Independent Review of NATS (En Route) Plc's Flight Planning System Failure on 28 August 2023

Interim report

14 March 2024

CAP2981

Contents

Summary

1. Following the major failure of NATS (En Route) Plc's (NERL) flight planning system on 28 August 2023, an Independent Panel was set up by the Civil Aviation Authority (CAA) to review the incident. The scope of the Panel's Terms of Reference is appended to this report as Appendix B, and the Panel's members are detailed at Appendix A. The Panel Members bring a wide-ranging and relevant set of skills and experiences but are independent of any individual stakeholder.

2. The CAA has estimated that there were over 700,000 passengers and others who were affected by the failure, often for several days, and this had considerable financial and emotional consequences for them. In pursuing its work, the Panel has been motivated to draw lessons from the incident which may help the prevention of future incidents, or at least to reduce the scale of the impact on consumers, airlines and others. NERL has indicated that it has put in place actions to address a number of internal findings arising from its investigation.

3. The Panel was set up and began its inquiry in October 2023. It has received, with one or two exceptions, very good levels of engagement from all stakeholders. Good progress has been made, particularly in respect of understanding the causes and timeline of the failure. Other longer-term and underlying factors need further investigation. This Interim Report is therefore more of a progress report, and indication of further lines of enquiry, rather than a definitive list of recommendations. It is expected that the final report will be concluded later in the year.

4. The Panel has grouped its eight terms of reference into three sections, which are reflected in the chapter headings of this report. Chapter 2 covers the cause of the incident, resilience, and investment matters (Terms of Reference 1, 3 and 4). Chapter 3 deals with communication, consumer impact, and the aviation system response (Terms of Reference 2, 6 and 7). Chapter 4 discusses performance incentives and allocation of resilience risks (Terms of Reference 5 and 8). A short Chapter 5 discusses the next steps in the Panel's work.

5. The Panel would like to thank stakeholders for their constructive input to its work to date. Where there are one or two exceptions, these are noted in the text. The Panel would also like to record its thanks to its secretariat.

Chapter 1
Introduction

Background

1.1 Following a failure on 28 August 2023 of the flight planning system operated by NERL, the CAA commissioned an independent review into the technical issues that occurred on the day and how the aviation system as a whole subsequently managed the consequences for consumers (and others) of those technical issues. The review was tasked to consider the immediate cause of the failure, steps taken to prevent reoccurrence and NERL's communication with stakeholders during the incident, as well as considering broader matters relating to the resilience of NERL, the impact on consumers, and the wider aviation system responses.

1.2 The review was tasked with examining these issues within the context of the established safety, economic and consumer regulatory and legislative frameworks and to make observations and recommendations to NERL, the domestic and international aviation system and the CAA. Further information is available on the review's case page.[1]

1.3 This chapter sets out details of the progress that has been made with the independent review since the process began.

The Terms of Reference and the review's Panel

1.4 On 6 October 2023 the CAA published the Terms of Reference2 for this review and announced Jeff Halliwell as the chair.[2] Sarah Chambers, Phil Cropper and Mark Foulsham were subsequently announced as the other Panel members.[3] The Panel members were appointed on the basis of (collectively) having a broad understanding of governance, technology, consumer and economic regulation issues along with the operation of air traffic management systems.

1.5 The Terms of Reference state that the review should conclude with a report to the CAA, identifying potential future actions for NERL, the CAA and airline stakeholders against the eight areas identified. As part of its conclusions the review may make recommendations for further analysis or work on particular issues by these parties. Following the review, the CAA will consider its findings

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1 https://www.caa.co.uk/commercial-industry/airspace/air-traffic-management-and-air-navigational-services/air-navigation-services/nats-august-2023-failure-review/

2 www.caa.co.uk/cap2594

3 A short biography of the panel members is available in Appendix A.

and any further steps that may be required. Any changes to the wider UK legislative and top-level policy framework will be a matter for the UK Government to consider following the conclusion of the review.

1.6 The Panel of this independent review is accountable for determining the final report findings and recommendations. Once completed, the final report will be shared with the CAA Board, and in turn the Secretary of State for Transport, and then be published.

1.7 The Panel is being supported by a secretariat provided by the CAA.

Teach-ins

1.8 The work of the Panel began with teach-in sessions with relevant experts from the CAA. CAA staff from the Safety and Airspace Regulation Group (SARG) provided the Panel with insight into the technical issues surrounding the failure of the flight planning system as well as an overview of national and international air traffic management processes and procedures. This was followed by two teach-ins with staff from the Consumers and Markets Group (CMG) at which matters regarding the CAA's management of the NERL licence[4], the legal and regulatory framework and approach to consumer enforcement were discussed. In further meetings, the co-ordination between the CAA's safety and economic regulatory teams was discussed in some detail.

Call for inputs

1.9 The Panel invited views and evidence on all matters within the scope of the review by issuing a call for inputs on 16 November 2023.[5] The call for inputs noted that the Panel was particularly keen to develop a good understanding of consumers' experiences of, and perspectives on, this incident, by reviewing available consumer research, engaging with consumer representatives, including through roundtables and commissioning primary consumer research.

1.10 The Panel received nineteen written responses from airlines, airports and trade bodies as well as the unions that represent NERL's employees. These have all been very helpful in informing the Panel's thinking.

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[4] Under the Transport Act 2000 the Government issued a licence to NERL to provide en route air traffic services in the UK. The Transport Act 2000 gives the CAA the role of economic regulator of NERL. The CAA exercises this role mainly through monitoring and enforcing the conditions in the Licence and through modifications to the Licence. The NERL Licence is published on the CAA's NERL Licence page.

[5] www.caa.co.uk/cap2607

Roundtables

1.11 The Panel engaged with industry participants by offering airlines and airports the opportunity to participate in roundtables which took place in early December 2023. These were well attended and gave the Panel first hand insight into industry experiences of the 28 August incident and an opportunity for the Panel to ask questions and request further information to help inform the independent review.

Consumer research

1.12 Given the impact on consumers of the 28 August incident, the Panel was very keen to obtain a detailed understanding of the passenger perspective. To that end, the Panel sought to commission a short online survey to gather quantitative evidence directly from affected passengers. This approach would require cooperation from airlines which hold contact details for all passengers on the affected flights. Unfortunately, airlines declined the Panel's request for support in this area with one airline suggesting that consumer research is a distraction, and others referring to data protection compliance issues and potential conflicts with their own passenger research.

1.13 The Panel notes the lack of support from airlines in this crucial aspect of the review. Nonetheless, the Panel has worked with Transport Focus to develop an alternative approach based on a series of qualitative discussions with consumers which will give the Panel a sense of the impact of the incident on the individuals who were affected. Whilst this approach was not the Panel's preferred one, the initial feedback from Transport Focus indicates that this is still proving to be very informative, although it will not be possible to form any accurate estimate of the total impact of the incident on consumers through this mechanism.

1.14 Interviews with affected consumers took place over January 2024 and a detailed summary of the results will be provided as part of the Panel's final report to the CAA. In addition, it plans to meet with other bodies who represent consumers, in particular, those who can speak for consumers in vulnerable circumstances. This is likely to form a significant part of the Panel's final report.

Engagement with NERL

1.15 In the immediate aftermath of the incident, NERL initiated an internal Major Incident Investigation. On 4 September 2023, NERL delivered its preliminary report to the CAA and to the Department for Transport.[6] The Panel has carefully

[6] The public version of this report has is available at www.caa.co.uk/cap2582.

reviewed this report, as well as correspondence from airlines on the type of issues to be addressed as part of the review.

1.16 The Panel met with NERL executives (and Board members) on 12 December 2023, as part of a site visit to Swanwick, where the Panel had the opportunity to ask a number of questions directly to NERL. The Panel was pleased that NERL has been able to share a preliminary version of its final report into the incident, ahead of NATS Holdings Board[7] reviewing and signing off the report. An early sight of this report has been helpful.

1.17 A further extensive Q&A session was held with senior NERL executives on 19 January 2024. It is expected that further dialogue with NERL will be required to help inform the Panel's final report.

1.18 Meetings also took place with the NATS Holdings Chair, Paul Golby, on 12 January 2024 and with Non-Executive Director Greg Bagwell on 29 January 2024. A follow-up meeting is planned with Non-Executive Directors appointed by The Airline Group Limited, the main commercial shareholder of NATS.

Other stakeholder engagement

1.19 The Panel met with Frequentis (the platform provider of the automated flight plan processing system) on 15 January 2024 to discuss its involvement in the incident resolution as well as issues around the commissioning and design of the flight planning software. A full set of questions were raised with Frequentis during this meeting, some of which were answered in the session; the remainder were responded to in a follow-up document provided on 24 January 2024.

1.20 Meetings have also taken place with the Association of British Travel Agents (ABTA), Ryanair, other regulators and the CAA Consumer Panel. The CAA Board has been regularly updated on progress. Meetings are planned with the Director of Shareholdings at the Department for Transport, and with the policy team at the Department for Transport.

1.21 The Panel is planning to hold follow-up meetings with stakeholders who have already been engaged, as well as open up further dialogue with a broader set of third parties.

[7] The boards of the subsidiary companies within the group are accountable to the NATS Holdings Board for all aspects of their business activities.

Chapter 2

Cause of Incident, Resilience and Investment

Cause of the incident

2.1 The cause of the failure of the NERL flight plan processing system (FPRSA-R) was the inability of the system software to successfully process the flight plan data for a specific flight from Los Angeles to Paris (Orly) on 28 August 2023. In the case of both the primary and the secondary systems, processing of the flight data resulted in critical exception errors being generated which caused each system to place itself into maintenance mode to prevent the transfer of apparently corrupt flight data to the air traffic controllers. At that point, further automated processing of flight plan data was no longer possible and the remaining processing capacity was entirely manual. To understand fully the sequence of events leading up to the failure, some understanding of flight planning requirements is useful.

2.2 Airlines planning to operate flights through controlled airspace are required to file a flight plan[8], containing information such as aircraft type, speed, and routing. This information is required by the various Air Navigation Service Providers (ANSPs) who will provide air traffic services (ATS) to the aircraft during the flight.

2.3 The UK is a participating State in the Integrated Initial Flight Plan Processing System (IFPS) which is part of the Eurocontrol centralised Air Traffic Flow Management (ATFM) system. IFPS is the sole source for the distribution of flight plan information within the participating European States.

2.4 The route of the flight took the aircraft through US, Canadian, Oceanic, UK and finally French airspace. The flight plan specified the individual waypoints for the whole of the flight from departure at Los Angeles to arrival in Paris.

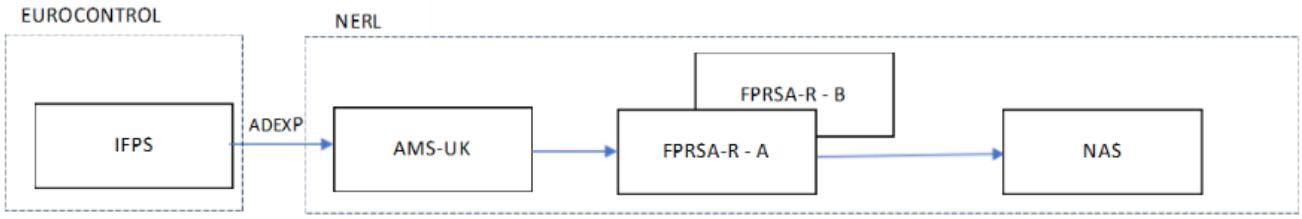
2.5 The flight plan was filed in accordance with standard procedures and forwarded to Eurocontrol for processing. The result of that processing was:

1. Conversion of the original data file to a European standard format known as ATS Data Exchange Presentation (ADEXP);
2. The addition of supplementary way points;
3. Identification of those States which require the flight information; and
4. The sharing of the ADEXP-formatted file with those States.

[8] In accordance with the requirements identified in ICAO Annex 2 and in ICAO Doc 4444.

2.6 The action of supplementing the original flight plan increases the number of waypoints in the converted data file considerably. Most waypoints are identified using five-letter abbreviations, although some older waypoints use only three.

2.7 The flight plan was received by the UK's Aeronautical Message Switch (AMS-UK) from the IFPS and passed directly to the FPRSA-R at Swanwick Area Control Centre (ACC). The role of the FPRSA-R is to further process the ADEXP data to identify the portion of the route that is to be flown in UK airspace and to extract that data for presentation to controllers at their workstations via the UK National Airspace System (NAS).



2.8 In the case of the flight in question, having extracted the relevant data, the FPRSA-R primary system began searching for an entry point into UK airspace; the waypoint APSOV was identified as being that point. FPRSA-R then searched the flight data for the exit waypoint from the UK. In this case, SITET was identified as the exit point, however, SITET was not in the original flight plan and so was dismissed by FPRSA-R as it is designed to do. FPRSA-R continued to search for an exit waypoint and ETRAT was identified as the next most appropriate. Again, however, ETRAT was not listed in the original flight plan and was not selected. SITET and ETRAT were both supplementary waypoints added by IFPS. The third waypoint identified as a possible exit point was at Deauville.

2.9 Deauville is one of the minority of waypoints that has a three-letter abbreviation, in this case DVL. As DVL was included in the original flight plan, FPRSA-R was able to identify it as a valid exit point. The DVL included in the original flight plan, however, referred to Devil's Lake in North Dakota and not to Deauville in France; both locations have the same three letter abbreviation.

2.10 The FPRSA-R has now identified a flight whose exit point from UK airspace, referring back to the original flight plan, is considerably earlier than its entry point. Recognising this as being not credible, a critical exception error was generated, and the primary FPRSA-R system, as it is designed to do, disconnected itself from NAS and placed itself into maintenance mode to prevent the transfer of apparently corrupt flight data to the air traffic controllers.

2.11 The FPRSA-R secondary system recognised that the primary system had disconnected itself from NAS and immediately assumed the task of flight data

processing. Despite having created a critical exception error in the primary FPRSA-R system, the same flight plan details were presented to the secondary system which went through the same process as the first with the same result: a second critical exception error and disconnection of the secondary FPRSA-R system from NAS. The time between receipt of flight plan and shut down of both primary and secondary processing systems was approximately 20 seconds. At this point, all automatic processing of flight plan data received from IFPS for presentation to NAS ceased and any further flight data processing would have to be managed manually.

2.12 The reason that a valid flight plan caused both the primary and secondary processing systems to fail is because of a unique set of circumstances regarding the specific routeing of the aircraft and because of the FPRSA-R architecture. For the event to happen the following must occur:

1. The aircraft route must include at least two waypoints with the same duplicated abbreviations, both of which are outside UK airspace, one prior to entry and the other after leaving.
2. One duplicated waypoint needs to be close to the point of exit from UK airspace.
3. The first duplicated waypoint needs to be included in the filed flight plan and the second duplicated waypoint needs to be absent, only appearing in the flight plan supplemented by IFPS.
4. Finally, the point of exit from UK airspace needs to be absent from the filed flight plan.

2.13 Whilst the planned route of the aircraft on 28 August was nominally the same as on the previous occasions the flight had been operated, there are many variables that affected the actual route flown. These include the use of the individual waypoint identifiers and/or promulgated air routes, or any combination of these. Prior to 28 August, the combination of waypoints and routes flown had not met the criteria required to trigger the unplanned exception in the FPRSA-R.

Contingency arrangements

2.14 The secondary FPRS-A system acts as a backup to the first. In the event of a failure of the secondary system, the only option available for flight plan processing to continue is to input flight data into NAS manually.

2.15 In normal operating mode, FPRSA-R can process approximately 800 flight plans per hour. Reverting to manual-input mode reduces that capacity to approximately 60 flight plans per hour. The provision of a means to edit flight plans manually is primarily to allow those plans with errors identified by FPRSA-R to be corrected;

the manual editing capability is not intended to act as a substitute for automated processing. The number of terminals provided for manually editing flight plans, and the staff to operate them, reflects this limited role.

2.16 Processed flight data is presented to NAS four hours in advance of the data being required by the relevant air traffic controller or airspace sector. This is done on a continuous basis so that at any given moment, NAS contains flight data for the following four-hour period. NAS will continue to present the stored flight data to controllers for as long as it has data available. From the point at which the FPRSA-R ceases to input to the NAS, however, the accuracy of stored data begins to degrade without further updates to such variables as the aircraft's route, speed or level.

2.17 NERL has stated that on the day of the incident there were 7 manually operated terminals available at Swanwick ACC. Although manual input terminals are present at Prestwick ACC, staff there are not qualified to enter full flight plans, terminals at Prestwick ACC are used for minor data entries only.

2.18 Whilst the long-standing provision of a four-hour data store period has proven to be effective historically, the Panel will be considering further the effectiveness of the period in relation to the level of flight data degradation, the provision of greater resource levels and the complexity of alternative options creating undue risk.

Fault identification and recovery

2.19 The role of the AMS-UK system is to receive data from Eurocontrol's IFPS and forward this to the FPRSA-R. The AMS-UK has a feature that enables data to be queued for processing rather than be presented directly to the FPRSA-R. Data can be held in either a pending or a pause queue, each of which operates differently.

2.20 Data in a pending queue will automatically be forwarded to the FPRSA-R whenever there is a valid connection; messages in a pause queue remain in that queue until manually released for processing. Typically, a pause queue would be created whilst system maintenance is undertaken. Data released from a pause queue is transferred to the pending queue for transfer from the AMS-UK to FPRSA-R once reconnection is established. The pause queue would then be closed.

2.21 On the 28 August, in response to the system failure, the AMS-UK created a pause queue to prevent new data being sent to the FPRSA-R. However, the flight plan message that could not be processed remained in the pending queue. Each time a connection was established between the AMS-UK and the FPRSA-R, the AMS-UK attempted to send the flight plan data to be processed. Each attempt was unsuccessful and caused the FPRSA-R to re-enter maintenance mode. In

maintenance mode, no acknowledgment to the AMS-UK could be sent by the FPRSA-R confirming receipt of the data and hence the flight plan remained at the front of the pending queue causing repeated failures. This was not the result of anomalous behaviour by either the FPRSA-R or the AMS-UK. There is no functionality in the AMS-UK or connected systems to remove a message from the pending queue in the event of repeated unsuccessful transmission attempts. In responding the way they did to the data being presented, both systems were operating as they were designed.

2.22 The repeated cycle that occurred each time a connection was re-established between the AMS-UK and FPRSA-R ended with the assistance of system supplier, Frequentis, four hours after the event. Whilst NERL's experts had detailed knowledge of the FPRSA-R and the AMS-UK as individual systems, greater understanding of the interface between the two systems by the Frequentis engineers was key to identifying the root cause of the event. Specifically, Frequentis engineers identified the need to transfer the flight plan causing the repeated failures from the pending queue in the AMS-UK into a pause queue. Once this was made known to NERL's engineers, resolution of the fault was quickly achieved and at that point, new messages could be processed in the usual manner.

2.23 Several factors made the identification and rectification of the failure more protracted than it might otherwise have been. These include:

1. The Level 2 NERL engineer was rostered on-call and therefore was not available on site at the time of the failure. Having exhausted remote intervention options it took 1.5 hours for the individual to arrive on-site in order to perform the necessary full system restart which was not permitted remotely.
2. The engineering team followed escalation protocols which resulted in the assistance of the Level 3 NERL engineer not being sought for more than three hours after the initial failure.
3. The Level 3 NERL engineer was unfamiliar with the fault message recorded in the FPRSA-R log.
4. Adherence to escalation protocols meant that the assistance of Frequentis was not sought for more than four hours after the initial failure despite their having a unique level of knowledge of the AMS-UK and FPRSA-R interoperability.
5. The joint decision-making model used by NERL for incident management meant there was no single post-holder with accountability for overall management of the incident, such as a senior Incident Manager.

6. The status of the data within the AMS-UK during the period of the failure was not clearly understood.
7. There was a lack of clear documentation identifying system connectivity.
8. The password login details of the Level 2 NERL engineer could not be readily verified due to the architecture of the system.

Reducing likelihood of re-occurrence

2.24 The Panel recognises that up to six different factors contributed to the circumstances that led to this particular outage (only one of which was the presence of duplicate waypoint data). It is highly unlikely that the same unique set of circumstances will converge at a future point to cause a major outage. However, it is possible that a different set of factors could create a similar scenario and without improvements to resilience planning the impact could also be significant. In its final report the Panel will make recommendations on how all aspects of risk planning (including safety, efficiency and consumer impact) could be addressed to provide for a more comprehensive framework of resilience preparation.

2.25 From an industry stakeholder perspective, although collaboration was positive in a number of respects, due to the lack of a strong contingency framework between parties, it was reported to the Panel that some airlines, and to a lesser degree, some airports, anticipated decisions ahead of formal communications, which ultimately led to a higher level of consumer impact, possibly more than was necessary. The Panel is aware of good practice in other sectors where the regulatory regime requires coordination of a broader set of stakeholders at a more effective level. These are described in Chapter 3 below.

2.26 It is recognised that the overriding priority for NERL is safety and there is no doubt from the Panel that safety as well as efficiency needs to be maintained. Notwithstanding the consequent requirement for higher levels of investment, given the impact on consumers that disruption creates, including a deterioration in well-being and increasing risk to individuals' circumstances (such as missing medical appointments or being held in dangerously over-crowded airports), further evaluation should be undertaken of how safety in the air can be maintained while reducing both the likelihood of disruption and the consequent extent of impact. This has been achieved in other industries, with a particular focus on consumer impact, undue harm and vulnerability.

2.27 The Panel will explore recommendations for preventing a re-occurrence of this event and for enhancing resilience further in their final report.

2.28 Technical support for the FPRSA-R is provided both by NERL engineers and, ultimately, by the manufacturer of the system, Frequentis. NERL operates a four-level engineering support structure. The initial response to a systems failure is

provided by the Level 1 NERL engineers, who do not have, nor are they expected to have, detailed knowledge of individual systems. They offer an initial response to a failure that might typically involve acknowledging the system failure alarm; completing an initial fault diagnosis and initiating a system re-set. A Level 2 NERL engineer has more detailed knowledge of a particular system and would be expected to be able to identify and rectify faults that a Level 1 NERL engineer would not. Of NERL's own engineering support teams, a Level 3 NERL engineer is the most knowledgeable and would be expected to have a very detailed knowledge of the system and be able to respond to most failures. Should a system failure be beyond the capability of the Level 3 NERL engineer, the ultimate recourse – Level 4 - is to the system manufacturer.

2.29 On the 28 August all elements of the FPRSA-R support structure were involved in trying to address the system failure. The timeline for the actions taken to initiate the various levels of support is included in Appendix D.

2.30 NERL's protocol for the availability of engineering support is based primarily upon the level of engineering work planned (particularly maintenance activities) and not on the level of demand for air traffic service provision. The NERL rostering arrangements for engineers provide for at least one Level 2 NERL engineer to be available on site during a "normal" working day. On public holidays, when maintenance is not routinely scheduled, it is common practice for staff to be available on standby at remote locations – typically at home. On these occasions, in the event of a system fault that requires Level 2 support, initial access would be via a remote connection. However, major operations, such as the full system restart required in this incident, cannot be performed remotely, and the engineer must be on site.

2.31 Level 3 NERL engineers work "standard" office hours and are not rostered to be available "on call" - although there is an expectation that they will support a major incident when required. However, the Panel notes that availability of support resources on a voluntary basis is likely to be less effective at times when an incident would have a higher impact, such as busy holiday periods.

2.32 In discussions whilst compiling this report, NERL has indicated that it has initiated a review of its technical services support arrangements which will consider the re-alignment of engineering resources more closely to service demand. In addition, NERL has indicated that guidance on the point at which manufacturer support should be sought in the event of a major systems failure is being reassessed, in the light of this event.

Follow on actions

2.33 In its final report the Panel is likely to pursue in greater depth the following areas:

1. The use of manual data input during periods of primary and secondary auto-systems failure.
2. The acceptability of service withdrawal as a safety mitigation.
3. Engineering support planning.
4. The operation resilience framework.
5. The performance and effectiveness of the Air Traffic Incident Command and Control Cell (ATICCC).
6. The identification and verification of systems design requirements.
7. The system architecture, software and data processing of automated flight planning systems.
8. Contingency scenario planning.

Sector and stakeholder involvement

2.34 It is clear from the level of readiness in the broader stakeholder group that improvements can be made. In particular, some findings that remain relevant today, arising from previous incidents, such as the major NERL outage on 12 December 2014 and recommendations in the CAP1515 report, do not seem to have been progressed. Examples include advancing regulatory and structural reform as well as formalising resilience issues through licence changes.

2.35 Ongoing discussions with stakeholder groups will provide the Panel with multiple points of input that will lead to a set of practical recommendations. However, fundamentally it is clear there is a significant lack of pre-planning and coordination for major events and incidents that targets the alleviation and remediation of major incidents above and beyond normal operating variances.

2.36 An Industry Resilience Group (IRG), formed in 2018, was a collaboration between airports, airlines, air traffic control and regulators. The IRG was established to ensure the activities and changes identified by the Voluntary Industry Resilience Group[9] in its report to industry were delivered. The output (documented in CAP1515) aimed to "*support a systemised approach to the way in which the UK's aviation network is planned and operated to enhance its day-to-day operating resilience, reduce delays and the associated costs to both industry and passengers*".

[9] The VIRG was formed in April 2017. The Group consisted of senior leaders in the CAA, NERL, Airports Coordination Limited, airlines and airports. Its purpose was to pool expertise and recommend actions addressing current and future resilience needs.

2.37 The Panel has yet to reach a conclusion on whether it considers resilience planning should be mandated through licensing or statutory provisions. However, in a similar way to regulators in other sectors, the CAA should have a strong part to play in any improved future model to ensure that stakeholders have a strong regulatory collaboration and coordinating reference point.

Investment

2.38 It is unclear how effective capital investment plans correlate with risks and priorities within NERL. Although a pipeline of system changes exists and is used to build the program of technology changes and improvements, greater clarity is needed.

2.39 The presence of the CAA with stronger oversight for capital planning would help ensure objectivity is maintained across the sector and capital plans are coordinated across stakeholder bodies. The Panel will further review the sharing of operational intelligence within the CAA to inform economic regulation decisions.

2.40 The Panel intends to explore in more detail the degree to which investment for resilience is explicitly included in the NERL 5-year business plans (and service and investment plans) that feed into the CAA's price control reviews.

Chapter 3

Communication, Consumer Impact and Aviation System Response

Communication and stakeholder engagement

3.1 The formal protocols for alerting customers and stakeholders to the event on the day appear to have been adhered to, and to have been effective in achieving their primary purpose of letting the key organisations know that air traffic restrictions were being applied. Nevertheless, evidence from the call for inputs and from the Panel's meetings with airports, airlines, consumer organisations and others indicates a good deal of dissatisfaction with the speed, style and effectiveness of NERL's communications with its customers and stakeholders both during the event and in its immediate aftermath.

3.2 The main concerns expressed by airlines and airports were about delays in providing warning of the problem; limited explanation during the event of what was going on and how long the problem was likely to persist; poor choice of communication platforms; and over-hasty withdrawal of communications once the immediate technical issues had been resolved. The combination of these issues resulted in more uncertainty and more severe impacts on passengers and others than was necessary. Some stakeholders also expressed dissatisfaction about insufficient engagement at senior level after the event, given the amount of disruption that had been caused.

3.3 The Panel understands from CAA estimates that over 300,000 passengers were impacted by flight cancellations, approximately 95,000 by long delays (over three hours) and at least a further 300,000 by shorter delays.[10] Evidence provided to the Panel, including the emerging findings from the research commissioned by Transport Focus and carried out by Define, indicates that many of these passengers were not satisfied with the promptness, frequency or breadth of the information provided to them. The worst affected were those already in airports. They felt that information should be provided more promptly, and that more frequent updates should have been issued, even if there was nothing new to report. Many complained about the shortage of visible and informed staff at airports, and the absence of any clear airport announcements.

[10] Estimates of cancellations and delays due to the incident were calculated by the CAA using "excess delays" and "excess cancellations" methodology, i.e. the number of delays and cancellations above the average daily delays and cancellations seen between 1 and 27 of August 2023.

3.4 There also seems to have been some misinformation about passenger rights, with leaflets being handed out by some airlines saying that the passengers had to make their own plans to get home (with no offer of assistance from the airline to find alternative flights), and that they should claim reimbursement for any out of pocket costs (without any offer of vouchers or other upfront means to assist in the cost of refreshments or accommodation). This was not a universal experience, and there were some good examples of individuals being offered all the appropriate assistance in line with the relevant regulations. It appears to the Panel that during a time of severe disruption the standard approach to informing passengers of their rights (standard notices at airline desks etc.) is not sufficient, and that consideration should be given to developing a more comprehensive suite of information tools, including loudspeaker announcements, appropriate numbers of staff circulating in and around the airport (possibly with tabards to clearly identify them) with standardised leaflets about passenger rights to hand out liberally. Any other leaflets handed out by airline and airport staff should contain the same information.

3.5 On the issue of early warning, the incident log shows that NERL informed Eurocontrol about the emerging problem at 10:43am, as soon as it was evident, and most of the large airports and airlines were informed through the first ATICCC call, just before 11am (see Appendix D). The airports and airlines however reported some inconsistency in the time and manner in which they first became aware that there was a problem. The smaller airports and airlines generally reported receiving information later than the larger ones, and a number of them heard about the incident initially from the media rather than from NERL or other official channels.

3.6 The common comment made to the Panel by all airlines and airports was that earlier warning of a potential problem (preferably three hours before restrictions were in place) would have made a considerable difference to their ability to make precautionary preparations, which in turn would have reduced the negative impact on passengers. In response to the NERL concern that such precautionary warnings could cause more disruption and uncertainty than they would avert, given that many potential problems do get resolved quickly, the airports and airlines made clear that they could cope with nuanced and provisional warnings more effectively than waiting until a problem was certain before being informed.

3.7 The draft final report of NERL's investigation of the incident acknowledges this concern, in one of their "Opportunities for Improvement" (OFI-5), which suggests that consideration should be given in future to further pre-warning, taking account of the likely impact upon customers beyond pure air traffic delay.

3.8 On the quality and style of communications by NERL, a common view expressed by airlines and airports was that the messages transmitted were of limited utility

and there was considerable frustration about the inability to ask questions or to find out information about the detail of the problem or about the timeline for resolving it. There were inevitable limits on what NERL could communicate in the early stages given that it did not know how long the problem would take to resolve. Nevertheless, there was considerable frustration expressed that NERL was using an old-fashioned teleconference platform for this communication, when even a basic Teams call could have given so much greater functionality and enabled a more orderly and constructive discussion.

3.9 Almost all the aviation stakeholders the Panel spoke to were critical of the early termination of formal communications by NERL, and the perceived paucity of informal communications after the event.

3.10 The Panel is concerned that there does not appear to have been any multi-agency rehearsal of the management of an incident of this nature and scale. Such rehearsal is best practice, and commonly and regularly conducted in other sectors. Individual stakeholders (including individual airports) do regularly conduct their own simulation exercises, but not in a scenario which requires effective cross-party coordination and cooperation with all other parts of the aviation system. The Panel expects to recommend that the CAA should review and lead such multi-agency planning. This is especially important, as some relationships between aviation sector stakeholders appear to be adversarial. This is not to the benefit of passengers, especially in a crisis situation such as this incident.

3.11 As a comparison in two other sectors, there are good examples where a broader set of stakeholders are required through the regulatory regime to coordinate at a more effective level. In the energy sector, following the 2003 UK blackout, Ofgem (the energy regulator) mandated the National Electricity Transmission System Operator to establish the Electricity Industry Emergency Plan. This protocol requires real-time information sharing between generators, distributors, and network operators during emergencies, facilitating coordinated response and resource allocation.

3.12 In the financial services sector, the Financial Conduct Authority regularly conducts cross-sectoral exercises simulating cyberattacks or market disruptions. These drills involve banks, insurers and technology firms, fostering communication channels and building trust for real-world incident response.

Consumer Impact

3.13 As discussed above, over 700,000 passengers were affected by flight cancellations and delays ascribed to the incident. The Panel has found it hard to collect quantitative evidence about the experiences of those passengers. Which? and others, including some journalists, provided some information soon after the incident about individual experiences, but we have so far attempted in vain to get

quantitative information about the amount and spread of the impact. We asked for access to the passenger lists of affected flights so that we could survey the individuals most directly concerned, but the airlines refused this and the CAA told the Panel that it does not have sufficient powers to require them to provide this information. Indeed, this meant that it has not been possible for the Panel to confirm the precise number of passengers affected by cancellations and delays.

3.14 The Panel therefore asked Transport Focus, as an independent statutory body with extensive experience of transport matters, to commission research from a respected research agency, Define. Define identified a number of individuals who had been directly affected by the incident. Their summary of the first interviews conducted with passengers reveals some considerable dissatisfaction with how they were treated, although some were complimentary about how airport and airline staff coped in what were very difficult circumstances.

3.15 The CAA estimates that over 700,000 passengers were affected by a combination of delays and cancellations caused by the incident. The Panel has no information about their financial losses. At an early stage the CAA expressed the view that this was likely to be considered an “extraordinary circumstance” so, under the relevant regulation (UK Regulation (EC) 261/2004, as amended (Regulation 261)), passengers were not entitled to the fixed sum compensation for a delayed or cancelled flight. (This contrasts with the position in the rail sector, where the “Delay Repay” regime applies without exception.) Passengers were however entitled (under Articles 8 and 9 of that Regulation) to be found an alternative flight, and to be offered suitable refreshment and/or accommodation if appropriate. Such costs should be paid for, or reimbursed, by the relevant airline or travel operator. It is not known if this happened in every case, and indeed evidence from the Define research suggests that it often did not, and that in many cases the refreshment vouchers were not accepted in many parts of the airport or were insufficient to cover the costs of a full meal. Nevertheless, the airlines clearly did incur considerable costs to cover passenger needs during this period. Ryanair, for example, stated that they spent over £15m to cover these consumer costs. The Panel expects to further investigate the quantum of costs which were incurred by airlines and other stakeholders.

3.16 One example of high negative impact was of a passenger and her child stranded abroad, who was handed a leaflet by the airline suggesting that they should make their own arrangements to get home and then claim reimbursement. A booking link was provided in the leaflet, but on that link the passenger could only find flights available four or five days later. The airline told her that it would only reimburse for one overnight stay, and no more information was provided. The passenger incurred costs totalling £900 and was only offered a refund to the value of the original flight.

3.17 An example of poor communications is of a parent travelling with a three-year old child who initially found out about the problem while at Gatwick airport by overhearing other passengers talking about delays. She found a member of the airline staff who told her to find somewhere to sit. She found seats in a cafe but then found it very hard to get any information. After waiting for two hours, she went to find a staff member who informed her that there would be no flights that day. After returning home she could not get through to the airline for over 24 hours, or access flights on the airline app as they had been booked through a booking agent, who told her to arrange new flights through the airline. When she eventually got through to the airline, she had to book new flights three days later, thus missing a vital part of her family holiday.

3.18 It is not yet clear to the Panel what proportion of passengers received speedy reimbursement for the costs they incurred, or how many of them have sought the assistance of the Alternative Dispute Resolution providers or the CAA's Passenger Advice and Complaints Team to resolve their claims. This will be followed up in the next phase of the review. The Panel will further evaluate the mechanisms for financial redress within the sector.

3.19 Apart from the financial impact on passengers, which appears to have been very considerable, the impact in terms of stress and anxiety was at least as serious. Parents travelling with children had particular concerns, especially as the conditions at airports were in many cases chaotic and there was insufficient seating available. Heathrow Airport was particularly badly affected, with severe congestion both inside the airport and on surrounding roads, leading to concerns about possible safety risks.

3.20 The Panel is particularly concerned about the impact on those passengers with disabilities, and others who were in vulnerable circumstances. As a part of its next steps work, it is planned to engage with organisations who can speak for such consumers.

3.21 The Panel notes that there is no statutory consumer body to collect, research and represent the views of air passengers. The CAA Consumer Panel advises the regulator on aspects of the consumer interest, but it has no powers of its own, and almost no budget. The Panel has found it difficult to get an overall structured view of passenger experiences. In a number of other regulated sectors, a statutory body with powers and direct access to a research budget is common and adds significant strength to the representation of otherwise individual passengers. Examples include the statutory representation of energy users by Citizens Advice, of water users by Consumer Council for Water, of financial service users by the Financial Services Consumer Panel, postal and telecommunication users by Ofcom, and rail/bus/major road users by Transport Focus. The Panel is likely to express a view on the appointment of such a statutory representative body.

Options may include strengthening the status, powers and resources of the CAA Consumer Panel, or extending the remit of Transport Focus, or amalgamating the responsibilities of all consumer bodies of regulated sectors into one national body with appropriate expertise and budget and ability to spread learnings across sectors.

Aviation System Response

3.22 The airlines and airports had a huge task on the day (and for several days after the date of the incident) to find alternative flights for affected passengers, to provide them with refreshments and hotel accommodation where appropriate, and to keep them informed. Some of the airlines laid on rescue flights at their own expense. The knock-on effect of the large volume of cancellations meant that some passengers were not repatriated until the end of the week, incurring many days of extra costs which, under Regulation 261, are the responsibility of the airlines.

3.23 Providing care and assistance was much harder than it would be in the event of more minor disruption, as so many people were stranded at the same time, on a busy bank holiday with more people travelling than usual. Airports and restaurants soon ran out of seating capacity and had no back-up facilities available. Hotels near the relevant airports got booked up so it was hard for many to find accommodation. And most important of all, alternative flights were fully booked very quickly, leaving many passengers stranded for several days.

3.24 In these circumstances it remains the clear duty of the airlines to be there for their customers. In many cases they made huge efforts to do so, but as noted above we have heard of many incidences where incomplete or incorrect information was given about passenger rights, where food vouchers were not accepted in many parts of the relevant airports or were insufficient to cover the cost of a meal, and where hotel accommodation was offered for fewer days than was required.

3.25 The CAA has issued the airlines with guidance on acceptable means of compliance with their duties under Regulation 261, including how the option of “pay and claim” should work. The Panel will consider how well this guidance was followed before writing its final report.

3.26 It is startling that an air traffic control problem which was fixed within seven hours, during which time a combination of stored data and manual processing of flights allowed many flights to continue albeit at reduced capacity, caused so many cancellations and delays with knock-on effects for so long. With the benefit of hindsight (including the knowledge of when the system would return to full functionality) it could be that the impact on passengers would have been reduced if more flights had been delayed rather than cancelled. On the other hand, making an early decision to cancel flights may have helped to give passengers the

certainty they needed on the day. This is an issue which the Panel may wish to look into further before writing the final report, though this issue should not detract from the fundamental point that the root cause of the cancellations and delays was the NERL system failure.

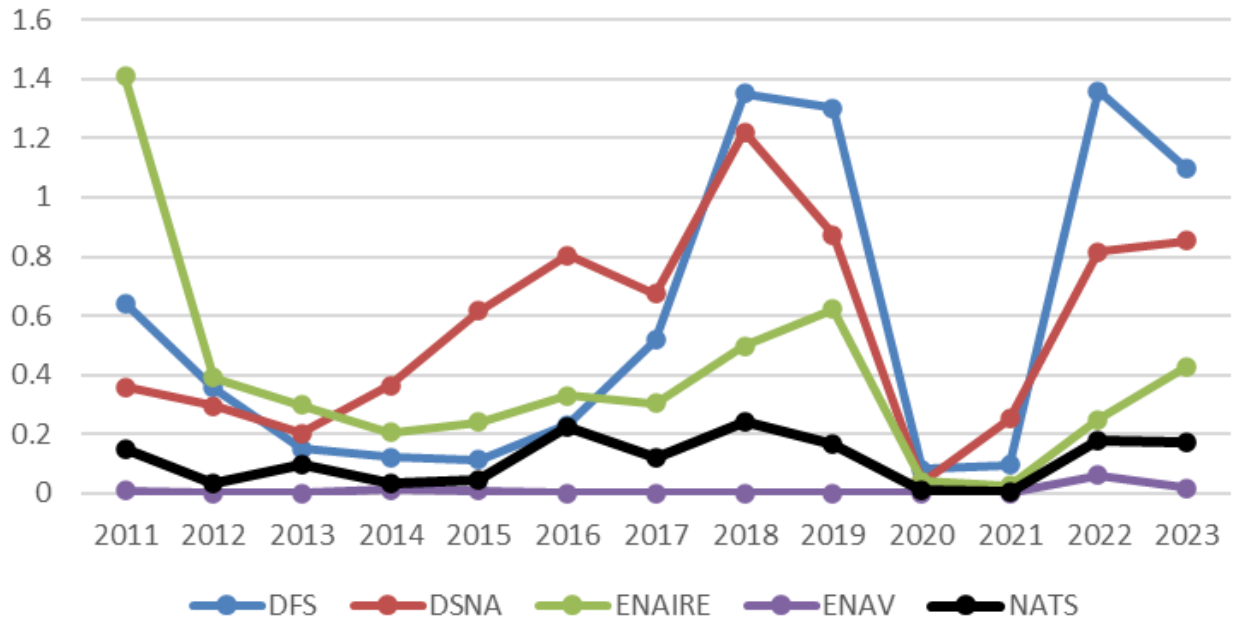
Chapter 4

Performance Incentives and Allocation of Resilience Risks

NERL performance and incentives

4.1 NERL service performance, when measured in terms of Air Traffic Flow Management Delays (ATFM delays) , including Air Navigation Service Provider (ANSP) attributable flow management delays and engineering delays, has been relatively good when compared with similar ANSPs in Europe. Figure 4.1 shows that ANSP attributable delay has generally been lower in the UK than in other comparable European countries (Germany, France and Spain, but not Italy). It should be noted that "delay minutes" do not take any account of cancellations, so on a day when a lot of flights are cancelled (such as 28 August 2023) this measure significantly underplays the impact on passengers.

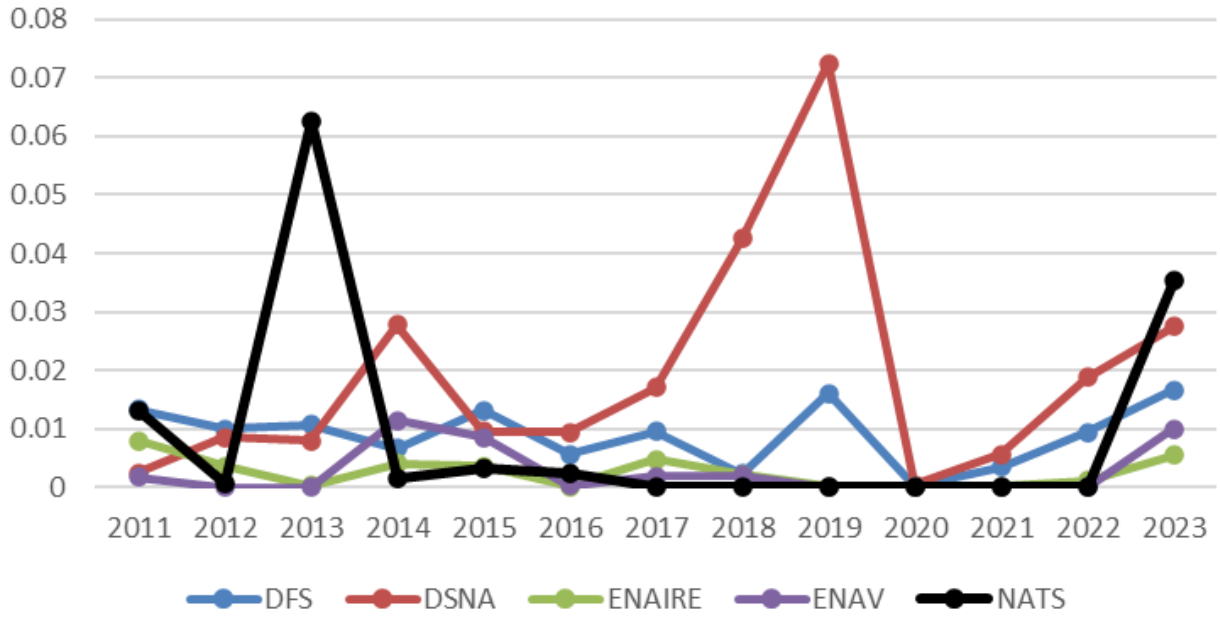
Figure 4.1 ANSP attributable delay minutes per flight



Source: CAA analysis of En-route ATFM delay data in http://ansperformance.eu/data/.
NERL comparators: DFS (Germany) DSNA (France); ENAV (Italy); ENAIRE (Spain). 2023 – Jan to Nov

4.2 When looking specifically at air traffic control equipment delay, Figure 4.2 shows that NERL generally performs well compared with peers, however there were two very significant incidents in 2013 and 2023, the latest of which was the genesis of this Independent Review.

Figure 4.2 Air traffic control equipment delay minutes per flight



Source: CAA analysis of En-route ATFM delay data in http://ansperformance.eu/data/.
NERL comparators: DFS (Germany) DSNA (France); ENAV (Italy); ENAIRE (Spain). 2023 – Jan to Nov

4.3 The Panel believes that the visibility and awareness of major or noticeable incidents could be higher. A clear line of sight between an incident and its ultimate impact, including the effect on consumers and the consequences of cancellations, would improve the targeting of incentives to requisite parties.

4.4 Incentives should not only ensure safety and encourage efficiency, but they should also address the needs of consumers, such as the need to improve resilience, and to provide assistance to consumers in vulnerable circumstances, reducing the likelihood of distress and for example, ensuring health provisions are secured.

Measures and basis of incentives

4.5 As mentioned above, the Panel has concerns about the measurement and incentivisation of NERL performance solely in terms of ATFM delay minutes, as opposed to the inclusion of passenger impact caused by cancellations as well as by knock-on delays. It is appreciated that the current metrics are based on international norms; flight cancellations can be caused by a myriad of causes out of the control of NERL; and these metrics have been considered previously in detail without any resulting change.

4.6 Nevertheless, it appears inappropriate that NERL is likely to achieve almost all of its performance targets in 2023, and to suffer very little financial consequence, after having caused such huge and serious disruption to passengers, as well as considerable costs for airlines, airports and tour operators. This suggests that the

performance incentive framework may not be measuring the right things, or indeed that the things that matter most to passengers and other parts of the aviation system are not properly measured at all. This is a topic that the Panel will consider in more detail in its final report.

Oversight model and sector comparisons

4.7 Also of concern is that the level of economic penalty which the CAA can currently impose on NERL for breach of its licence appears relatively modest in relation to the overall cost of the incident, and also in relation to NERL's financial position.[11] In its final report, the Panel will be comparing the quantum and detail of the incentive/ penalty regime specified in the CAA's economic regulation of NERL to other economically regulated monopolies and entities, such as those in the water, energy, rail and airport sectors.

4.8 A further area of concern is that the CAA's scrutiny of the effectiveness of NERL's investment programme appears to be relatively light touch, which the Panel believes may be less intense than the scrutiny given to the investment plans of some regulated utilities by their respective regulators. Such scrutiny as there is appears to focus more heavily on the efficiency of the spending than on its effectiveness in securing resilience (though this emphasis is often seen in other regulated sectors too). The Panel heard that pre-Brexit, a significant amount of NERL's scrutiny was conducted at the European level, meaning that the CAA may not have had the chance to build the weight of expert scrutiny in this area which other economic regulators possess. The Panel is concerned that the level of consumer input and challenge to NERL's investment plans is low compared to other regulated sectors. The establishment of Consumer Challenge Groups and Customer Engagement Groups in water and energy is acknowledged as having significantly improved the quality of companies' business plans. Although the effectiveness of some of these Groups has been questioned, the best of them appear to represent good practice in respect of regulated monopolies.[12] The CAA, in conjunction with the airline community and Heathrow Airport Ltd, itself set up a consumer challenge board to scrutinise and critique the airport's business plans in respect of its forthcoming regulatory period.

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[11] NERL maximum capacity penalties amount to a relatively modest 1.25% of NERL's "determined costs", which is equivalent to an approximately 1% return on regulated equity. This rises to a maximum of 1.75% of determined costs or 1.4% return on regulated equity if a flight efficiency metric is also taken into account. Potential bonuses are much smaller than potential penalties. The determined costs line is the core component of NERL's regulated revenue allowance (NERL regulated revenue allowance can be higher or lower than its "determined costs" due to application of pluriannual price adjusters).

[12] See, for example, chapter 2 of RIIO-ED2 Final Determinations Core Methodology.

4.9 As a comparison, the UK's financial services sector operates within a multi-layered regulatory framework. This system has a threefold aim: guaranteeing the operational resilience of financial institutions, safeguarding consumer protection and holding both firms and individuals accountable for their conduct.

4.10 A cornerstone of this framework is the 2021 Operational Resilience rules. These demand proactive identification, assessment, and management of potential operational risks, including both internal vulnerabilities and external threats. Critically, firms must demonstrate their ability to absorb, adapt, and effectively respond to disruptive events while maintaining the delivery of essential services.

4.11 Consumer protection, another crucial pillar, is addressed through a diverse set of regulations overseen by the Financial Conduct Authority (FCA). These regulations shield consumers from a range of harmful practices, encompassing misleading advertising, the mis-selling of financial products, and unsuitable investments that could cause financial hardship.

4.12 Reinforcing accountability within the sector is the Senior Managers and Certification Regime (SMCR) implemented in 2009. Under this regime, individuals holding key positions within financial institutions are personally accountable for ensuring their firm's compliance with regulations. Additionally, certain roles within the industry require certification by the FCA, guaranteeing the competence and ethical fitness of those entrusted with sensitive financial responsibilities.

4.13 The overarching framework for all these regulations is established by the Financial Services and Markets Act 2000. Specific regulations within this framework, such as the FCA Principles for Business, the Consumer Credit Act 1974, and Parts 7 and 8 of the Financial Services Act 2012, collectively define the expected standards of conduct and consumer protection across the financial services sector.

4.14 To incentivise adherence to the standards, the framework also incorporates a system of rewards and penalties. Firms demonstrating robust operational resilience and strong consumer protection practices may be rewarded with regulatory recognition, improved market access, and reduced supervisory oversight. Conversely, non-compliance can lead to material consequences. Firms themselves may face hefty fines, licence suspension and requirements to provide redress to affected consumers. In certain cases, senior managers can be held individually accountable through personal fines, disqualification from holding regulated positions or even criminal prosecution.

4.15 This multi-layered regulatory framework demonstrates the ability of a regulated sector to foster a responsible and resilient multi-agency ecosystem that prioritises not only strict operational stability but also robust consumer protection.

Trade-offs between safety, efficiency and consumer impact

4.16 The Panel has been told by NERL that air safety is its overriding priority, and nobody has disputed that. For passengers too, safety is clearly the top priority. Yet it is clear from the recent consumer research commissioned by NERL[13] that consumers value resilience as a second priority after safety. Passengers are particularly keen to avoid long, disruptive delays which greatly affect their journeys and subsequent plans. Furthermore, while the regulatory regime rightly prioritises the maintenance of "a high standard of safety in the provision of air traffic services", NERL also has statutory duties to take all reasonable steps to secure that the system is efficient and co-ordinated, as well as to secure that the demand for air traffic services is met. Notwithstanding the economic trade-offs that are required and indeed are already considered,the Panel questions whether the overwhelming prioritisation accorded to safety has meant that very little attention has been paid to improving resilience. In its final report, the Panel will scrutinise further the degree of organisational emphasis given to resilience, both in terms of specific investment, and in terms of scrutiny by the Board.

4.17 In terms of safeguarding consumers during disruptions, the UK's energy sector strikes an effective balance between both regulatory measures and industry initiatives. A two-pronged approach ensures vulnerable consumers receive not only essential support but also financial assistance in times of need.

4.18 On the regulatory side, the Priority Services Register puts those most at risk at the forefront of communication, guaranteeing priority outage notifications, meter readings and welfare checks. Additionally, financial safety nets such as Winter Fuel Payments and Cold Weather Payments provide essential support, while supplier emergency credit offers a lifeline for struggling prepayment customers. Furthermore, consumer protections against back-billing and mandatory support measures offer further protection measures.

4.19 Complementing these regulations are proactive industry initiatives such as the Vulnerability Commitment. This pledge, adopted by energy suppliers, commits them to continual improvement in supporting vulnerable consumers through accessibility, collaboration, and innovation. Fuel Banks, run by charities, take this dedication a step further by providing emergency top-ups for prepayment meters in vulnerable households.

4.20 Through this approach, in an age of significant price volatility the UK's energy sector prioritises both safety and consumer protection, demonstrating a

[13] Blue Marble, Passenger research for price control reset, Dec 2021.

commitment to safeguarding consumers, especially those most vulnerable, during challenging situations.

Allocation of Resilience Risks

4.21 The Panel's analysis of the incident to date suggests that the following stakeholders have had to shoulder the risks and liabilities arising from it:

4.22 **NERL:** A relatively modest penalty associated with not meeting one of their performance incentive targets (approximately £1.8m)[14], plus any costs associated with rectifying the software problem on the day and removing the risk of its re-occurrence.

4.23 **Airlines:** Most of the costs associated with re-routing or reimbursing passengers, including in some cases laying on rescue flights, and providing care and assistance (hotel accommodation, refreshments etc.). Ryanair alone estimates that these costs were in excess of £15m. BA estimates that it incurred £18.3m in consumer care costs, £1.9m in refunds and an extensive range of other costs. Figures are not yet available from other airlines but are expected to be commensurate with the number of their affected flights. The Panel has not yet been able to evidence the quantum of estimated costs, but hopes to be able to do so, with the cooperation of stakeholders, for inclusion in its final report.

4.24 **Tour operators and travel agents:** Other costs associated with re-routing or reimbursing passengers and providing care and assistance, for those passengers who booked package holidays. Information on the scale of these costs has not yet been made available to the Panel.

4.25 **Passengers:** None of the over 700,000 passengers estimated to have been impacted could claim compensation for the delays and cancellations. Passengers would have normally been entitled to such compensation if this had not been considered an "extraordinary circumstance". So they will have borne responsibility for any costs or loss of amenity they will have suffered. Even though the airlines, tour operators and travel agents are responsible for the direct costs of re-routing, care and assistance, evidence suggests that passengers in practice had to pay a significant proportion of these costs upfront and may not have been fully reimbursed. Some of them also lost several days' holiday for which they had paid, or several days' income from work to which they were not able to return. The total

[14] NERL estimates that, for 2023, it will be liable to face a financial penalty of approximately £1.8m for not exceeding its C3 target (average weighted NERL attributable En-route ATFM delay per flight). Excluding the delays due to the event on the 28 August 2023, NERL performance throughout 2023 would have resulted in no financial penalty.

costs of this large group have not yet been calculated but is likely to be very high; the Panel will seek to make an estimate in the next phase of the review.

4.26 The Panel will consider the role of any third parties in improving resilience, including the organisation that developed, and provides engineering support to, the FPRSA-R (Frequentis). It will also consider to what extent travel insurance has played a part in assisting with consumers' expenses.

4.27 To the best of the Panel's knowledge, ANSPs in other jurisdictions do not bear airline and airport costs of providing care, assistance, and re-routeing to consumers. The Panel will be investigating this further.

4.28 As noted above, in the UK, airlines (together with tour operators and travel agents, (and in the case of an extraordinary circumstance the passengers themselves)) effectively bear almost all the risks associated with disruption to consumers regardless of the ultimate cause of the disruption. From the consumers' perspective, one of the advantages of this is that airlines face strong incentives to re-route those consumers quickly to their ultimate destination instead of having to fund their accommodation. The Panel has seen examples of airlines putting on rescue flights and allowing passengers to travel with alternative carriers as a way to expedite passengers' disrupted journeys. On the other hand, there is evidence of some very poor examples of consumer care following the 28 August incident, where passengers were offered very little assistance and were left waiting for several days before finding a flight home.

4.29 NERL faces some, albeit rather limited, financial incentives to provide a resilient service. It argues strongly that it would not be appropriate for the ANSP to face substantial downstream liabilities arising from the interruption of the provision of air traffic services, even where this is directly attributable to its systems or mistakes, as this might discourage the use of tactical or strategic measures designed to maintain safety performance, but which inevitably cause delays or disruption and therefore costs which would ultimately be borne by the airlines. The Panel is not convinced by the first point, as the primacy of safety is strongly embedded in the regime and in the culture of NERL, as well as in its licence. The Panel is engaging with other safety critical sectors to explore this balance further.

4.30 In its final report, the Panel will set out how responsibility for the costs caused by disruption, especially on the scale of this incident, compared with allocations in other jurisdictions and industries. One potential parallel which has been suggested is the rail sector, where responsibility for delays is allocated on a detailed basis between the train operating companies and Network Rail. This regime has been criticised in the 2021 Williams Report as unnecessarily bureaucratic and expensive, and adding no value to the consumer experience, though others argue that it does lead to a full examination of what went wrong which in turn drives improvement. There are three notable features of the rail industry regime that

distinguish it from aviation: in rail the system of “Delay Repay” has no exceptions (e.g. for “extraordinary circumstances” as in aviation), so consumers know they are entitled to compensation from the train operating company irrespective of the cause; the amount of compensation is linked to the amount paid for the ticket rather than by reference to a set formula; and Network Rail does bear responsibility for compensating train operating companies for their outlay in reimbursing passengers where the fault is attributed to Network Rail.

4.31 The Panel has had discussions with regulators in various other sectors and is not aware of any other sector in which the network operator does not assume liability for losses directly attributable to its own systems, although the Panel understands that a catastrophic disruption to the national energy supply does not entitle customers to compensation. In making these comparisons and drawing any potential conclusions, the Panel will be mindful that the very considerable direct costs of this incident described in this report fell mainly to airlines, airports, tour operators and travel agents to bear, as well as to the large number of passengers who were disrupted and have not had all their costs reimbursed. The Panel will also review the availability, and ease of access to, alternative dispute resolution in the aviation sector compared with the schemes available to consumers in other sectors.

Chapter 5

Next Steps

5.1 The Terms of Reference require the review to conclude with a report to the CAA, identifying potential future actions for NERL, the CAA and airline stakeholders against the eight areas identified. As part of its conclusions the review may make recommendations for further analysis or work on particular issues by these parties and others. As the Panel's research is still ongoing, it is not in a position to provide firm recommendations at this time, though it will do so in its final report. As noted above, it is likely that the Panel will make recommendations across a range of issues, including in the following areas:

- the cause and management of the incident;
- resilience planning;
- the need for systemic improvements in communications, both between parts of the aviation system and between them and the travelling public;
- the powers of the regulator to seek information from airlines and airports, and to enforce the consumer duties of airlines and airports;
- the framework for consumer engagement and representation; and
- dispute resolution.

5.2 The panel acknowledges that its viewpoints and indications of potential recommendations are based on information gathered to date, and recognises that some of the recommendations may require material time, cost and/or legislation to implement. As further evidence is received, the Panel’s views will adapt based on a fully informed position, and the practicalities of implementing changes will be considered as part of its final report. Next steps on this review include:

- Finalisation of consumer research and review of its findings.
- Further review of the NERL Final Major Incident Report.
- Further engagement with NERL, in particular, and firming up findings and recommendations.

5.3 Further engagement with the NATS Holdings board, including the roles played by directors appointed by The Airline Group Limited, the main commercial shareholder of NATS, and with shareholders including the UK Government.

- Further engagement with airlines, individually and collectively.

- Further engagement with the Department for Transport.
- Engagement with other ASNPs, Eurocontrol and further engagement with the US Federal Aviation Administration.
- A review of the CAA regulatory oversight arrangements of NERL.
- A deeper review of operating and planning procedures.
- A review of contract and commercial arrangements.

5.4 We expect to conclude this review with the submission of a final report to the CAA later this year, to be subsequently shared with Department for Transport and published

APPENDIX A

Review Panel's short biographies

Jeffrey Halliwell

Jeff's executive experience is in Chief Executive Officer roles with consumer-facing businesses such as Fox's Biscuits/Northern Foods, First Milk and Bernard Matthews. His background is in international marketing and commercial roles with blue-chip businesses such as Mars and Colgate. He also ran a private equity backed tech business. Jeff now has a varied chair and non-executive portfolio across private, public, and third sector organisations, particularly supporting organisations with a social purpose. Among other previous roles, he has been Chair of Cafedirect plc and Airport Coordination Ltd, and a non-executive director of Working Links Ltd and Natures Menu pet food. He has served as a trustee of Shaw Trust and Homestart Leicester, and as a non-executive director in a number of NHS organisations. He is a former Chair of watchdog Transport Focus and of the Customer Challenge Board in respect of Heathrow Airport Ltd. He is currently Chair of the Coal Authority, Deputy Chair of the Sea Fish Industry Authority, and a non-executive director of Widgit, a small educational software company.

Sarah Chambers

Sarah is an expert in regulation, consumer and competition policy and advocacy, with experience as Chief Executive of the postal services regulator and wide-ranging experience as a senior civil servant. She currently chairs the Legal Services Consumer Panel and is an Electoral Commissioner. She is also a member of the Determinations Panel of the Pensions Regulator, the Consumer Expert Panel of the Office of Rail & Road, and the Judicial Appointments Commission, and has a number of other advisory and trustee roles. She is a former member of the CAA Consumer Panel and of the Competition & Markets Authority Panel.

Phil Cropper

Phil completed twenty years in operational ATC with NATS before joining the UK CAA in January 2000 as an ATS Inspector. In July 2003 he was appointed to the post of AAA (Airspace, Air Traffic Management & Aerodromes) Northern Regional Manager, the post he left in January 2019. After some project work for CAAi in the role of Senior ATM adviser, Phil is now semi-retired. Phil has a degree in aeronautical engineering from the University of Manchester.

Mark Foulsham

Mark is a highly experienced COO/CIO/CDO, Board Advisor, NED and Transformation Leader. He has a strong track record of driving digital transformation within senior operations, IT and business change delivery roles primarily within the financial services and utilities sectors. Mark originally qualified as a Chartered Civil Engineer working for multinational engineering firm Atkins and subsequently as IT Director within the French group Bouygues and Macquarie Bank. He spent 12 years as CIO at esure Group, including Gocompare, and served three years as Chief Digital Officer for the disability charity Scope. In parallel with that role, he also worked with challenger banks and FinTechs on their digital transformation journeys and authored two books addressing effective data protection. Most recently Mark was COO at Kensington Mortgages overseeing a full spectrum of operational, digital, data and technology-related change programmes.

APPENDIX B

Scope of the review

The below is an extract from the Terms of Reference.

This review will consider available evidence and, as appropriate, make observations and recommendations on the following areas:

1. **Immediate cause of the incident and preventing the occurrence of a similar incident**: The Panel will review the NATS' preliminary report[15] and any relevant subsequent reports from NATS to ensure the cause of the incident is understood and appropriate mitigating actions have been implemented. The Panel will consider whether there are aspects of the events that led to this incident – technical, organisational and cultural – that may require further analysis and whether there are further steps that NATS, the CAA and other stakeholders should take to help it prevent the occurrence of similar incidents.

2. **Incident communication and associated stakeholder engagement**: The Panel will consider the NATS Major Incident Plan and whether any changes may be needed to the way communication of a major incident takes place, both internally and to stakeholders. The Panel should consider whether the NATS policies and protocols on event escalation which were in place were adequately designed and worked effectively.

3. **The resources and resilience arrangements available to NATS' regulated business** to respond to system failures and major incidents in the UK's en route air traffic system: The Panel will consider the availability of NATS technical staff and resources from service partners to respond to major incidents (24/7) and whether it has appropriate resilience arrangements in place to prevent, deal with, and recover from, system failures and similar major incidents.

4. **Broader considerations around investment and infrastructure of NATS' regulated business**: The Panel will consider whether there are any wider lessons from the incident for NATS, the CAA as the regulator, or other parties, regarding the level and nature of previous and planned infrastructure investment by NATS as well as the procedures and approach NATS adopts as part of its infrastructure deployment.

5. **NATS performance and incentives**: The Panel will consider comparable evidence about how well NATS performs against its peers and whether there are any lessons from this incident that should inform the framework for setting of NATS performance targets in the future, and the level of financial consequences

[15] Public version of this report is available at www.caa.co.uk/CAP2582.

faced by NATS not meeting target service levels, noting the need for any incentive scheme to avoid unintended consequences and take into account NATS' responsibilities to provide safe and efficient air traffic services.

6. **Consumer impact:** The immediate impact of the incident led to significant cancellations and delays that affected customers for several days because of the displacement of aircraft and crews and non-availability of alternative flights at the time of year. The Panel will set out an explanation of the generalised impacts of the incident on airlines, airports and consumers, particularly in relation to delays and cancellations and other issues that occurred together with any lessons to be learned.

7. **Aviation system response:** The Panel will assess how the aviation system – including airlines and airports - met their passenger rights obligations and consider the extent to which the sector performed well against its obligations as well as areas for improvement that might lead to better passenger outcomes in the future. This should include airlines and airports response to the incident, their communication with affected passengers, timeliness of re-routeing and re-booking of passengers, availability of additional capacity, the level of costs passengers were expected to "pay and reclaim" and management of vulnerable passengers. The Panel will also consider whether there are further steps that could be taken by airlines, airports and by the CAA (in respect of its guidance) that could allow greater flexibility and better consumer outcomes, ensuring that affected passengers reach their intended destinations in a reasonably timely manner.

8. **Airline and airport costs of providing care, assistance, and re-routeing to consumers**: the Panel will set out how the current UK framework allocates responsibility for these risks and associated costs between different parties and how this allocation works in other comparable states and industries. This will ultimately help inform Government on whether and how it wishes to consider the wider UK policy and legislative framework on these matters.

APPENDIX C

Abbreviations

ACC	Area Control Centre
ACM	Airspace Capacity Manager
ADEXP	ATS Data Exchange Presentation
AMS-UK	Aeronautical Messaging Switch
ANSP	Air Navigation Services Provider
ATC	Air Traffic Control
ATICCC	NATS Air Traffic Incident Communication and Coordination Cell
ATFM Delays	Air Traffic Flow Management Delays
ATM	Air Traffic Management
ATS	Air Traffic Services
DSM	Duty Service Manager (the most senior engineer on duty)
EASA	European Union Aviation Safety Agency (European Safety Regulator)
EUROCONTROL	The organisation responsible for the air traffic management network in Europe
FPRSA-R	Flight Plan Reception Suite Automated
ICAO	International Civil Aviation Organisation
IFPS	Integrated Flight Planning System
NAS	National Airspace System (Implemented on the Host Computer System)
NATS	NATS Holdings is the parent compary of a group that includes NERL, the economically regulated business of NATS Holdings.
NERL	NATS (En Route) Plc - the economically regulated business of NATS. NERL is the UK's main provider of ATS.
SMCR	Senior Managers and Certification Regime

APPENDIX D

Incident timeline

Monday 28th August 2023

Local time	Party	Elapsed time	Actions
08:32	NERL	00:00	Flight plan for BF371 received by FPRS-A from IFPS.
08:32	NERL	00:00	Primary and secondary FPRS-A systems fail to successfully process the flight plan data and switch to maintenance mode. Automatic processing of flight plans ceases
08:32	NERL	00:00	Manual input of flight plan data begins
	NERL		Level 1 engineer begins system checks and tests.
08:59	NERL	00:27	Level 1 engineer attempts reboot FPRSA-R software.
09:06	NERL	00:34	First contact with Level 2 engineer on standby remotely.
09:23	NERL	00:51	Duty Engineering Service Mgr. (EASA) notifies Operations Supervisors (OS) at Prestwick ACC, Swanwick ACC & Oceanic ACC and advises to start preparation for operational impact in the event of continuing outage.
09:28	NERL	00:56	DSM sends SMS message to NATS collective major incident managers group.
09:35–09:50	NERL	01:03-01:18	Contact made with: - NATS Technical Services Director; NATS Operations Director; and NATS CEO
10:00	NERL	01:28	DSM, OS & Airspace Capacity Mgr. (ACM) meet. Decision taken on what traffic regulations would need to be enacted if resolution not achieved.

Local time	Party	Elapsed time	Actions
10:04	TUI	01:32	First aware of mass delays across the UK via the Group Operations Centre in Hanover.
10:08	Luton Airport	01:36	Luton informed of a technical failure by NATS at LTN.
10:12	NERL	01:40	DSM & Level 2 engineer agree engineer to attend on site.
10:14	Gatwick Airport	01:42	Notified of the failure by Gatwick control tower.
10:38	NERL	02:06	Bronze meeting convened.
10:43	NERL	02:11	Eurocontrol advised that regulations would be required for UK airspace.
10:45	Virgin Atlantic	02:13	Noticed there was an issue when slot delays were noticed.
10:45	Liverpool Airport	02:13	ATC noticed slot changes and NATS MAN informed them there was a problem. No direct contact from NATS.
10:45	Regional and City Airports	02:13	Found out information from BBC news, no comms from NATS on day of incident.
10:45	NERL	02:13	Eurocontrol Network Manager advises airline/airports of regulations effective @ 11:00
10:50	Virgin Atlantic	02:18	Call made to Heathrow Operational Efficiency Cell to query slots. Was advised that Heathrow had been told of a system failure and were waiting for further information.
10:58	NERL	02:26	NERL discussion regarding the need for Level 3 engineer.
11:00	Virgin Atlantic	02:28	Message appeared on Eurocontrol portal. No direct communication came from NATS until the ATICCC call.

Local time	Party	Elapsed time	Actions
11:00	easyJet	02:28	Call from Eurocontrol. Flight movements in the UK would be limited to 60 per hour.
11:00	NERL	02:28	Flow regulations active.
11:02	NERL	02:30	Silver command contacts NATS Duty Press Officer who in turn advises corporate comms.
11:05	British Airways	02:33	Notification from Eurocontrol Network Manager.
11:05	Ryanair	02:33	Notification through Eurocontrol Network Operations Portal
11:06	NERL	02:34	Silver command convenes.
11:07	easyJet	02:35	Contact from Eurocontrol regarding incident.
11:30	NERL	02:58	ATICCC activated.
11:30	Ryanair, Gatwick Airport, TUI, British Airways, Manchester Airport Group, Virgin Atlantic.	02:58	Email received from NATS stating ATICCC was activated.
11:40	Gatwick Airport	03:08	NATS confirmed that the fault had been identified. GAL Bronze command was stood up.
11:45	British Airways, Ryanair, Manchester Airport Group, Virgin Atlantic	03:13	First ATICCC customer call.
11:47	NERL	03:15	Level 2 engineer arrives on site.
11:47	NERL	03:15	First ATICCC customer call.
11:51	[✂]	03:19	[✂]

Local time	Party	Elapsed time	Actions
11:53	NERL	03:21	Level 3 engineer contacted.
11:53–12:28	NERL	03:21-03:56	Full hardware reboots attempted led by Level 2 engineer.
12:12	Virgin Atlantic	03:40	Second update posted on Eurocontrol Portal informing users of a system failure and there no indication of a solution yet.
12:15	[✂]	03:43	[✂]
12:20	NERL	03:48	Gold activated
12:20	NERL	03:48	Further flow restrictions identified – 40 flights/hour for Swanwick ACC airspace & 20 flights/hour for Prestwick ACC airspace effective 12:30
12:26	NERL	03:54	Additional FPRSA-R system logs requested to assist failure mode analysis.
12:30	TUI	03:58	Meeting with senior leaders and wider team. No projected time of fix. Gatwick requesting airlines cancel 80% of flights and close check-in. MAN check in still open.
12:32	NERL	04:00	Stored flight plan data exhausted.
12:39	NERL	04:07	Teams call with level 3 engineer and software supplier, Comsoft
12:45	British Airways	04:13	Received update from Heathrow's Demand vs Capacity team requesting all airlines to cancel UK, Ireland and European flights until 1800BST.
12:45	Gatwick Airport	04:13	Gatwick Silver stood up.
12:51	NERL	04:19	Teams call with level 3 engineer, Comsoft and AMS-UK operator.
12:58	NERL	04:26	Comsoft directs reprocessing of pending messages to isolate the message causing software exceptions.

Local time	Party	Elapsed time	Actions
13:00	Jet2	04:28	Second ATICCC call.
13:00	TUI	04:28	Senior management had a call with NATS.
13:00	easyJet	04:28	Second call from Eurocontrol.
13:00	NERL	04:28	Further tightening of flow regulations.
13:00	Virgin Atlantic	04:28	Heathrow call held stating that problems were still ongoing on no solution had been identified.
13:30	Gatwick Airport	04:58	Gatwick uses social media and press statements to inform pax of multiple delays and cancellations.
13:26	NERL	04:54	Test flight plans successfully processed by FPRSA-R
13:45	British Airways	05:13	Update from NATS ATICCC that the issue that not been resolved and that flight plans were being processed manually.
13:55	Gatwick Airport	05:23	Gold stood up.
14:00	NERL	05:28	4th Bronze team call.
14:00	[✂]	05:28	[✂]
14:02	Ryanair	05:30	Phone call from Martin Rolfe advising that a solution may have been identified but no timeframe for implementation or for traffic flow regulations to be removed.
14:11	Virgin Atlantic	05:39	Third update posted on Eurocontrol portal, stating that there is no current solution to the problem.
14:15	Gatwick Airport	05:43	Informed that NATS had identified and resolved fault and system would be entering recovery.
14:19	[✂]	05:47	[✂]
14:27	NERL	05:55	Auto processing of flight plans recommences – technical system restored.

Local time	Party	Elapsed time	Actions
14:30	Jet2 and British Airways, Virgin Atlantic	05:58	Third and final ATICCC call.
14:32	NERL	06:00	2nd Gold call.
14:32	NERL	06:00	3rd ATICCC call.
14:43	Virgin Atlantic	06:11	NATS advise that automatic processing is continuing and flights will be actioned on first come first serve basis with widebody flights continuing to be priority.
14:45	Bristol Airport	06:13	All Airport and BP calls chaired by ADM with latest updates cascaded.
14:54	NERL	06:22	Bronze deactivated
15:00	NERL	06:28	ATICCC deactivated.
15:06	easyJet	06:34	NATS informed the airline that a fix had been identified and hopefully they were entering recovery.
15:11	NERL	06:39	Silver deactivated.
15:15	British Airways	06:43	Final communication from NATS ATICCC that the system had been returned to normal.
15:15	Jet2	06:43	Message issued by NATS that no further calls would be made.
15:15	Virgin Atlantic	06:43	NATS update that they have identified and resolved the issue and that the system is now in recovery.
15:24	NERL	06:52	Traffic regulations begin to be lifted.
15:30	Virgin Atlantic	06:58	Significant improvements seen to slots from UK airports as the system begins to operate automatically.

Local time	Party	Elapsed time	Actions
16:00	[✂]	07:28	[✂]
16:00	NERL	07:28	3rd Gold call – Transport Secretary briefed.
16:10	Jet2	07:38	Most penalising restrictions lifted.
16:10	NERL	07:38	Most restrictive traffic restrictions lifted.
16:40	Bristol Airport	08:08	Airlines provided their respective operational plans.
16:45	Bristol Airport	08:13	All Airport and BP calls chaired by ADM with latest updates cascaded.
17:48	Virgin Atlantic	09:16	NATS update via generic email.
18:40	Gatwick Airport	10:08	Gold command stood down.
18:03	NERL	09:31	Traffic regulations end.
19:00	[✂]	10:28	[✂]
19:01	NERL	10:29	4th Gold call. Major incident investigation to be initiated

Tuesday 29th August 2023

Local time	Party	Elapsed time	Actions
09:31	NERL	1 Day 00:59	5th Gold call.
16:00	NERL	1 Day 07:28	6th Gold call.
16:00	TUI	1 Day 07:28	Flight programme normalising but airports are extremely busy.
16:00	Gatwick Airport	1 Day 07:28	9 red cancellations, 19 green cancellations and 56 arrival cancellations.
	easyJet	1 Day	First formal communication from NATS to the COO and Director of Airport Ops and Nav.

Wednesday 30th August 2023

Local time	Party	Elapsed time	Actions
	British Airways	2 Days	New seat configuration for additional capacity implemented for 28-30th period.
08:30	TUI	2 Days 23:58	Programme returned to normal but there are some knock-on crew issues.

Thursday 31st August 2023

Local time	Party	Elapsed time	Actions
All day	Jet2	3 Days	Overnight delays continue due to fleet shortage.

Monday 4th September 2023

Local time	Party	Elapsed time	Actions
All day	Bristol Airport	7 Days	Last impact of delays and cancellations due to displaced crew and aircraft. Majority of vehicles had been collected from carpark.