
  - Our experience has shown that, where possible, the physical colocation of key stakeholders greatly facilitates communication, and decision making, in particular when this relies on discussing and agreeing compromise. SESAR's APOC concept provides detailed guidance on how this can be achieved. Where multiple operating centers exist, the lines of communication, control and engagement need to be clear (and tested).
  - "Work From Home ready": organizations should prepare for situations when it is not possible to achieve adequate physical representation and explore how the latest technological developments which we have adopted for remote working throughout most of 2020 can be used to help.

## 3.2 Developing Standard Operating Procedures

Many disruptive events will have similar–although not identical–causes and consequences. As such, an efficient response can be developed following an overall common response pattern, recognizing the various phases of typical disruptions (**Figure 3**)

The development of clear standard operating procedures (SOPs) and checklists will make the response significantly easier to implement for everyone, assuming that all staff members involved are familiar with and trained for operating with these SOPs. SOPs and checklists should, at the minimum, outline a standardized process to address adverse conditions. They should feature a step-by-step process to manage the disruption, clearly identify the role of each stakeholder, list the resources and points of contact, provide tools when applicable, and describe the typical path to returning to regular operations. Best practices, lessons learned, and other relevant procedures and documents should be referenced as well.

Developing a practice-ready SOP requires the following:

- Identifying the nature of the disruption to be addressed through the SOP: Procedures should not be "too generic: in order to provide clear guidance to the operating staff. Individual events that can warrant the development of a SOP include runway excursions, aircraft recovery, fuel spill at the gate, etc. Items such as "apron events" or "runway incidents" might be too broad in scope and lead to SOPs that miss the point when it comes to providing clear and detailed guidelines.

- Confirming the stakeholders and communication channels: Identify all stakeholders that could impact, be impacted, or contribute to the response. Describe the agreed communication channels and chains of command. Develop flow charts to explain these processes.

- Confirming available resources.

- Describing tools/rules to forecast or confirm the demand (including cancellations, delays, etc.): It is worth noting that accurately determining the capacity or demand in a specific area or across the airport overall can be challenging at best of times and will prove even harder during a live situation. Personnel dealing with the disruption may need to use their best "guess-timates" in order to avoid the information instability and analysis paralysis challenges described earlier.

- Developing demand management options and recommendations.

- Developing a communication plan.

- Providing tools for monitoring implementation.

A detailed process for developing SOPs collaboratively is available in ACRP Research Report 229: Airport Collaborative Decision Making to Manage Adverse Conditions. This process also provides for the regular review and update of procedures. A checklist template is available in the appendix of the present document.

In addition, airport-specific templates can be developed to speed up the regular assessment of the situation ("situational report") which can be used to provide all stakeholders with common situational awareness about the disruption. An example of such a template is available in appendix as well.
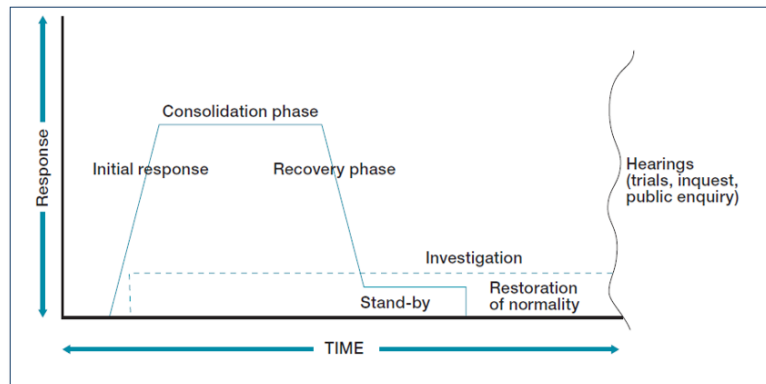
**Figure 3. Typical phases of a disruption event**

### 3.2.1 Early Warning Indicators & Disruption-Specific Performance Indicators

Operational units most likely already have a range of Key Performance Indicators (KPIs) which they track during normal operations to understand their performance. The same KPIs can be used to assess the impact of the disruption and develop effective mitigation.

Beyond these KPIs, it is also helpful to understand what triggers particular processes, further escalation, or de-escalation of the response for each partner. This can happen once some of the "traditional" levels of service breach certain targets which can be monitored and defined as Early Warning Indicators (EWIs). Response may also need to be escalated based on triggers not tracked as one of the main KPIs.

Finally, it is important to define the triggers for de-escalation i.e., the moment when the "recovery" phase starts, or when the response team can be stood down.

To summarize, we recommend that the following are defined by each stakeholder, discussed openly, and monitored by the Response Team(s):

- Operational KPIs in place with each stakeholder (e.g., punctuality, queue times, etc.)
- KPI targets for normal operations / disrupted operations, including thresholds e.g.,
    - Punctuality for normal ops targets (e.g., 95% OTP at T+15 min).
    - Punctuality for disrupted ops target (e.g., 80% OTP at T+30 min).
- Early Warning Indicators as triggers for response escalation or de-escalation (e.g., no. of passengers impacted, or percentage of schedule impacted – beyond a KPI-based approach, the level of response can also be based on expected duration of the incident).
- Disruption-specific KPIs – the examples below are based on the experience of our members:
    - No. of aircraft on airport (includes non-standard parking and taxiways) – may trigger diversions.
    - Amount of waiting time for aircraft to access stand (when taxi times become meaningless) – may trigger disembarking on (non-standard) parking position.
    - No. of departing passengers already check-in and delayed by 1/2/3… hours – may trigger welfare and financial penalties for airlines.
    - Occupancy in certain areas – may allow the efficient allocation (re-)allocation of frontline staff to provide updates and welfare to passengers (do specific arrangements need to be in place If congestion occurs at touchpoints which the airport does not directly manage e.g., border control, security)?
    - Amount of time for baggage from check in area to the aircraft (in case of a baggage belt failure or baggage handling system congestion) – may cause delays or trigger departures without bags.

o   Amount of waiting time for aircraft to access the runway for departure (e.g., congestion at de-icing) – may cause delays and trigger cancellations.

As events beyond the boundaries of the airport may trigger disruption locally or escalate ongoing situations, a number of external sources may complement local EWIs, e.g., nearby airport status.

Social media is often underused and can be a great source of information to detect or scope situations that traditional EWIs may not have set off or captured, however its validity and relevance needs to be assessed carefully

### 3.2.2 Airspace and Flight Considerations

The following aspects may have to be evaluated to effectively deal with disruption in a timely manner. These may not apply in all situations, and the list is not exhaustive, however early planning may help response efforts:

- How will flights be prioritized, and will this be done according to pre-defined (and pre-agreed) criteria? At airports with Air Traffic Flow Management (ATFM) this may be achieved via "regulations" but may need to be locally managed by the airport / ATC otherwise.
- What is the readiness status of prioritized flights?
    - o   Aircraft and crew
    - o   Passengers, baggage, cargo
    - o   Ramp equipment (e.g., pushback truck…)
- What airports are capable of handling diversions and how many?
- When can we start repatriating diverted flights and in what sequence?

*Note: Making flight data information across the stakeholders increases situational awareness, help addressing the issues aforementioned, and facilitate the decision making process. These data are typically easier to retrieve in countries or regions where the ANSPs has implemented collaborative decision making (CDM) at the ATFM level, and at airports that have an airport CDM (A-CDM) process in place with their air traffic control tower.*

### 3.2.3 Passenger and Baggage Considerations

The following aspects may have to be evaluated to effectively deal with disruption in a timely manner. These may not apply in all situations, and the list is not exhaustive, however early planning may help response efforts:

- What will the triggers be for flight cancellations, inbound and outbound?
- How long will airlines continue to check passengers and baggage in or when will they stop?
- What arrangements exist in case of cancellations, for example consolidation of multiple flights and re-protection agreements?
- If passengers are already on board, what would trigger disembarkation into the concourse?
- If baggage cannot be delivered, how long do we allow passengers to wait until they are released?
- Are adequate ground transportation arrangements in place?
- Are adequate accommodation arrangements in place?
- When should we start offering welfare (e.g., water, blankets, bedrooms)?
- Are we able to support passengers with special needs?

### 3.2.4 The Duality of the Response: Focusing on "Now" and "Later" Simultaneously

As described previously, an important challenge in managing disruption is the lack of, or instability of information. This impacts the short-term for example with poor accuracy of readiness impacting departure capacity (particularly for airports without Airport Collaborative Decision Making (A-CDM)), and the mid-term due to poor schedule visibility (particularly for airports without ATFM).

In order to manage disruption effectively, focus will need to be on the initial response and its impact onto the continuity phase, and both phases' impact onto the recovery phase. In other words, response teams may need to work in "real-time" and "scenario mode" at the same time.

This may be best enabled by calling on additional resources with different skills and tools as information stability challenges mentioned above may allow "live" tools to be used for the "real-time" work, however "scenario mode" usually relies on using "offline" data and tools, recognizing the unreliability of schedules in case of significant disruption (airlines and ground handling companies usually prioritize operational response over schedules' updates).

### 3.2.5 Review Process

It is important to determine and call the end of the disruption and the return to "normal" operation. This is best done by using pre-defined KPIs to identify the de-escalation and recovery phases.

Although it is not strictly "real-time", closing the incident event by conducting a thorough review of how the operation has unfolded and was managed is essential to identify improvement opportunities and enhance preparedness before the next event.

At this time, the focus should be on identifying both what went well and what can be improved. It is an opportunity to review operational processes' effectiveness (doing the right thing) and efficiency (doing things right) with the clarity that hindsight offers.

This process should happen as early as possible to ensure most feedback is collected while stakeholders still remember the event and how they dealt with it, recognizing that many thinking processes and discussions will never be part of the documents' record. The specific roles and number of stakeholders to be interviewed, as well as the format (e.g., meeting or individual conversation) will vary based on each event's characteristics (usually, senior leadership will express an interest in getting involved for highly disruptive impact with reputational impact).

We believe that the process of learning from experience could be improved by training employees on how to conduct an effective daily review of operations to be used for further analysis. This can be augmented by capturing additional feedback and lessons learned from specific events.

Our experience suggests that the quality of the feedback and lessons learned increases once this is explicitly made a core individual objective of operations managers. It should also be shared at the appropriate level within the organization to promote accountability of the various improvements required. Additional guidance is provided in the appendix.

### 3.3  Communications

Efficient communications play a key role in the management and recovery of disruptive events. It is essential to gather the information required to share a clear direction with all stakeholders, and thereby improve decision-making. It will also have a positive effect on the public's perception of how disruption is handled.

The development of an offline communication plan can be helpful in thinking ahead about all the stakeholders who may have to be communicated with in times of disruption.

- Internally (within the response team),
- Externally (with the wider airport community),
- Wider public (traveling public and media).

A few considerations are particularly important when communicating in disruption:

- General communication on an ongoing situation vs. its impact: when airports are facing multiple, isolated disruption leaving parts of the airport impacted and others "business as usual" it is critical that the level of urgency or disruption in each area is clearly communicated.

- What level of information should be available to each stakeholder? For example, operational staff would require updated readiness status for flights, which the airline may not want to share with passengers. As ever: short and clear usually works best!

- How should each stakeholder receive the information to understand it best? For example, the operational community may be comfortable with NOTAMs while airlines' station managers may need the same information spelled out in non-technical jargon.

- How will information be shared? Which specific tools / channels should stakeholders get official information from: mailing list, hotline, etc.? The robustness and latency of these tools should be evaluated regularly.

- How often should the information be updated? To avoid information overload during disruption management, it can be helpful what is communicated systematically as it happens or kept for regular briefings.

- It is also worth noting that not communicating does not mean no information will be available: the vacuum is quickly filled by non-official channels, for example passengers' social media messages.

An example of a communication plan is provided in the appendix.

## 3.4 Data Sharing & Digitalization

Airports are often "data rich and information poor", as the various stakeholders own large sets of data which are often left unused, and rarely shared with the rest of the community. Sharing and integrating such data is key to develop common situational awareness and enables a better understanding of each other's customers: ground handling, airlines… and ultimately the passenger. While genuine obstacles may exist (e.g., costs involved), these are often compounded with more political hurdles (e.g., information deemed commercially sensitive, etc.). Wider information sharing can be especially helpful in disruption to prevent information instability and allow better decision-making.

Beyond the availability of information itself, many of the information gathering, scenario planning, decision making, and communication processes detailed in the previous sections can be supported by tools, and some may be automated. These can be categorized in the table below (**Table 1**).

**Table 1. Data sharing tools categorization**

| LIVE OPERATIONS MONITORING <br> - to improve situational awareness <br> - to improve decision making | SCENARIO PLANNING <br> - to improve decision making | COMMUNICATIONS <br> - for situational awareness |
|---|---|---|
| Current status of flights: <br><br> ● From a flight perspective (e.g., A-CDM, turnaround view) <br><br> ● From a passenger-flow perspective (e.g., how many passengers have already checked-in, gone through security, etc.) <br><br> Current status of airport (occupancy, capacity, throughput) <br><br> ● From a touchpoint perspective (e.g., queue times) <br><br> ● From an area perspective (e.g., congestion) | What-If tactical tools using a combination of real and scenario data to support the planning and assessment of various mitigation options. For example, <br><br> ● In case of reduced arrival and/or departure capacity, which prioritization strategy will be enabled? <br><br> ● Can some of the demand management scenarios be pre-built to handle a live schedule? <br><br> Longer-term simulation tools (e.g., schedule or capacity analysis) to develop recovery phase scenarios towards a return to normal operations. | For internal communications: <br><br> ● Messaging app <br><br> ● Situational awareness app (e.g., displaying live operational data) <br><br><br> For external communications: <br><br> ● Chatbot |

| Predicted status of flights at various time horizons (as above). | | |
|---|---|---|
| Predicted status of airport at various time horizons (as above). | | |

Beyond the financial considerations required before investing in such tools, a few questions should be answered:

- What is the maturity of the process which needs replacing / enhancing? (is it documented and tested?)

- Why automate? (to reduce workload, speed up the process…?)

- What is the quality of the data? ("garbage in… garbage out", i.e., a great tool will not improve the quality of poor inputs and provide a superior quality output!)

If changes in data quality or process are expected, this should be carefully planned when selecting the technology (consider the lifetime cost of a tool inclusive of potential changes required).

Overall, scalability is key: it is important to "start small" and show the benefits of incremental investment in technology. Disruption will be infrequent and budget to support 0.001% of time will be hard to come by!

Digitization can be a great enabler, in particular via the integration of key operational system and the development of predictive and scenario capabilities. As airport operations' complexity increases, developing an ability to measure and predict the flows of passengers, baggage, cargo, vehicle, and staff will become key to manage normal and disrupted operations more efficiently. Technological advances in data science and artificial intelligence, along with fast-time simulation tools' integration with operational systems ("digital twin" concept) will undoubtedly enable leaps forward. However, system integration and data validation efforts involved in developing a "single source of truth" are considerable, therefore airports should seriously consider the pace and scope of their digitization ambitions. As noted earlier, scalability is key.

## 4. Best Practices for Developing Resilience

This section will focus on recommendations to help airport systems develop resilience, i.e., an ability to absorb the impact of disruption without significantly deteriorating efficiency or performance and recover from such disruption faster. Our Think Tank's recommendations can be grouped around similar themes as described in the following paragraphs. We recommend developing specific Concepts of Operations for disruption management, building on our Think Tank recommendations. The airport, as "orchestra conductor" should offer to own these, however they should be developed in collaboration with, and signed off by all stakeholders.

### 4.1 Organization & Resources

Preparing an organization to manage disruption involves improving most of the concepts developed earlier. This is often a challenge of culture and organizational change.

### 4.1.1 Resilience Culture

The development of a resilience culture within the wider organization, and not only the risk department/unit, is essential to improve capabilities in preparation for the next disruption. Too often, the activities (training, process development, tools procurement, etc.) are deprioritized at the corporate level due to the low probability of occurrence. Although the risk is perceived to exist in the operational world, enablers of resilient organizations may lie in its financial, or human resources world, etc. Difficult choices may be required to align the organization's direction with its risk mitigation ambitions, in terms of structure, investment decisions, etc.

Considering the range of human, financial and reputation costs which poorly managed disruption can incur, it is essential that senior leadership develop a culture of "resilience is everyone's job". Senior leadership awareness and endorsement is required to ensure that risks are carefully considered, collectively accepted, and clearly accounted for.

A "no wrong answer" culture is also helpful in developing and continuously improving. Allowing teams to try and "fail safely" will accelerate the organization's learning process and help refine both general approach and specific processes.

### 4.1.2 Multi-Skilled Employees

In some instances, disruption will be characterized by failing infrastructure, equipment, or tools. Organizations should make sure their employees are familiar and trained to use backup processes, tools, and equipment: for example, in case of Departure Control System (DCS) failure are staff able to use another one, or follow manual check-in processes?

In other instances, managing disruption will involve some level of resource shortfall. The risk assessment activities detailed earlier can help identifying where this could materialize. For example, airports who manage the security process and within heavily unionized environment may consider strikes as a significant risk to their operation, which would translate into a shortage of staff to process passengers and baggage at this touchpoint.

Resource planning usually considers the demand variability during normal operations. However, no organization would scale its workforce to cater for "extreme" variation which such an event would represent.

A practical approach to provide some flexibility include the training of additional staff to cover tasks of low technical or regulatory complexity. For example, training staff to help with providing welfare, wayfinding, bag loading at security lanes, etc. may allow the reallocation of critical resources to other areas in times of need.

Cross-training frontline resources is usually within the influence of the operational teams. The organization can offer further support by identifying back-office staff who can provide further support via volunteer schemes, etc. It is worth noting that assigning back-office staff specific frontline activities may require specific familiarization and training activities to take place. Reflecting on the complexity of frontline roles may provide some interesting insights to share with the workforce planning or learning and development parts of the organization.

### 4.1.3 "One Team" Culture

Cross-functional teams working together within (and outside of) their organization to improve resilience and preparedness will naturally improve relationships and collaboration. Such activities are great at also improving formal or informal team's agility and information sharing which bring significant benefits during disruption.

Training then involving back office (including senior management) staff to support the frontline during disruption will also develop a stronger bond between different parts of the organization (in addition to presenting development opportunities).

Finally, developing the right resourcing policies (rostering, leave, on-call availability, etc.) will also help organizations maximize their staff availability when the need arises. Note however that employees' willingness to support their company in time of need can vary dramatically and should not necessarily be taken for granted.

At a more senior level, technical expertise is not always necessary to lead an organization through disruption effectively. Consequently, a large pool of senior managers within a typical organization may, with the right training, present an adequate mix of skills and behaviors to support in such times. Having senior managers from various departments on call to cover a "disruption roster" is a great way to demonstrate the resilience culture described earlier.

Considering the various support activities required, current capabilities and a usually limited training capacity, we recommend the setup of "reserve" teams selected from an initial volunteers' pool which can be rostered to provide adequate cover.

### 4.1.4 Preparedness and Readiness

Whether it is frontline, back office or support staff, disruption will undoubtedly expose all employees to the uncertainty of unusual situations, information unreliability, and new organizational dynamics. Beyond the general familiarization and initial training, regular refresher training is required to maintain competence.

Training should ideally include both theory and practice. Learning a lesson from the pilot community: there is no better preparation than frequent learning and exercise.

Regular risk assessment review should offer plenty of inspiration to develop possible scenarios to train for. Too often, such training is limited to emergency plan exercises, which will involve fewer stakeholders and will tend to test the same established procedures, focused on aircraft accident/incident. This is unlikely to help develop the agility required in handling different types of disruption (check-in failure, baggage handling system failure, power failure, etc.).

Scenarios can be developed as table-top exercises, virtual or in person, and should aim to test all tools, procedures, and operational practices (e.g., communication flows, etc.).

A limitation of planned exercises is that their results are not representative of a live situation unfolding. Where possible, a better approach (yet more complicated to set up) would be to set exercises under "exam conditions" i.e., without alerting participants nor allowing them time to prepare.

Finally, based on the learnings from disruption management or the regular preparedness exercises, are there lessons we should apply to normal ops too? We believe the skills and behaviors that can enhance disruption response will have benefits during normal operating conditions as they will allow airport communities to improve how well and how fast they adapt to ever changing needs and expectations from passengers (e.g., fewer delays, higher service levels), airlines (e.g., shorter turnaround times, shorter connecting times) and policy makers (e.g., environmental measures).

### *4.2  Infrastructure, Equipment & Systems*

Similar to how "risk zero" cannot realistically be achieved, aiming for a 100% resilient system is a utopia. Catering for any kind of disruption would be extremely costly and inefficient. The risk identification activities will help identify the frequency, duration and magnitude of risks faced by a particular airport, who will then decide how to address these.

### 4.2.1 Maximizing Availability

This is rather common sense, but the organization needs to ensure that infrastructure availability is maintained to the maximum extent possible is key. This involves maintaining assets as efficiently as possible, considering preventive maintenance regimes where they are shown to be beneficial.

This also means carefully planning all maintenance and other works programs schedules to integrate activities and minimize impact where possible. For example, if work is planned on a taxiway, is there an option to carry out some works on the stands to/from which access is restricted rather than close them twice?

### 4.2.2 Removing Silos

Flexibility also requires organizational alignment. For example, airport communities frequently create capacity silos (single-use terminals, stand apportionment, etc.). In times of disruption these restrictions can translate into lower operational capacity. Considering the political implications of such arrangements, opportunities to relax artificial capacity silos need to be discussed prior to disruption rather than during its mitigation.

### 4.2.3 Maximizing Flexibility

This third category relies on an initial intent and design to supply and deploy flexible infrastructure, equipment, and systems. Some examples are listed in **Table 2**.

Ensuring these infrastructure, equipment and system are flexible and common use also prove helpful when demand drops and capacity is in oversupply (e.g., pandemic affecting passenger demand) as this allows airport systems to quickly scale capacity back via hibernation of capacity, temporary staff reductions, etc. with the understanding that any capacity still available can serve all airlines, passengers, baggage, and cargo.

**Table 2.** Example of flexible infrastructure and equipment

| AREA | EXAMPLE OF FLEXIBLE INFRASTRUCTURE / EQUIPMENT |
|---|---|
| Terminals | ● Common User Terminal Equipment (CUTE) and Common User Self-Service (CUSS): check-in desks, bag drops, CUTE system, etc.<br><br>● Infrastructure design: allow infrastructure to adapt to passenger flow e.g., corridors to handle alternating flows of arriving / transfer, or Schengen / international, etc. Target a one-roof concept to enable more flexibility. |
| Airside | ● Multiple Aircraft Ramp System (MARS) / Multi-Choice Apron (MCA) stands.<br><br>● Non-standard parking areas on taxilanes / taxiways / maintenance areas, etc. |
| Baggage | ● Horseshoe design for baggage lanes.<br><br>● Identified unused landside or airside area for temporary storage of ULDs / bags. |

### 4.2.4 Building Redundancy

Another approach focusing on infrastructure, equipment and systems is to build redundancy for the most critical or at-risk areas. The cost can be significant but this approach, usually used to maintain minimum capability, can make the difference between operating or not.

For example, airports operating in areas prone to frequent power outages due to unreliable power networks may decide to invest in building power grid redundancy at a local level for core infrastructure / systems e.g., NAVAIDs, etc. It is essential that frontline and facility management departments are trained in activating contingency equipment on a regular basis to ensure prompt activation when required.

### 4.2.5 Balancing Capacity & Service

An approach to maintain target service levels during disruption is to promise service levels that can consistently be achieved. In other words, once the risks are identified, reviewing their impact on one's operation will help identify the level of impact on operational and service performance for the airport and its partners. A service promise that equates performance in disrupted conditions will therefore almost "guarantee" that these same service levels will be exceeded during normal conditions.

This approach is in use at a large, complex layout, hub airport subject to frequent low visibility / windy conditions. In order not to suffer the impact of reduced rates in terms of delays and schedule perturbation, it has set a lower runway capacity than what is achievable during "normal conditions", which allows it to operate at the capacity limit during poor weather conditions as well and exceed this performance in good weather.

### *4.3 Processes*

### 4.3.1 Re-defining Priorities: Minimum Service Levels and Recovery Time Objective

To effectively manage disruption, it is useful to understand how differently the various stakeholders may operate. Identifying what is important and how it will be measured is essential: it is highly likely that no partner is singlehandedly responsible for any of these, therefore advanced discussion is required to discuss these and ensure that all stakeholders are aligned and resourced accordingly. In most instances, various stakeholders will have to explore how they would balance service, cost, and reputation.

As described earlier, several KPIs may already be in place to monitor normal, and disrupted operations. The various stakeholders may want to define Minimum Service Levels (MSLs), which represent the level of performance which stakeholders will try to maintain at all costs. Similar to Early Warning Indicators, these may trigger specific responses, for example, by setting a MSL for passenger waiting time at the reclaim belts, an airline or ground handling company will have to ensure sufficient staff are available or reallocated to manage all baggage by a target time, or ensure that passengers are communicated to, allowed to leave the airport and baggage delivered to them later on. Awareness

of this "service promise" provides other stakeholders an indication of how response will escalate, and how they can prepare to support it.

Disruption-specific KPIs may take priority as response escalate, for example:

- During normal operations, an airline's most important KPI may be punctuality.

- During disruption causing severe delays, the airline will monitor "passenger on-board delay" - with a Minimum Service Level of 3h (as regulation imposes disembarkation and welfare provision).

- The airport will initiate some level of flow restricting once the number of non-standard parking position is 50% full – with a Minimum Service Level set at "full house" triggering airspace closure.

A proven approach to set these various targets is to carry out thorough review processes of normal and disrupted days to analyze historical performance and develop baselines for what good / bad looks like, supported by robust root-case analysis processes.

Another tool that may be helpful is to define a Recovery Time Objective (RTO) – a time by which return to "normal' operations is expected. This is essentially setting a KPI target for a set time in the future to help make proactive decisions. For example, in case of runway closure, an RTO could be set to recover operations by 23:59, defined by all scheduled arrivals having landed. If the closure is extended and night operations are expected to continue beyond the agreed RTO in numbers, this may trigger a decision to proactively delay / cancel flights and consolidate operations.

This illustrates a common conflict for airports when managing disruption: should we continue to operate in "very" disrupted conditions for extended periods of time (with creeping delays, etc.) or proactively curtail operations to maintain services levels (and possibly make decisions on behalf of airlines)?

### 4.3.2 Disruption Management Operating Principles

Where possible, it is helpful to discuss and pre-approve among decision makers key operating principles for the management of disruption as this will help prepare processes and scenarios accordingly and eliminate the range of options that should be explored to develop appropriate mitigation strategies. The questions below can be used to start a dialogue at an airport's level:

- Should we "protect the hub" by ensuring home-based carriers return to normal operations as quickly as possible?

- Is the aim to be as "fair" as possible (and how is this defined?) or to expedite recovery as quickly as possible?

- Should runway capacity be allocated to larger seat capacity aircraft on the assumption that they will serve more passengers (favoring widebody over narrowbody)?

- Should en-route flights be prioritized (favoring long-haul over short-haul)?

- Should market accessibility be protected (favoring low-frequency operation)?

Airports may consider using different operating principles in the different phases of response. For example, in the case of an unpredictable situation, the urgent nature of a disruption may require an immediate response, which means decisions must be easy to make, easy to communicate, and easy to implement, sometimes at the expense of perceived fairness.

For example, in the case of loss of runway capacity, experience suggests that a restriction by aircraft size category (based on ICAO classification) is easily understood by the air traffic operational community and can be easily implemented. Similarly, limiting traffic to certain zones / areas / airports. This may however not be "fair" based on the airport's traffic mix.

Once the situation has stabilized, resources focused on the initial response can focus on exploring scenarios that may be perceived as more equitable, but would require time for analysis, discussions and scenario making, for example:

- Reduction of schedule based on share of slots per airline.

- Re-protection policy considerations (inter-airline agreements to carry each other's passengers in case of cancellation).

- Market accessibility consideration.

### 4.3.3 Coordinating Approaches

It is likely that different stakeholders will have different priorities, and these may be different depending on the scale of the disruption. Each functional area should be aware of the key trade-offs that could be created as a result, for example if an airline's normal operation driver is punctuality, but it changes to connectivity during disruption, what is the impact:

- airside: impact on punctuality, turnaround times, ground demand…

- landside: misconnected passengers, congestion…

- baggage: misconnected baggage…

Beyond the impact on operations locally, an understanding of what happens at outstation is also helpful. An airline that has long planned turnaround times at outstations can afford to recover some delays at origin during the rotation without impacting the punctuality of the second departure wave.

Each stakeholder can then assess what impact a typical disruption would have on one's own objectives and priorities and contribute to develop community-wide mitigation strategies. Considering the complexity of such approach, and the usual time pressures involved, it is worth exploring the value of developing appropriate guidance material for times of disruption incorporating input from all relevant stakeholders (e.g., Concept of Operations).

Finally, an awareness of the political landscape complexity is essential when coordinating these approaches, as it may require difficult questions to be raised, and ideally answered in advance. For example:

- What are the principles for demand management (priorities for enforced cancellations / delays)?

- Who is responsible for passenger welfare (before / after check-in, on arrivals)?

- What are the criteria for a temporary relaxation of capacity silos (e.g., stand apportionment)?

### 4.3.4 Managing Expectations, Roles, and Responsibilities

It is essential to clearly communicate expectations and requirements during disruption at the airport. Recognizing that some stakeholders may access the airport infrequently, updating the airport's Conditions of Use documents may help disseminate this information to all ground handling agents and operators.

### *4.4 Looking Beyond the Airport's Boundaries*

Nowadays, airports are part of vast aviation networks that span continents, and also tightly integrated ecosystems that help them operate locally. Enhanced resilience builds on these two dimensions.

Air Traffic Flow Management (ATFM) is a game changer in the disruption management. Developing a capability to see and influence the flow of aircraft before it is within the airport's own or surrounding airspace brings significant benefits at a local level, for example Central Flow Management Unit (CFMU) from Eurocontrol, Ground Delay program from the FAA, Regional ATFM in South-East Asia, and Zone Block concept in UAE[3].

With various levels of maturity and sophistication, these operating models allow ANSP to impose delays at origins to reduce demand at destination. Some have developed the capability to monitor to ground demand and remaining parking capacity at airports, essential information when diversions increase.

More advanced ATC concepts such as E-AMAN, etc. offer the prospects of using predictive capability to refine tactical measures and better manage Demand-Capacity Balancing (DCB) on a larger scale. However, most concepts already

---

[3] AIC A 06/2019 https://www.gcaa.gov.ae/aip/current/AIRACs/2019-P05/html/eAIC/eAIC-2019-06-A-en-GB.html

in place tend to be reactive rather than preventive, as adverse events are not anticipated nor coordinated between airports.

Similarly, departing and terminating passengers or cargo will rely on land connectivity to access the airport, along with all the logistics involved in running an airport and its surrounding community.

Airports worldwide are working on improving their ability to operate as integrated ecosystems and collaborate more effectively. Examples abound in Europe and elsewhere, for example A-CDM [4], Total Airport Management (TAM)[5] and the Ground Coordinator Concept.

Too often mistaken for a "system upgrade" or a "building opening", these initiatives are in fact complex operational change programs which rely on people's readiness to work differently. A-CDM implementations are often celebrated alongside openings of integrated Airport Operations Centers (APOC), symbolizing improved collaboration through the colocation of several key stakeholders. However as noted by Eurocontrol, "not every airport will establish an APOC … as it does not necessarily fit the local scope and size to justify such an investment".

Guidance exists to help organizations develop their roadmaps towards more integrated and collaborative operations, for example Eurocontrol's on how to develop capabilities to establish an Airport Operating Plan (AOP)[6].

## 5. Conclusion

This document provides airport systems with practical recommendations to improve their ability to manage disruption. The approaches, processes, tools, and systems discussed in this document can be adapted and implemented at any airport. Building a resilient aviation industry requires that all stakeholders develop strategies and operational plans enabling them to prepare, mitigate, and expedite recovery from the next disruption.

Communities that develop a "resilience" culture and enhance collaboration will adapt to new circumstances quicker and be better prepared for future disruption. This needs dedicated focus and significant time, and we hope the information shared by ENAC Alumni will be helpful on this journey.

*
*   *

**Disclaimer.** This document is provided to the general public for information purposes only. The information shared in this material is not all-encompassing or comprehensive and does not in any way intend to create or implicitly affect any elements of a contractual relationship. Under no circumstances, ENAC Alumni, the task force members, and any participating organizations are responsible for any loss or damage caused by the usage of this content. ENAC Alumni does not endorse products, providers, or manufacturers. Trade or manufacturer's names appear herein solely for illustration purposes. The participation of individuals or organizations to this task force is not an endorsement or validation of any finding or statement contained in this paper.

---

[4] A-CDM https://www.eurocontrol.int/concept/airport-collaborative-decision-making
[5] TAM https://www.eurocontrol.int/project/total-airport-management and https://www.sesarju.eu/projects/tam
[6] https://www.eurocontrol.int/sites/default/files/publication/files/airport-network-integration-apoc-aop-v1.pdf

# APPENDICES

## APP.1  Example of Disruption Management Process Checklist

The actions below are listed in an approximate level of chronological priority; however, some activities can run in parallel. For each of these actions, an owner and a timeline should be defined: "who" is responsible, and "by when".

| ACTION | DETAILS / COMMENTS |
|---|---|
| Resource mobilization (consider additional resources if required to manage disruption) | See comments about support teams in 5.1 Organization & Resources |
| Confirm list of stakeholders and point of contact for each<br>● ATC<br>● Ground handling companies<br>● Airlines<br>● etc. | See guidelines of information required per stakeholder at the end of this document. |
| Establish nature of the disruption and response<br>● Details on location, time, etc.<br>● Are aircraft / passengers involved?<br>● Are facilities involved? | Suggested source(s): Response Team, Control Centre. |
| Confirm unavailable facilities / infrastructure, and estimated reopening time<br>● Runways, taxiways, stands<br>● Terminals, piers<br>● Baggage system<br>● etc. | Suggested source(s): Response Team, Control Centre, Head of Terminals, Head of Airside, etc. |
| Determine airspace / runway status<br>● Current flow rate?<br>● Current levels of holding delay?<br>● Were we in an arrival or departure push?<br>● If ATC-related, what is the expected duration of disruption / opening time? | Suggested source(s): ATC. |
| Confirm diversions status:<br>● Which flights have diverted?<br>● Where to?<br>● What is the status of passengers on these flights? | Suggested source(s): ATC, Control Centre. |

| ACTION | DETAILS / COMMENTS |
|---|---|
| Carry out detailed situational report<br>● Operational / non-operational status for all touchpoints<br>● Frontline feedback<br>● Areas of congestion | It is recommended to use airport-specific templates to ensure all a comprehensive review is done (see example in appendix). |
| Determine touchpoints and overall airport operational capacities | See flowchart example in appendix. |
| Develop demand management approaches and recommendations Where possible using pre-approved approaches. | See flowchart example in appendix. |
| Develop communication for operational, internal, external audiences Agree level of detail shared, medium used and frequency. | It is recommended to develop pre-approved NOTAM / messages for each category of audience / stakeholder. |
| Estimate accumulation of passengers at various touchpoints | |
| Monitor impact of demand management approach (once implemented)<br>● Track planned vs. actual runway movements and impact on parking<br>● Update flight priority list per operator<br>● Update aircraft passenger loads to help prioritize services and welfare<br>● Monitor congestion in the airport (processing + dwell areas) | See flowchart example in appendix. |
| Document control | Will help the review process and may be useful for auditing purposes. |

## APP.2  Example of Disruption Communication Plan

| STAKEHOLDER | FREQUENCY | CHANNEL |
|---|---|---|
| Response Team | Every 30 minutes | Situational report template. |

| STAKEHOLDER | FREQUENCY | CHANNEL |
|---|---|---|
| Flight Ops community stakeholders (e.g., ATC, OCCs) | ASAP | NOTAM |
| Local Stakeholders (e.g., Airline Station Manager) | Min. every 1 hour | Corporate Communications emails + website + social media |
| External stakeholders (e.g., Airline Head Office) | As required | Same as Local Stakeholders + direct communications from Commercial Department |
| Passengers & Frontline staff | As required | Same as Local Stakeholders + FIDS, airport app |
| General Public | Min. every 1 hour | Website update + social media + traditional media briefings (e.g., TV, radio, etc.) |

## APP.3 Example of Situational Report Template

Templates used for situational reports should aim to be reasonably exhaustive to provide standardization of what areas are looked at However, they should be used "by exception", focusing on what has changed or what needs attention.

**Date:**          **Time:**

| AIRSPACE & RUNWAY | | | |
|---|---|---|---|
| Airspace status | | DEP Throughput | |
| Traffic look-ahead | | ARR throughput | |

| SCHEDULE INTEGRITY | | | |
|---|---|---|---|
| Cancelled Arrivals | | Diverted Main Alternate | |
| Cancelled Departures | | Diverted Other | |

| STANDS AVAILABILITY | | | |
|---|---|---|---|
| Local Airport | | Main Alternate | |
| Code C | | Code C | |
| Code D | | Code D | |
| Code E | | Code E | |
| Code F | | Code F | |

| | TERMINAL A | TERMINAL B | TERMINAL C | MAIN ALTERNATE |
|---|---|---|---|---|
| Landside Access | | | | |
| Forecourts and Car Parks | | | | |
| Check-In | | | | |
| Security | | | | |
| Emigration | | | | |
| Horizontal / Vertical Circulation | | | | |
| Concourses | | | | |
| Transfers | | | | |
| Immigration | | | | |
| Baggage System | | | | |
| Baggage Reclaim | | | | |
| Onward Journey | | | | |
| Cargo | | | | |

## APP.4  Example of Process for Developing Demand Management Approaches

Demand Management Plan process
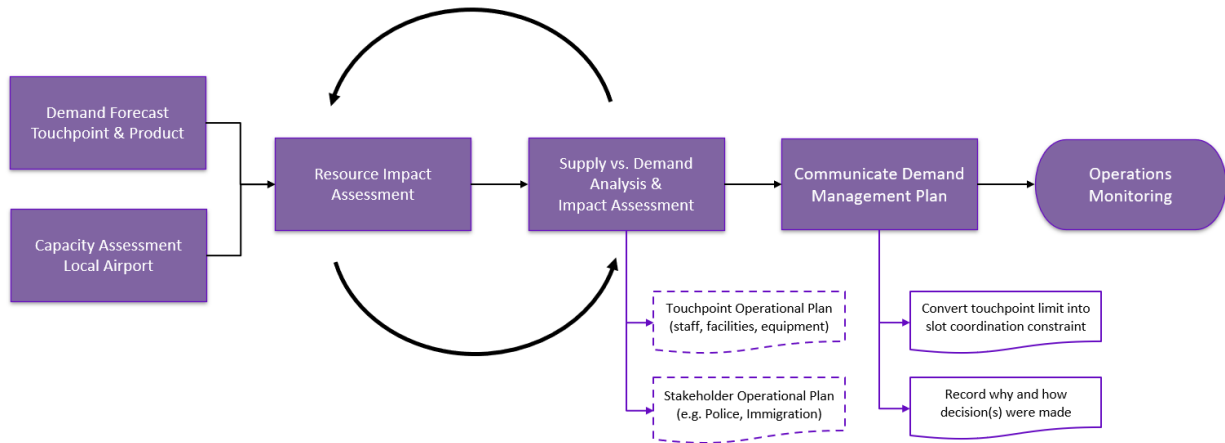


## APP.5  Example of Process for Determining Touchpoints and Airport Overall Capacity
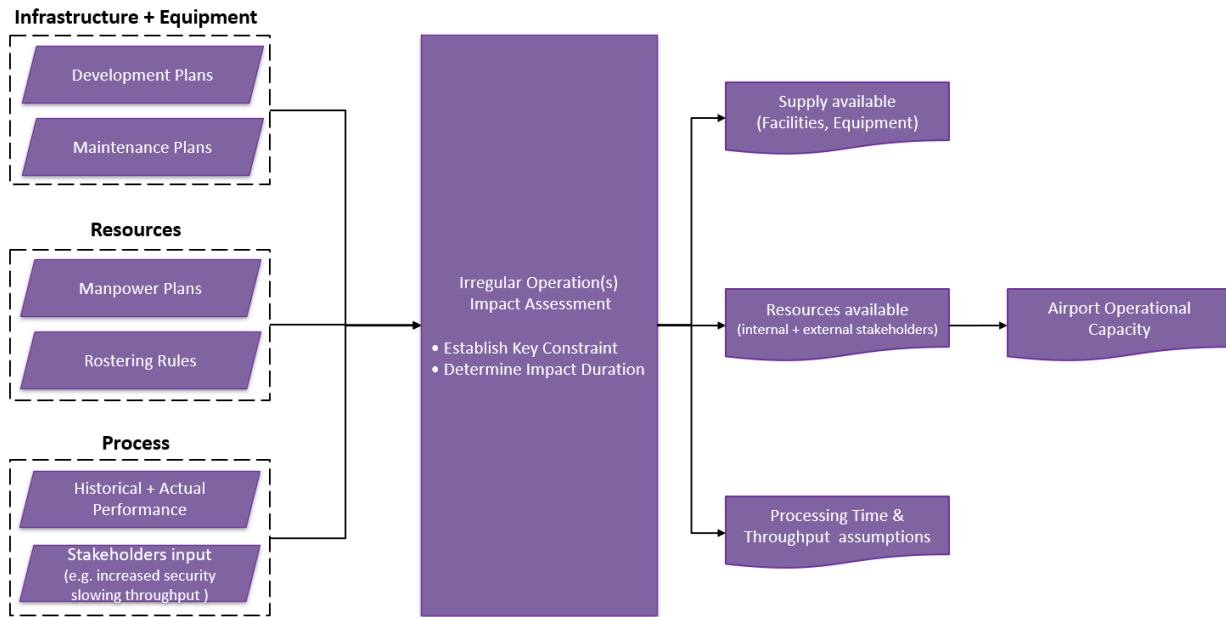


Notes:
1) It is important to think end-to-end when determining the infrastructure and equipment available: for example, baggage belt availability may not be the engineering view (i.e., the belt is moving) nor the ground handling view (i.e., I can access the baggage offload area), not the terminal operations view (i.e., passengers can access the reclaim hall). It is only "available" if all links in the chain are working.
2) When looking at the resources, thinking "global" is critical, e.g., what is the impact of assuming an increase in resources in a particular area: can we reallocate from other areas (is there a lead-time?), can we mobilize additional resources (does this impact resource levels in the future?), etc.
3) Encourage stakeholders to translate their equipment and resources into passengers / baggage / aircraft processing capability, as each will be better placed to understand how the current mode of operation may

impact their operation, e.g., do not talk about trucks and liters of deicing, rather translate this into a number of aircraft per hour.

## *APP.6 Example of Process for Monitoring Impact of Demand Management Approach*
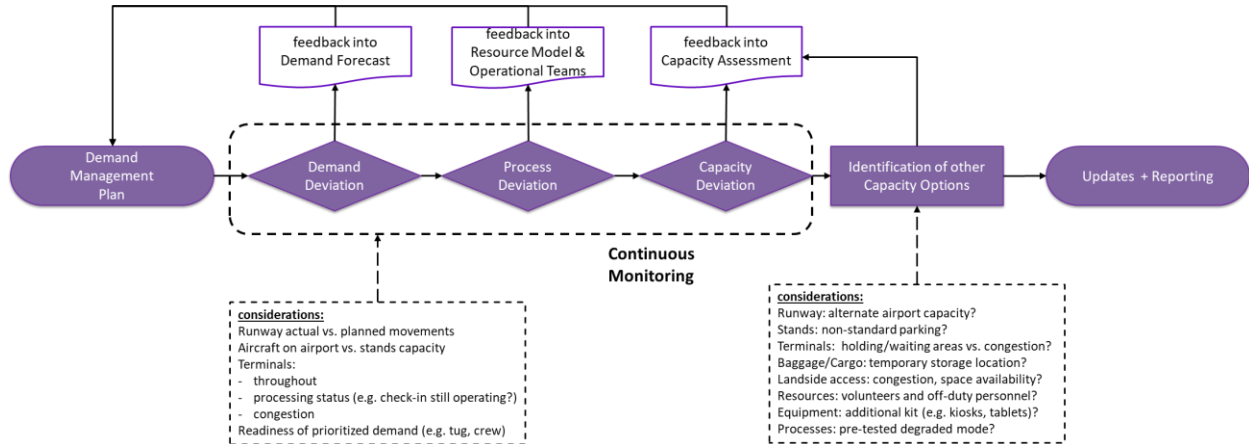


## *APP.7 Recommendations to Develop a Robust Lessons Learned Process*

Performing a thorough review of "what" happened, "how" it happened, and capturing lessons learned is obviously helpful to perform root cause analysis and understand one's performance. It is also essential to critically analyze the airport system processes and initiate continuous improvement activities that will enhance business continuity and preparedness for the next disruption.

**Phase 1: Information gathering – "what" happened?**

For events that had a significant impact and exposure outside of the usual operational audience, we recommend appointing a facilitator who was not involved in the management of the event, to ensure unbiased feedback is gathered. Where possible this person should be from an operational background.

Several tools can help to gather witness statements, the simplest one consisting of customized checklist with key questions to gather the information required, brainstorming sessions with key stakeholders, and surveys or forms to be completed by participants.

| ITEM | DETAILS |
|---|---|
| Sequence of events | Gather timeline elements from involved personnel to determine a clear sequence of events from initial deviation to resumption of normal operations. It can be a global brainstorming gathering all participants, or based on an existing and detailed process, each personnel can define the timeline of what they went through during the event. |
| Identify probable causes and consequences | Each deviation from normal operations should be linked to one or several probable causes and consequences. |

| ITEM | DETAILS |
|---|---|
| Understand each stakeholders' perspective and experience | Beyond the events which characterize the disruption, stakeholders involved can often share their opinion on "how" the disruption was managed. This is particularly helpful to assess if existing processes / procedures are realistic, appropriate and if changes should be considered. |
| Review available materials and resources in place | During individual interviews or as part of larger group sessions (e.g., higher management), a review of overall resources (workforce, equipment, documentation…) should be performed to assess the organization's capabilities for future disruption management and recovery |
| Review the training and qualifications of supporting personnel | In addition to the previous steps, the organization should always assess the readiness of its personnel and consider training / refresher training needs. |

Such a checklist should be developed as soon as possible to maintain the highest chances of gathering accurate feedback from participants.

Such a checklist would be useful in addition to a self-assessment questionnaire, completed by employees, who would be gathered and shared during an operational debriefing (preferably on-site and in-person).

**Phase 2: Root cause analysis – "why" did it happen?**

After gathering all qualitative and quantitative information about what happened, the next step is to understand why and what caused this event, for example:
- Was the operations plan "off" and if so, why?
- Was the actual demand / capacity / processing "off" and if so, why?
- Was an unusual / disruptive event successfully mitigated, and have we prevented expected / usual consequences from occurring?

A root-cause analysis [7]can be performed on this information and available historical data can be statistically reviewed to support this analysis.
Risk assessment tools can be used to clarify all risks associated with any root cause identified and to review potential consequences.
Conversely, feedback on positive performance should aim to identify good practices which should be adopted as new standards. How can these be integrated to existing processes and employees trained in using them?

**Phase 3: Share lessons learned**

An output of phase 2 should be minutes of meetings and a list of corrective actions aiming at improving the processes on a short- or longer-term period.

Phase 3 will appear complete and useful when all aspects have been thoroughly discussed and the findings are used to develop technical, organizational, and procedural action plans.

**The real value of the post-event feedback is in communication**

---

[7] https://asq.org/quality-resources/root-cause-analysis or
https://www.mindtools.com/pages/article/newTMC_80.htm

Integrate the feedback into normal processes: based on our experience, it is essential to communicate on a regular basis - not to say continuously - about the operation. During normal operations, airports usually have handover processes in place to ensure operational managers brief their teams about what happened before and what is expected during their shift. Adverse events and abnormal situations debriefing offer a good opportunity to review the usefulness of EWIs.

Corrective actions should be turned into specific objectives, with clear accountability. We also recommend consolidating corrective actions identified during each event in an existing register to facilitate tracking and avoid conflicting priorities.

Airports may want to adopt a severity assessment that automatically provides visibility / assigns accountability at specific levels of the organization, for example:
Impact 0-2 → Operational airport team
Impact 3-5 → + management
Impact 6-8 → + operational stakeholders
Impact 9-10 → All decisive stakeholders

*
*    *