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Adapting Operations to a Harsher World

January 2023



THE FACTS

Over the Christmas period of 2022 airlines across North America were impacted by a severe cold spell that closed airports across a wide geographical range. All airlines were affected but there were distinct differences in their ability to absorb and recover from the disruption.

THE ANALYSIS

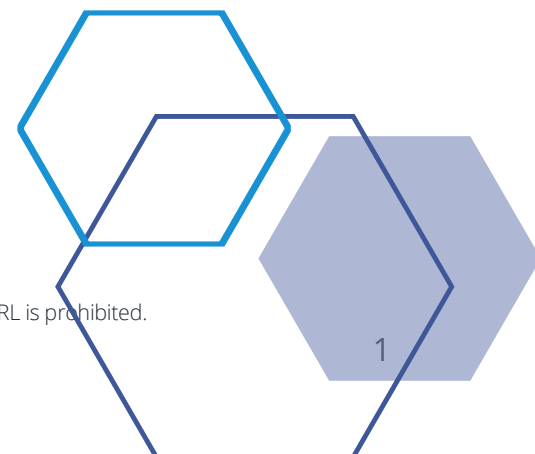
It is inevitable that the number and frequency of severe weather events will grow as the climate crisis develops. In addition it is very unlikely that the Covid-19 pandemic and the conflict in Ukraine will be the last such events to impact the airline industry within its long-term planning horizons. Operational processes and systems will be tested more than ever before and airlines that fail to recognize this will be doomed to a succession of catastrophic collapses.

In looking at how to address the issue there are two distinct phases to be considered, network design and supporting technology.

Network design involves optimising the revenue that may be achieved from a set of resources that include aircraft, crews, airport facilities and traffic rights. Recent events have shown that robustness of operation is also a factor that network planners should consider.

In thinking about the robustness of a network it may be useful to consider the classical physics concepts of equilibrium.¹ A neutral equilibrium is one which may be disturbed by an external force but is then amenable to being restored to its original state by the application of an equal and opposite force. By contrast an unstable equilibrium is one which may also be disturbed by a small external force but this

¹ <https://study.com/academy/lesson/stable-equilibrium-overview-examples.html>
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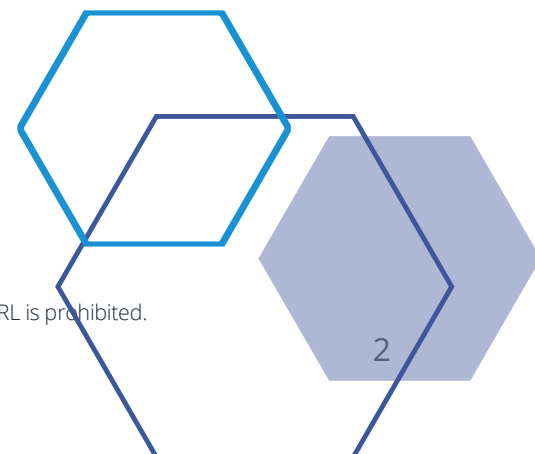
triggers an accelerating collapse after which the original equilibrium may only be restored by putting in large amounts of effort.

In airline networks a neutral equilibrium is one characterised by adequate reserves of both resources and time, limited knock-on impact of a single failure and viable ways of routing around a problem. An unstable equilibrium is one where a failure may cascade to impact multiple further operations and there are insufficient reserves available to restore the operation expeditiously. Those airlines that were least impacted by the Christmas storm were those whose network started in a state of neutral equilibrium.

Network design generally takes place on long time scales and in an atmosphere of relative calm. When a winter storm, or a wildfire, or an ATC dispute strikes, the atmosphere is anything but calm and solutions for getting back to equilibrium need to be found and applied quickly. The task is easier when the network equilibrium is a neutral one but the necessary components apply even to the most unstable of situations. A new, temporary, schedule needs to be constructed taking into account the current location of assets, the viability of routes and airports, and obligations to passengers and employees. Crews need to be reassigned and their new arrangements communicated rapidly and accurately. In fact a vast amount of communication needs to take place in an automated manner as a major disruption event will rapidly overtake the capabilities of any human-mediated communication. Within an overall plan aimed at restoring equilibrium there need to be feedback loops that allow tactical management of local situations. Third-party services such as ground handlers, caterers and hotels need to be brought in to the planning and execution of the recovery.

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A smooth recovery from a disruption event requires state of the art capabilities that didn't exist a generation ago when many airlines implemented their operational technology. Much more is possible with modern systems. Airlines that have invested in these systems start at an advantage when the weather closes in. If they have also designed their networks to achieve neutral equilibrium in the first place they will suffer less and recover more quickly than those that run outdated systems in support of an unstable network.

THE SPECULATION

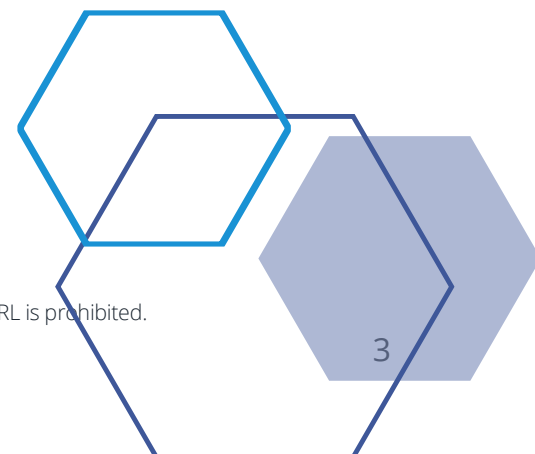
Every major disruption event prompts exhortations that it should never happen again. This was true of the recent winter storm and it was true of the summer 2022 meltdown in Europe as airlines and airports alike struggled to cope with the release of pent-up demand after two years of Covid restrictions. Governments in some jurisdictions have already legislated to increase levels of compensation for passengers caught in airline failures. Following the Christmas storm there are suggestions that the USA might introduce measures similar to those in place in Europe. This could tip the balance in favour of serious investment by US carriers as the costs of disruption outweigh the costs of managing it better.

Airline network design is one of the more complex commercial problems in the world today. Moves to make networks more resilient without making them unsustainably expensive to run should be top of mind for airline management. Interestingly the network optimisation challenge may be ideally suited to attack using quantum computer technology that is likely to come on stream in the next three to five years.

By contrast the toolkit needed to address disruption when it happens is based on effective application of existing technologies. It needs strong will and investment to put into practice the solutions that are already out there waiting.

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