Report Appendices

A Post Event Consultation with Customers and Stakeholders

A1. Record of Briefings and Consultations

A2. Summary of Briefing to NATS / Customer Operational Partnership Agreement (OPA) Meeting

A3. Feedback contained in the 2013 Airline Customer Survey

B Wider Communications – on the day and post-event

B1. Media Messaging on 7th December 2013

B2. Statements by the CAA

B3. Factual Briefing to Customers – 9th December 2013

B4. Follow-Up Briefing to Customers – 17th December 2013

B5. Customers and Stakeholders who received the briefings

B6. Statement on NATS Website for Wider Audiences – 9th December 2013

B7. Report to the Transport Select Committee

C ATICCC Coordination with Customers

C1. ATICCC Communications Log – 7th December 2013

C2. Organisations Subscribing to ATICCC Alerts

C3. Log of Traffic Management Actions on 7th December 2013 – to minimise the impact of the disruption

C4. Log of Flow Management Position (FMP) Actions on 7th December 2013

D Independent Assessment of the Engineering Response

D1. Summary of Technical Findings in TRC Report to the NATS Board – March 2014

E Evidence of Historic System Resilience Levels

E1. Engineering Delay Performance since 2009 – as an indicator of whether risk management has been effective

Appendix A
Post Event Consultation with Customers and Stakeholders

A1. Record of Briefings and Consultations

Date	Organisation	Communication and Feedback
9 Dec 13	OPA, Airports, Ops Directors	Email sent to airlines and airports giving the details of incident and actions taken to resolve it together with status and improvement actions and apologising for the impact on airlines, airports and their customers. Statement added to www.customer.nats.co.uk Customer Website (See Appendix B)
10 Dec 13	British Airways Vicki Schupke Ranson, Tony Buss, Peter Jukes, Dave Wood Paul Tate	Andy Shand face to face Advised the details of the incident and actions taken to resolve it together with a description of the service quality impact and reasons why the traffic from Heathrow going West and South saw higher levels of delay than traffic going East and North. Also discussed impact of airline ability to change routing and opportunities to improve this in future. Also briefed on the outline of the investigation and follow-up actions. BA advised that they had just under 200 cancellations as a result of the incident.
10 Dec 13	Ryanair	Letter to NATS requesting understanding why delays differed between Stansted and Luton. NATS response sent by email on 10 Dec.
11 Dec 13	NATS Lead Operator Group	Andy Shand Briefing to Lead Operator group on background to event and follow-up actions taken including reference to airline ability to take up revised routing options. Aer Lingus, British Airways, BA CityFlyer, CAA (SARG), CityJet, Delta Air Lines, easyJet, Emirates Airlines, FedEx Express, Flybe, Gama Aviation, Qatar Airways, Ryanair, Virgin Atlantic
11 Dec 13	Heathrow Airport Derek Provan Normand Boivin	Martin Rolfe, Andy Shand, Jon Proudlove face to face with Operations team explained background and actions taken and impact on Heathrow plus intent to engage airlines and airports in enhanced recovery procedures.
12 Dec 13	FASIIG	NATS briefing to airlines, airports and CAA (SARG) as first item on FASIIG agenda.
12 Dec 13	Ryanair	Letter from Ryanair referencing compensation for impact on passengers.
16 Dec 13	Thomas Cook	Letter from Thomas Cook requesting information on event and advising impact on their operations but thanking NATS for support from FMP.
17 Dec 13	Airlines and Airports	Briefing issued on lessons learned from 7 December and impact on CP3 performance regime (see Appendix B)
17 Dec 13	Ryanair	Response to Ryanair advising that RYR would receive reduction in charges in 2015 as a result of CP3 performance regime.
18 Dec 13	Flybe	Note from Simon Cudd at Flybe regarding calls on 7 Dec responded to by Andy Shand via email and also verbal discussion stating that FMP had attempted on a number of occasions to call Flybe Ops lines but not being answered
19 Dec 13	FAS DSG	Martin Rolfe briefing to FAS DSG members representing CAA, IATA, BATA, ELFAA, AOA, DfT, MoD and ACI.
20 Dec 13	Thomas Cook	Response to Thomas Cook expressing regrets for impact on their operation and advising actions taken and expected charges reductions to TCX in 2015 unit rate.

| Date	Organisation	Communication and Feedback
7 Jan 14	Ryanair	Letter from Choorah Singh responding to email from Andy Shand on 17 Dec
15 Jan 14	BA	Letter to Keith Williams including sections of NATS board report and communications with BA during and since the incident.
23 Jan 14	OPA	Aer Lingus, IAA, American Airlines, British Airways, Delta, easyJet, Flybe, Jet2, Monarch, Ryanair, Thomson, Thomas Cook, United, Virgin briefed on follow up to 7 December and agreed to set up hotspot on enhanced recovery from disruption.
		(Briefing summarised at Appendix A2)
24 Jan 14	easyJet	Andy Sage, Paul Carroll & Andy Shand from NATS visited EZY to discuss NATS information portal. The meeting was started by a briefing on 7 December event and lessons learned and a copy of the presentation provided to EZY. Discussion focused on the potential to support EZY desires to have additional support to handle disruption on a wider scale across Europe which is subject of further discussion. EZY were generally positive about ATICCC handling on the day and did take up alternative rerouting options.
	Will Facey Francis Richards Dominic Haysom Duncan Philip	
6 Feb 14	NATS Airports and Airline CEOs	Letter from Richard Deakin and Martin Rolfe offering face to face meetings to discuss lessons learned from 7 December.
20 Feb 14	Ryanair	Letter from Richard Deakin to Adrian Dunne
27 Feb 14	CityJet	Martin Rolfe and Andy Shand Briefing on 7 December and lessons learned plus charges reduction in 2015. Feedback was that CityJet had limited ability to react to alternative options due weekend staffing and had 7 cancellations. CityJet need to update ATICCC contacts for CityJet. Thanked NATS for briefing and welcomed OPA hotspot.
	Robert Campbell Smith Robert Adams Carlos Garcia	
18 Mar 14	OPA Hotspot	NATS Meeting held with OPA members, MoD & Eurocontrol to agree detail of hotspot. Agreed that hotspot will focus on:
		1. Development of Playbook Scenarios for recovery
	OPA attendees	2. Enhanced communication (broadcast) of scenarios in force & status
		3. Briefing on ATSOCAS operations
		Positive feedback from airlines about handling of the event and agreed that having set scenarios would help airlines ability to react to non standard routing.
20 Mar 14	Glasgow Airport Board	Martin Rolfe and Andy Shand briefing. Glasgow Board thanked NATS for briefing and indicated their interest in being kept appraised of recovery procedures being developed by OPA. Also thanked NATS for comms during the event.
	Campbell McKinnon – Ops Director	
	Amanda McMillan – MD	
1 Apr 14	Southampton Airport	Martin Rolfe & Alex Culley briefing. Feedback from Southampton very positive, they welcomed NATS presentation and engagement with them. NATS Southampton are engaged with Swanwick regarding OREP and are waiting to hear back on progress on the offer to provide a delegated function to the south. Offer to engage with Flybe and the OPA Hotspot to try and improve communication and use of re-routes during a disruption scenario
	Colin Houston (NATS GM)	
	Ian McDermott-Paine (Head of Airside)	Southampton Airport very supportive of the ATICCC, they commented on how well the process worked and cited Heathrow Ethiopian 787 fire and the 7 December failure as examples of successful event management.
	Mike Glen Dan Townsend	The Airport welcomed the opportunity to discuss events with NATS and had questions on
		- Changes to TC sectorisation to the south and west to improve traffic flow
		- Airline ops capability to change flight plans
		- Use of ATSOCAS potential, relevant to them due to customer base and proximity to class G airspace

Date	Organisation	Communication and Feedback
8 Apr 14	Monarch Mark Deacon (Nav Svcs) Andrew Parker (Head of Ops) Nils Christy (Chief Pilot)	Martin Rolfe and Alex Culley Briefing to Chief Pilot and Head of Operations. Very supporting of ATICCC and stated that the comms process works well, they strongly support our use of text messages to communicate events. Airline wants to work closely with us and supports the scenario concept as a way of managing disruption, will support the Hotspot going forward
10 Apr 14	Aer Lingus Anne Bradley (Head of Operations) Fergus Wilson (COO) Rory Sergison (ATM)	Martin Rolfe, Alex Culley and Juliet Kennedy Briefing to COO and Ops Director at Swanwick. Very supportive of ATICCC. Want to be part of Hotspot and agree this is the best way to manage disruption on this scale. Key message that recovery is the most important stage for them – they want clear messaging of outage duration so they can plan a restart, even if this bought forward a plan that is maintained will enable them to plan operations and passenger expectations. Passenger communications are airline responsibility, they must be given the messages ahead of media and public so they can plan their response and operation (as is the case with ATICC).
24 Apr 14	British Airways Keith Williams (CEO) Andy Lord (Director Ops) Garry Copeland (MD Ops)	Richard Deakin, Martin Rolfe and Andy Shand Briefing for BA CEO (Keith Williams) on 7 December. BA welcomed the OPA work and proposal to have a tabletop exercise in Autumn. Also highlighted that playbook scenarios should be mandated.
25 April 14	Flybe Saad Hammad (CEO) Ian Baston (Director Flight Ops)	Richard Deakin, Martin Rolfe, Andy Shand & Andy Sage Overall review of Flybe relationship and introduction to Swanwick for Flybe CEO. Included briefing on 7 December and follow up actions. Flybe very supportive of doing a table top exercise on recovery from disruption.
22 May 14	Ryanair Choorah Singh (Deputy Dir Ops) Adrian Dunne (Director Ops)	Face to Face meeting Martin Rolfe & Andy Shand with Choorah Singh Deputy Director Operations and Adrian Dunne Director of Operations. Positive feedback on ATICCC communications and discussion of lessons learned. Ryanair supportive of OPA work. NATS confirmed expected impact of 7 December on Ryanair charges in 2015 and that NATS is not subject to third party claims. Ryanair made the point that the primary ATFM figures are an underestimate of the impact due to rotational delay which NATS accepted.
1 June 14	United Mark Hurston Andrew Jost Glenn Morse Mark Brodbeck Mike Stills James Tochinara	Andy Shand & Alex Culley Briefing to United Airlines ATM, Dispatch and Flight Ops senior management in UAL Operations Centre Chicago on issue, lessons learned and OPA hotspot work. Well received and positive feedback from UAL on NATS transparency and unsolicited feedback on events. Would like to ensure that data is also on NOP Portal – which NATS confirmed it was.
3 June 14	American Tobin Miller Mike O'Brien Brian Schultz Des Keaney Richard Seales Robert Wagner Brian Will	Andy Shand & Alex Culley Briefing to American Airlines Operations, Dispatch, Flight Ops & ATM senior management in Dallas Operations Centre. Also well received and positive feedback on NATS communications. Welcomed use of playbook scenarios.

Date	Organisation	Communication and Feedback
4 June 14	Delta Gary Edwards Rob Goldman Rich Stark Randy Rohan Mark Radley Bill Manion	Andy Shand & Alex Culley Briefing to Delta Airlines Operations, Flight Ops, Dispatch and ATM senior management. Again positive feedback on communications and support for lessons learned work.

A2. Summary of Briefing to NATS / Customer Operational Partnership Agreement (OPA) Meeting

Lessons Learned from Dec 7

- Failure of Technical Monitoring & Control System (TMCS) – part of Communications System (VCS) for Area Control at Swanwick
  - VCS allows direct access comms between sectors, airports & adjacent centres & is automatically configured for the sector configuration.
  - File corruption occurred on the primary server which then transferred to the hot standby as they were linked via RAID*.
  - Server was replaced but the software fault then transferred to the spare
  - Failure mode left the VCS panels unable to reconfigure as the sectors split – leaving the AC Ops Room in night time band-boxed configuration

- Decision taken to keep ops room in night configuration until issue resolved

- Regulations applied to all AC sectors

- Over 90% of traffic operated but with average delay per flight of 33 minutes & circa 300 cancellations

- ATICCC convened & run till 1930

- Reroute options & level capping adopted

- Issue resolved at 1835 & all regulations lifted at 1920
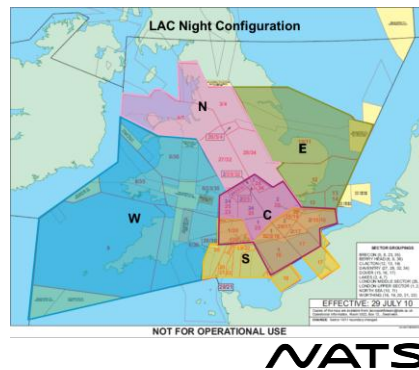
*Redundant Array of Independent Disks

NATS

Lessons Learned

Action Taken

- Systems segregated & additional spares/backups created
- Incident enquiry launched via NATS TRC to address actions:
  - Further reduce the risk of similar failures.
  - Further improve engineering, operational and communications response to failures.
  - Review options for providing enhanced resilience – Operational Resilience Enhancement Plan
  - Agree procedures to increase customer use of alternative routes and level caps for this failure & other failures
    - OPA Hotspot raised and agreed at OPA on 23rd Jan

Slide 2

NATS

Lessons Learned & recommendations

- FMP saw some reluctance from operators to follow level capping advice – due workload?
    - E.g. PC W2 observed 10 flights that could have level capped saving 1,070 mins remained at previous levels despite advice.

- Use of pre-arranged level cap scenarios to reduce workload
    - E.g. Solent to Channel Islands approved Channel Islands to EGKK FL120 through ORTAC. (was used on 7th)

- Linked with the scenarios, ensure a profiling script is created to allow the FMP to brief AOs effectively, resulting in fewer queries

- Lessons learned on ATICCC

- Review LAS local knowledge to optimise additional capacity e.g. EGGW departures FL310+ that could have worked Central sectors

- Use of Western Radar & London Military in West and East

Slide 3

NATS

OPA Hotspot

- Objective:
  Agree procedures with OPA that enable more effective use to be made of alternative routing/available units

- NATS is reviewing options for failures affecting each of the major NATS operations where appropriate – e.g. AC, TC, PC, Oceanic

- Agreements with adjacent ACCs & units

- Lessons learned for operational communications with airlines & airports in disruption

NATS

Operational Resilience Enhancement Plan (OREP)

- Role of the OREP to identify credible options that will safely enhance service resilience and performance in times where a degradation in service capability impacts civil operations.

- The core work-streams include:

    1. A review of the function of ATICCC, focussing on the role of ATICCC in terms of facilitating internal and external communications.

    2. A review of our Traffic Management and Service Provision procedures during contingent operations. This will include aspects such as promulgation of contingency scenarios and/or routeings, and a review of existing scenarios based on the 7th December event to identify appropriate enhancements.

    3. A review of operational ATC procedures during contingent operations. This will include a review of Ops Supervisor / Engineering Service Manager training & TRUCE activities and an assessment of Short Dial connectivity with adjacent ACCs.

    4. A review of ATM operations in times of significant contingency in either one of the operations rooms. This may include how we utilise the capability provided by other agencies (e.g. the military), and an assessment of potential procedures to enable greater connectivity e.g. between TC and the continent, and between AC and the London airports under very specific conditions.

- Each work-stream is being sponsored by a member of the Senior Management Team.

NATS

ACM and Contingency

- Aim is to produce a 'systemised' response to enable maximum use of available capacity.
- All parties to be engaged in dialogue.
- Intention is to develop a 'Playbook' system that is easily understood.
- Current thinking is to compile 'usable routes' that operators can file in case of contingency.

7 December Communication

- Communication on the day challenging as airline Ops staff too busy to answer phones and attend ATICCC calls
  - NOTAM?
  - ATICCC website?
  - NOP?
  - Pre-defined plan code?

NATS

Service Principles that underpin ATSOCAS

- Pilots are ultimately responsible for collision avoidance and terrain clearance.

- Controllers shall endeavour to provide the service that pilots request.

- Pilots may ask for an alternative service at any time.

- Pilots and controllers 'agree' the service. Any change must be agreed so that all parties understand revised responsibilities.

- Because of nature of the Class G environment (non mandatory ATS) services may be limited i.e. reduced traffic information

- Movements are flight planned
  - Route must comply with the RAD
  - Must include a Departure point and specified joining fix
  - Current available joins are GIBSO, LEDGO, SKESO, TINAN, STU, EXMOR, DAWLY, MOSUN
  - Address to ATSOCAS – EGTTZFZB for Western Radar

NATS

Service Providers

Western Radar

- 06.30 – 21.00
- Basic, Traffic, De-confliction
- FL 70 to FL 195
- FL 70 to FL 245 in TRAs

London Military

- 24/7
- Basic, Traffic, De-confliction and Radar Control
- All Levels inside and outside CAS.
- Subject to unit priorities list (unlikely to be significant military flying if there is an issue with UK ATM Provision)

NATS

A3. Feedback contained in the 2013 Airline Customer Survey

NATS' Airline Customer Survey is undertaken annually. The 2013 survey was conducted during November and December 2013 and therefore it has been possible to compare the scores for the survey questions pre/post 7 December 2013 as an indicator of customers' reaction to aspects of the event.

Four questions relating to 'Technical Resilience' and 'Managing Unusual Events' were included in the 2013 survey as follows:

"This question asks you to score various aspects of NATS operational performance against your own business priorities. First score each statement with how important it is to your business, and then score how well NATS delivers this statement. A score of 10 would represent the highest importance and excellent delivery:

- *NATS technical systems' resilience*
- *Management of any periods of disruption (e.g. technical failure, weather, industrial action by other ANSPs)*
- *Feedback to customers following any periods of disruption (e.g. technical failure, weather, industrial action by other ANSPs)*
- *Provision of relevant information via ATICCC during an incident"*

When completed Surveys were submitted

> Pre 7 December = 25
> Post 7 December = 38

Responses to Questions

The chart shows that the score for 'systems resilience' decreased after the 7 December event, whereas all other scores increased.

The drop in system resilience score clearly reflects the duration and severity of the failure.

The other scores are in line with other feedback received post event where customers considered NATS had done a good job in managing difficult circumstances.

A survey score of 8-9 out of 10 is normally considered to represent 'good performance, with scope for improvement'.
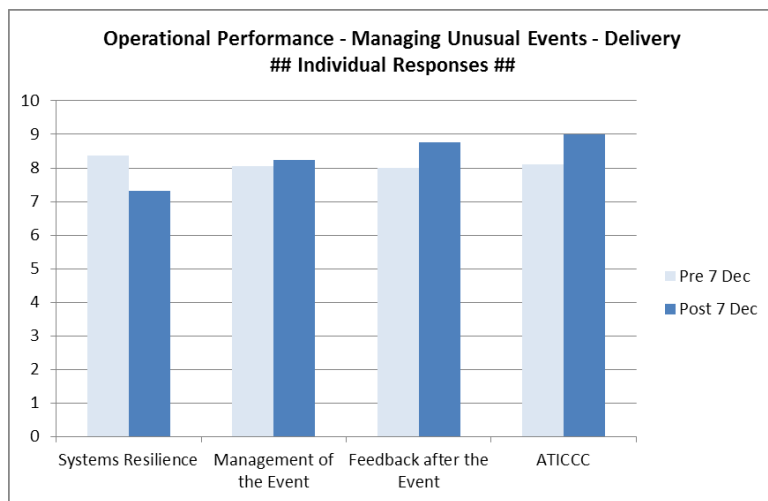
General NATS Question

The survey also included a new question in 2013: *"Based on your experience of dealing with NATS, how likely are you to speak positively of us to a colleague"*. The responses can be translated into a 'Net Promoter Score' which is widely used as a measure of overall customer satisfaction.

While there are a large number of elements that will influence how an individual scores this question, the chart shows a negligible change in both the Average and the Net Promoter scores pre/post event.
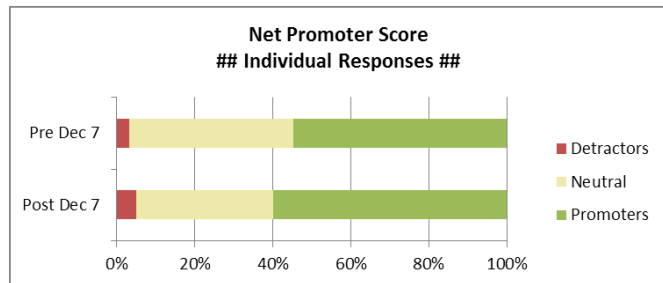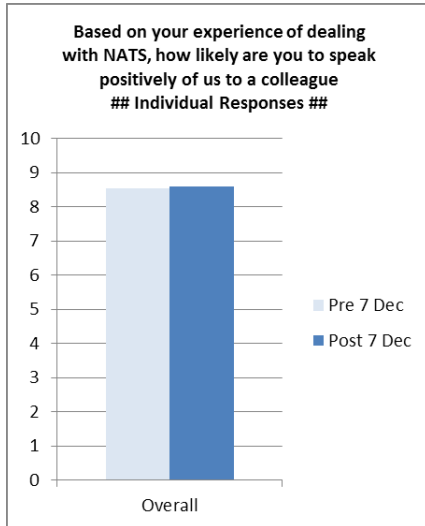
Appendix B
Wider Communications – on the day and post-event

B1. Media Messaging on 7th December 2013

1.   An initial line to take was agreed between CEO, MD Operations and Director Communications which was passed onto head of media relations. Early "flash" reporting on the BBC accurately reflected this line and thus established the direction for the story.   Each statement and all interviews included an unreserved apology.

2.   Initially, NATS focus was to explain in simple terms why fewer aircraft were able to fly - the inability, due to the technical failure, to transition from the lower capacity night-time operation to the higher capacity day-time operation. The first statement answered the key questions that the public and journalists were concerned about, although we weren't at that stage able to detail how long disruption would last or how many flights were affected.

FIRST MEDIA STATEMENT (Saturday 07:55)

"Due to a technical problem at Swanwick we are currently experiencing some difficulty switching from night time to daytime operation. This may result in some delays for which we apologise. Engineers are working to rectify the problem as soon as possible."

3.   A second statement was issued to media and via Twitter at 09:41hrs. This was more detailed and as a consequence more complex as we sought to explain the issue. It did importantly stress that safety was not compromised. With hindsight it could have included a reference to working with airlines and airports to minimise delays.

SECOND MEDIA STATEMENT (Saturday 09:41)

"Due to a technical problem at Swanwick we are currently experiencing some difficulty switching from night time to daytime operation. At night, when it's quiet, we can combine sectors of airspace. When it gets busy in the daytime we split the sectors out again. The voice communications system is configured to enable this to happen.

We experienced a technical problem in the early hours of this morning, which means that it hasn't been possible to reconfigure the voice communications system to split out the sectors for the busier daytime traffic in some areas of the UK enroute airspace.

Engineers are working to rectify the problem as soon as possible, but this is resulting in some delays. Safety has not been compromised at any time, and we sincerely apologise for any inconvenience being caused to passengers."

4.   A third statement was issued to media and Twitter at 12:17hrs, announcing that a fix had been identified, when operations would be returned to normal and confirming the level of service NATS had still managed to provide through the morning. Both these points played very prominently throughout afternoon coverage.

5.   While reference was made to a backlog of flights, with hindsight, the statement could have made it clearer that it would take some time for flights to return to normal.

THIRD MEDIA STATEMENT (Saturday 12:17)

"In the early hours of this morning, a technical problem occurred at our Area Control centre at Swanwick. The problem is related to the internal telephone system used by our air traffic controllers and is expected to take about six hours to resolve.

At night, when it's quiet, sectors of airspace are combined. As it gets busier in the daytime the sectors are split out again and additional control positions are opened to meet the traffic demand. Because of the problem with the internal telephone system, it was not possible to open the additional control positions this morning, resulting in a significant reduction in capacity in some areas of UK en-route airspace.

Safety has not been compromised at any time.

Normally by midday on a Saturday we would have handled about 2000 flights. Today we have handled somewhere in the region of 1,700 – a reduction of about 20%.

We now understand what the problem is and our engineers are working hard to rectify the issues as quickly as possible. Everyone in our operation is continuing to work closely with our customers to manage the traffic and clear the backlog.

We apologise sincerely for any inconvenience being caused to passengers.

More info:

- *We've handled just under 80% of normal capacity on a normal Saturday.*
- *Usually 2000 movements by midday*
- *Today 1666 by midday*
- *47% of daily traffic today."*

6.   The term 'internal telephone system' was used in the third statement to signal a difference from controller-pilot communications, which had the potential to become a point of confusion for reporters and commentators.

7.   It transpired through later media coverage that this attempt to avoid causing undue alarm by referring to "internal telephone system" had inadvertently resulted in an over-simplified understanding of the nature of the system and failure involved. Media and in particular one Ryanair spokesperson started suggesting a system as basic as a telephone network should a. not cause as much disruption as had been experienced and b. not take this long to fix. As a result, terminology was change in later statements, and press officers proactively explained the nature of the system to reports and producers.

8.   Non-Executive Board members have also expressed the view that NATS presentation of the number of flights flown in the day did not coincide with passengers' experiences of considerable delay.

9.   Questions have been raised about whether NATS' messaging relating to capacity was helpful. We believe it was incumbent upon NATS communications effort to:

> Ensure accurate and timely information;

> Provide an accurate indication of the scale of the problem, as requested by media and others;

> Highlight to all audiences, including Government and Regulator, the relatively high level of service that was maintained despite significant technical failures;

> And thereby protect the reputation of the company.

10. It the view of the executive that NATS' capacity messaging effectively achieved these objectives and media coverage over the day indicates that perception of impact would have been exaggerated otherwise.

11. The final "ops normal" statement that was issued at 19:20hrs referred to "ground communications" and included further detail about the complexity of the communications system involved. This statement was read out verbatim by leading TV news outlets, which helped address the previous over-simplification and misunderstanding.

FOURTH MEDIA STATEMENT (Saturday 19:20)

"The problem which arose this morning with the ground communications system in the NATS Operations Room at Swanwick has now been resolved and operations are returning to normal.

The technical and operational contingency measures we have had in place all day have enabled us to deliver more than 80% of our normal operation. The reduction in capacity has had a disproportionate effect on southern England because it is extremely complex and busy airspace and we sincerely regret inconvenience to our airline customers and their passengers.

To be clear, this is a very complex and sophisticated system with more than a million lines of software. This is NOT simply internal telephones, it is the system that controllers use to speak to other ATC agencies both in the UK and Europe and is the biggest system of its kind in Europe.

This has been a major challenge for our engineering team and for the manufacturer, who has worked closely with us to ensure this complex problem was resolved as quickly as possible while maintaining a safe service."

12. Tweets were issued with links to each statement over the day which is best practice in crisis communications. However, with hindsight, we believe more could have been done on Twitter

independently of the formal statements to keep passengers and others updated on the progress of our recovery plan.

B2. Statements by the CAA

7 December 2013

A CAA spokesperson said:

"We are in close contact with NATS to ensure we understand the situation and are offering them any assistance we can provide. Passengers have rights to care assistance from their airlines if flights are delayed or cancelled, including food and accommodation if the delay is overnight."

If asked about safety: "The CAA does not believe there are any immediate safety concerns, and are satisfied with how NATS are managing the situation. We are keeping in close contact with them throughout the incident."

More information on passenger rights can be found at www.caa.co.uk/passengers

10 December 2013

A CAA spokesperson, said:

"We have held senior level discussions with NATS about the technical failure on Saturday, which caused major disruption to passengers across the UK.

"It is important that NATS learns the lessons from this failure, so we welcome its major incident review and separate Board-led investigation. We will decide, in the light of those, if any further action is necessary.

"Meanwhile, we are actively considering broader questions of NATS' operational performance as part of the next regulatory settlement and will be publishing our proposals for the future regulation of NATS in early 2014.

"Saturday's events had a particularly serious impact at Heathrow, and this demonstrates once again how capacity constraints at that airport make it less resilient to disruption. We therefore welcome the work of the Airports Commission, which is currently examining the need for additional aviation capacity in the UK and look forward to their proposals."

B3. Factual Briefing to Customers – 9th December 2013

Published on NATS Customer Website and e-mailed to NATS' customer contacts (see B5).

Statement following Technical Fault at London Area Control – 7 Dec 2013

Following the incident caused by a failure of the Swanwick Area Control Ground-Ground Communications System on 7th December please find below a high level description of the system and actions taken to recover.

The incident

> In the early hours of December 7, computer disks became corrupted on two primary and one secondary servers supporting the ground-ground communications system. A spare server was fitted, but that too corrupted.

> The effect of the loss of this system is that were air traffic controllers to try to log onto a new workstation (i.e. to split sectors), it would not receive a configured ground-ground communications panel for the airspace sector they were due to control.

> At the time of the failure, the air traffic operation was in a night-time configuration (5 operational sectors open). The lack of ground-ground communications meant it was not possible from 05:00 to start splitting the airspace up into the additional 15-20 sectors that would be used on a typical day.

> The London Terminal Control and Prestwick operations are on completely independent communication systems and were unaffected by the failure.

System recovery

> Diagnosis of the fault and the subsequent restoration of the system had to ensure that the critical radio communications with aircraft were maintained throughout the incident. This was successfully achieved and there were no safety incidents resulting from this system failure.

> The fault was rectified by taking a fresh server and restoring known good software and data from a secure back-up. From the point that the fault was fully understood to the point at which it was certain the corrective action would not affect operations took six hours.

> Full functionality was restored to the Area Control operations room at 19:00. Additional sectors were then opened in a controlled manner. Note that since recovery we have successfully exercised combining and splitting sectors on a number of occasions with no issues.

Current status and improvement actions

> The server has functioned since with a hot-standby server available and further off-line backup units being created. Additional monitoring and supplier support is in place to further mitigate the risk of re-occurrence.

> System log files and the failed disk drives have been sent to the manufacturer for more detailed analysis to assess the exact cause of the triple failure.

> We have started investigations to get to the root causes of the failure and to identify any short, medium and long-term actions required.

NATS CEO, Richard Deakin, advised:

"Immediately after the incident, we launched our own major incident inquiry and our Board has also instigated, through our Technical Review Committee, an investigation led by the independent non-executive member of our Board and Chairman of the Airline Group.

Some of the comments over the weekend show that some parties believe our contingency was insufficient and instead we should be able to continue at 100% capacity in any eventuality. In addition to these measures, we believe it would now be to everyone's benefit for the CAA to conduct an open and transparent review to confirm:

> whether the level of contingency we have in place meets reasonable operational expectations at reasonable cost, or

> whether further measures need to be adopted, and if so

> how these further measures should be funded within the regulatory regime.

We are keen to do all we can at NATS to ensure the aviation industry has a full understanding of the capability that is in place in the UK and to take any further steps our customers and regulators decide are necessary to help avoid a repeat of last Saturday's problems."

Flight statistics for 7 December:

Our flight data shows that NATS handled a total of 3,764 flights on 7 December but we understand that airlines cancelled circa 300 flights. Overall delays exceeded 130,000 minutes.

Whilst the technical and operational contingency measures we have in place enabled us to maintain the operation, the reduction in capacity had a disproportionate effect on southern England due to its complexity and high level of flight demand and we sincerely regret inconvenience to our airline and airport customers and their passengers.

We will provide a further update on the results of investigation and lessons learned.

B4. Follow-Up Briefing to Customers – 17th December 2013

Issued by Andy Shand, General Manager Customer Affairs
Published on NATS Customer Website and e-mailed to NATS' customer contacts (see B5).

Lessons learned from 7 December 2013 NATS system failure investigation & impact on CP3 performance regime

As stated in previous correspondence and communications regarding the failure of the Swanwick Area Control Ground-Ground Voice Communications System on 7th December, NATS sincerely regrets the impact that the resulting delays had on your operation. Following the incident we wrote to you on the 9th of December with a brief overview of the incident, actions taken to recover the system and planned follow up actions.

As stated in the note, NATS has launched our own major incident inquiry and the Board has also instigated, through our Technical Review Committee, an investigation led by the independent non-executive member of our Board and Chairman of the Airline Group. When the conclusions of this investigation are available we will share these with you.

One of the findings from our initial investigation is that some of the capacity available by level capping and re-routing to avoid the affected airspace was not fully utilised by airlines due in part to the complexity in filing non-standard routes and levels. In addition there may also be other options available that could help mitigate the impact of reduced capacity but would likewise require flights to operate in a non-standard manner. We will discuss these options at the Operational Partnership Agreement meeting on 23rd January with the aim of setting up a joint working group to develop scenarios which are easier to deploy in future. If you are interested in joining this discussion or have your own lessons learned from the event on 7th December that you are willing to share with us, please feel free to contact me.

There have been some questions raised regarding the financial impact of delays caused by the failure on 7th December upon NERL via the CP3 service quality performance regime. Regulations were in place from early morning until 20:00, causing significant impact to customers, resulting in around 300 cancellations and total delay of circa 137,000 minutes. The level of delay was significant in the context of the delay terms in the CP3 performance regime and our current assessment suggests that the result will be a net reduction in revenue to NERL amounting to circa £7m. Prior to the event NERL was predicted to receive a performance bonus of circa £5 million for maintaining very low delays in 2013 but this will now translate into a penalty of up to £2m once the delay impact of 7 December on the CP3 terms has been taken into account. Under EU regulations, customers will receive a rebate of this amount through the unit rate in calendar year 2015 (following the n+2 system). The exact delay statistics and impact on the CP3 service quality regime are still being finalised and details of the resulting adjustment to the 2015 unit rate will be confirmed as part of the 2014 DfT consultation on UK charges.

Throughout the event NATS actively managed customer communications through the use of the Air Traffic Incident Communications and Coordination Cell (ATICCC) and communicating directly with customers and stakeholders. A separate lessons-learned exercise is being conducted related to the operation of ATICCC including some opportunities to improve customer calls but in general customer feedback on ATICCC has so far been positive. Again, if you have views on the communications via ATICCC we would be pleased to hear them as they can be fed into the lessons learned exercise.

B5. Customers and Stakeholders who received the briefings

> Airline and airport customers – NATS' main points of contact
> CAA
> DfT (ministers and officials)
> Network Management Board
> European Commission
> FAB partners
> Ministers
> MPs (transport select committee, all party group on aviation, opposition spokespeople, constituency MPs)
> Technical advisers to the Board
> Lenders/bondholders

B6. Statement on NATS Website for Wider Audiences – 9th December 2013

Posted on www.nats.aero/news

NATS welcomes calls for inquiry into UK airspace resilience

Responding to comments from certain airlines and MPs following Saturday's disruption to air traffic in the UK, NATS fully agrees that an inquiry into the level of contingency and resilience in UK airspace would be welcome and beneficial for all.

NATS Chief Executive, Richard Deakin, said:

"A public debate has started over the level of contingency NATS had in place for Saturday's issue. We delivered over 90% of an extremely busy schedule of flights during the day and recovered to normal operations in 14 hours. We had never seen this technical issue in over 10 years of operation at Swanwick, during which time over 20 million flights have been safely handled, with a service level among the best in the world.

"We believe this is an appropriate level of contingency that balances both a good level of service to our customers with an affordable level of cost for them to bear. As a regulated business, we also believe it is in line with our regulatory settlement.

"However, it was clear that the reduction in our service had a significant impact on our customers and the flying public. This is something we deeply regret and are determined to do all we can to avoid it happening again.

"Immediately after the incident, we launched our own major incident inquiry and our Board has also instigated, through our Technical Review Committee, an investigation led by the independent non-executive member of our Board and Chairman of the Airline Group, Peter Read.

"Some of the comments over the weekend show that some parties believe our contingency was insufficient and instead we should be able to continue at 100% capacity in any eventuality. In addition to these measures, we believe it would now be to everyone's benefit for the CAA to conduct an open and transparent review to confirm:

> whether the level of contingency we have in place meets reasonable operational expectations at reasonable cost, or
> whether further measures need to be adopted, and if so
> how these further measures should be funded within the regulatory regime

13. "We are keen to do all we can at NATS to ensure the aviation industry has a full understanding of the capability that is in place in the UK and to take any further steps our customers and regulators decide are necessary to help avoid a repeat of last Saturday's problems."

B7. Report to the Transport Select Committee

Text from a letter sent to Louise Ellman, Chair of the Transport Select Committee
from John Devaney, Chairman NATS
13 January 2014

Introduction & Summary

First and foremost we very much regret the disruption caused to our customers and their passengers. Fortunately events such as this are extremely rare and our systems and procedures are designed to specifically minimise the probability and impact of a technical failure. The last time major disruption occurred through a NATS technical failure was in 2008, and the impact on that occasion was less than half that experienced on 7th December. While the specific root causes of the failure are still the subject of a NATS investigation, be assured that the consequential impacts are sufficiently understood such that technical and operational changes have now been made to ensure that this incident will not reoccur.

In order to provide a degree of context, the NATS average delay as measured through our regulatory regime was approximately 5 seconds per flight for the UK in 2013. This includes the delay accrued on the 7th December. For 2013, our regulatory target value was 8.5 seconds, and the European average performance was around 30 seconds delay per flight.

I would like to reassure you that in keeping with our primary responsibility safety was maintained at all times during this event. Indeed, the reason for the reduction in airspace capacity on the 7th was to limit the flow of traffic through our airspace to maintain safety which is, and always will be, NATS' first priority.

During the failure, NATS handled over 90% of the normal traffic demand for the day, albeit with significant delays to some customers. NATS staff worked throughout the day to recover the operation with as little impact to traffic as possible. Although a drop in capacity of 10% sounds fairly minor, it is worth noting that in the busy UK airspace this is the equivalent of handling 400 less aircraft on a relatively quiet day.

NATS maintains a significant level of resilience within our operation. This level is agreed through consultation with customers and approval by the regulator. We believe the current level off resilience strikes the right balance between operational assurance and cost.

Additional resilience over and above the levels we currently have would require increased funding by the airlines through the regulatory mechanism under which NATS operates.

NATS is not seeking to make new proposals different from our business plan submitted to the CAA in the last quarter. However, given the events of 7 Dec, we are keen to re-confirm that our customers and the regulator are satisfied that these resilience levels are still appropriate.

Further Detail

Cause: The failure on 7th December was of the Technical Monitoring & Control System (TMCS), a significant element of the Voice Communications System (VCS) for Area Control at Swanwick. The VCS system comprises over a million lines of software code and hardware installed in over 300 air traffic control workstations   The TMCS sub-system is an older component of the NATS infrastructure and was, in any event, due to be modernised in early 2014. The configuration of this part of the system comprises of a main server and a hot backup server which takes over in the case of a failure of the main server. An additional third server is preloaded with software and configured for use in the case of a failure of the main and backup failure. This level of resilience is standard practice in mission critical ATM systems worldwide and reduces (but does not eliminate) the likelihood of a total sub-system failure to a low level (typically less than one occurrence in 5 years). This resilience has ensured that any hardware failures within this sub-system have been fixed quickly using standard procedures and without impact to operations. However, on this occasion, the failure mode and associated recovery was significantly more complex and time consuming.

The system failure occurred as a result of a file corruption in the primary server that was transferred to the secondary server. The spare server, which is used to mitigate hardware failure, also failed as it was also affected by the same file corruption and hence it could not take over in the designated way.

The nature of the failure meant that Swanwick Area Control could not split sectors out from their night time configuration to support normal daytime operations without loss of essential ground-ground voice communications functionality, a key support to normal operations.

NATS' Response: Initially the failure was tackled using normal processes and procedures which have been successful in the past. Once it was clear the failure would not be fixed in this fashion, the issue was immediately escalated to the more senior technical specialists both within NATS and our technical supplier. This escalation commenced in the early hours of 7 December before the arrival of morning traffic flows. In parallel it was escalated through the NATS management chain, including the NATS Board, and by the instigation of the Air Traffic Incident Coordination and Communication Cell (ATICCC). This stakeholder forum includes the DfT, CAA, airlines, airports, neighbouring air navigation service providers and Eurocontrol. This communication vehicle was used almost hourly to inform those stakeholders of the latest progress. In addition our communications team used a range of media to keep the travelling public updated on the evolving situation. The technical experts from both NATS and the supplier organisation were involved throughout the course of the day and are continuing to work together to investigate the root cause. During the course of the day, over 100 additional engineers and specialist supported the effort to restore the system.

In order to ensure the safety of the operation, standard procedures were applied to restrict the flow of traffic and ensure that this could be effectively handled within the available sectors. NATS worked with customers and adjacent agencies with the objective of maximising the traffic that could be handled, e.g. through re-routes and level caps, although not all of these opportunities were taken up by customers. Initial attempts by NATS Engineering to repair the failed server proved unsuccessful and it was necessary to build an entirely new server. This solution was confirmed at around midday and full functionality was restored by 18:35 and all capacity restrictions lifted by 19:20.

It is worth noting that in any failure scenario NATS applies a principle of safeguarding the existing operation to ensure that no attempt to resolve an incident could lead to either a further reduction in capacity or a compromise of safety. In practice this means that restoration of the service is done in a highly rigorous and carefully planned manner which has an unavoidable impact on the speed of recovery.

The root cause of the software failure is still being investigated and all results shared and discussed with the CAA. The system is functioning normally, and with additional spares and back-ups in place to ensure resilience and minimise on-going risk.

Impact: Flow-restrictions were in place from early morning until 20:00. While more than 90% of the operation was maintained, it still caused significant impact to customers, resulting in around 300 cancellations, 1412 delayed flights and total delay of 126,080 minutes – an average of 33 minutes' delay per flight.

Compensation: Section 10(1) of the Transport Act 2000 outlines the statutory immunity NATS is given from claims of compensation that arise from decisions NATS has to take to ensure safety of operations (such as the decision to reduce capacity while the full system was being recovered). The legislation can be found here: http://www.legislation.gov.uk/ukpga/2000/38/section/10

However, NATS is still held to financial account for our performance. NATS is subject to a regulatory performance regime which includes a financial bonus or penalty depending on whether our delay performance is better or worse than the established targets. The level of delay on 7th December was significant in this context and our current assessment suggests that the result will be a net reduction in revenue amounting to circa £7m.

Prior to 7th December, NATS was predicted to receive a performance bonus of circa £5m for maintaining very low delays in 2013 but this will now translate into a penalty of up to £2m once the delay impact of 7th December on the performance terms has been taken into account. Under EU regulations, airlines will receive a rebate of this amount in 2015 through the unit rate they pay for air traffic services.

The exact delay statistics and impact on the performance regime are still being finalised and details of the resulting adjustment to the 2015 unit rate will be confirmed as part of a Department for Transport consultation on UK charges later this year.

Future Risk: The specific cause of the system corruption that resulted in the failure is still under investigation. However, changes have been made to prevent similar corruptions being copied to the hot standby and spare units in the Technical Monitoring and Control System (TMCS) component of the Frequentis VCS. NATS has also created additional spares and backups to help

manage any future failures more rapidly. The already planned enhancement of this component remains on track to be deployed into operation prior to summer 2014.

These measures are in line with NATS' approach to resilience which is to seek to minimise the likelihood of failures and the impact on service when they occur, rather than attempt to prevent all failures (i.e. total resilience).

Immediately after the incident, we launched our own major incident inquiry and I instigated, through our Technical Review Committee, an investigation led by an independent non-executive member of our Board, supported by other non-executive directors and external technical advisers.

Follow-on actions: A number of short and longer term actions are in the process of being identified and are being worked both within NATS and with our customers and regulator as a result of this failure in order to:

> Further reduce the risk of similar failures.
> Further improve our engineering, operational and communications response to failures.
> Agree procedures to increase customer use of alternative routes and level caps.
> Review our agreed resilience levels with customers and regulator to assess the appetite for further investment to guard against similarly rare but highly disruptive events.

Appendix C
ATICCC Coordination with Customers

C1. ATICCC Communications Log – 7th December 2013

Time	ATICCC Event	Communication Summary
05.47	Decision taken to convene ATICCC	
06.25	ATICCC convened	
06.30	Text ATICCC convened	N/A
07.00	Email to Customers	NATS ATICCC has been activated following a technical fault at Swanwick Area Control. Regulations have been applied until the fault can be resolved. A Teleconference will be held at 0725z, [contact details removed]
07.01	Initial update issued on website	Due to a technical problem at Swanwick we are currently experiencing some difficulty switching from night time to daytime operations. This has limited the ability to split the control sectors within London En- Route.
07.16	Text sent to Customers	NATS ATICCC has been activated following a technical fault at Swanwick Area Control. Regulations have been applied until the fault can be resolved. Teleconference at 0725z
07.25	ATICCC Conference Call Website Update Also emailed & text update to customers	Regulations have been applied to Clacton & Daventry (combined), Lakes & North Sea (combined), West and South - in place until 1400z. Additional staff have been brought into FMP, who will apply re-routes and level caps into London Terminal Control and Prestwick to manage the impact to London En-Route. Prestwick and London Terminal Control are fully staffed. Eurocontrol are recommending re-routes to avoid London En-Route. There is additional capacity available in London Terminal Control for eastbound flights out of London Airspace; please call FMP to identify possible re-routes.
9.15	ATICCC Conference Call Also emailed and text update to customers	Regulations remain in place for Clacton & Daventry (combined), Lakes & North Sea (combined), West and South. There is capacity available in London Terminal Control for eastbound or northbound flights out of London Airspace prepared to take level caps; please call FMPto identify possible re-routes. Western Radar is available to provide an ATSOCAS service through Class G airspace; please call FMP to identify possible re-routes. There are currently no airport regulations for inbound flights, however, En-Route regulations may affect inbound flights.
1130	ATICCC Conference Call Also emailed and text update to customers	The problem is related to the internal telephone system used by our air traffic controllers. Because of the problem with the internal telephone system, it was not possible to open the additional control positions this morning, resulting in a significant reduction in capacity in some areas of UK en route airspace. There is still additional capacity available in London Terminal Control for eastbound or northbound flights out of London Airspace prepared to take level caps; please call FMP. There is still additional capacity available through Prestwick airspace and for northabout Atlantic traffic; please call FMP. Please update Off-block times to ensure efficient code usage We now understand what the problem is and our engineers are working hard to rectify the issues as quickly as possible.

1315	ATICCC Conference Call Also emailed and text update to customers	NATS Engineering confirm they have identified the problem with servers that support telephone comms between controller positions. The first of the two servers has been rebuilt and is being configured but not expected operational until 1730- 1830 UTC. Flow rates have been extended on Swanwick sectors to 2000. FMP advise that all flights departing after 1600Z will require a Flight Confirmation Message to ensure that the network systems have an accurate picture of demand. DNM will issue an AIM message to that effect. Additional capacity is available by level capping on some routes & London Military can offer service outside controlled airspace. Contact FMP if you wish to use this service as flights can be excluded from the regulations. Airfields report no issues with airborne holding. Next ATICCC Call 1515Z [contact details removed]
1515	ATICCC Conference Call Also emailed and text update to customers	NATS ATICCC update 1515Z. engineering advise they expect the first of the two comms servers to be operational at circa 1800Z. FMP have confirmed that the Flight Confirmation Message will NOT now be required at 1600Z. The next ATICCC Customer call is at 1645Z [contact details removed].
1715	ATICCC Conference Call Also emailed and text update to customers	NATS ATICCC Update 1715Z. The system fix is being implemented though we are seeing some unanticipated changes to the panel configurations. There is a workaround in place but we have further reduced flow by c.15% in order to manage controller workload. Next ATICCC call will be at 1830Z [contact details removed].
1930	ATICCC Conference Call Also emailed to customers closing ATICCC	NATS ATICCC Update 1930Z 7 Dec. The system fix has been deployed and splitting / band-boxing of sectors has been confirmed to be working normally. Regulations have started to be stepped out of with immediate effect. ATICCC is now in the process of being closed down. If you have any issues with individual flights please contact UK FMP as normal.

C2. Organisations Subscribing to ATICCC Alerts

AAIB	Cathay Pacific	Heathrow Airport	Ocean Sky
Abertis Airports	Cega Group	Highlands & Islands Airports	Office Depot
ACL	CHC	Honeywell	OryxJet
Acropolis Aviation	Citation Air	IAA	Oxford Airport
Aegean Air	CityJet	IATA	PenAvia
Aer Lingus	CNL	Iberia	PremiAir
Aero Bombardier	CoAir	Icelandair	Prestwick Airport
Aero Service	Concierge Aviation	Infratil Airports	Projet Aviation
Aeros	CSA	IOM Airport	Qantas
Air Astana	Defence Forces	Jeppesen	Qatar
Air Berlin	Delta	Jersey Airport	Reyesholdings
Air Canada	DfT	Jet Aviation	RJ
Air Charter Scotland	Disney	Jet2	Rockwell
Air France	EASA	JetClub	RVL Group
Air India	East Midlands Airport	Jota Aviation	Ryanair
Air India	Eastern Airways	Juno	SAA
Air Malta	EasyJet	KLM	SAA
Air New Zealand	Edinburgh Airport	Leeds Bradford Airport	SAS
Air Tanker	Eidelweiss Air	Leicester Airport	Saudia
Airbus	Embraer	Loganair	SBC Global
Airdispatch	Emirates	London City Airport	Southampton Airport
Alitalia	Enniskillen Airport	Lufthansa	Southend Airport
Alticor	ERAA	Lufthansa System	Stansted Airport
American	Ethiopian	Luton Airport	Suckling
AmiriFlight	Etihad	Lydd Airport	Swiss
ANA	Eurocontrol	Malaysian	TAM
Atlantic Airlines	EuroManx	Manchester Airport	Thomas Cook
Aurigny	EvaAir	Manston Airport	Thomson
Austrian	Execujet	Marshall Executive	Titan Airways
BA	FAA	MasterJet	TransAero
BA CityFlyer	FairOaks Airport	MEA	Transport Scotland
BAE	Farnborough Airport	Menzies Aviation	TUI
BALPA	Fedex	Met Office	TUIfly
Belfast	Finnair	Met Police	Turkish Airlines
Belfast City Airport	Firstdata	MIAAir	United
Biggin Hill Airport	Flair-Jet	Mist	UPS
Birmingham Airport	Fly Zoom	MoD	US Air Force
Blackpool	Flybe	Monarch	US Airways
Blue Yonder	FlyGFS	MyTravel	USS
Bond Helicopters	Flylea	NanshanJet	VIH
Bournemouth Airport	Fraport	NBAA	Viking UK
Bristol Airport	FWZ	NCA	Virgin Atlantic
Bristow	GAMA	Netjets	VLM
Brussels Airlines	Gatwick Airport	Newcastle Airport	Wizzair
CAA	Glasgow Airport	Newquay Airport	Worldwide Jet
CAA ERG	GSSAir	Norwich Airport	WSAviation
Cambridge Airport	Harrods Aviation	NTASA	Yemen Airways

C3. Log of Traffic Management Actions on 7th December 2013 to Minimise the Impact of the Disruption

This log is reproduced to show the nature and extent of the activities carried out. Accordingly, technical terms are not explained in all circumstances.

Time	Action Taken
04:10	Current traffic demand indicated a requirement for the following number of sectors to be available by 06.30 - 4 between North and East, 3 on West, 2 on Central and 3 on South.
04:45	Further investigation had shown that the situation was now considered to be much more serious and the requirement to remain in night mode operation therefore regulations would be required.
	TC/PC/Shannon all advised that additional re-routing of traffic would be required. British Airways advised.
05:30	9 flights re-routed via Scottish sectors to avoid Lakes/North Sea (LKN).
05:35	Regulations applied to LKN, Daventry/Clacton (CTY), West and South. The actual flow rates modified to achieve a level of demand that the combined sectors could handle safely and efficiently.
	Following rates were applied; (flights per 60 minutes) LKN 35/60; CTY 53/60; West 30/60; South 50/60
05:50	A decision was made to start to utilise the TC/PC capacity once the morning shift came in in 40 minutes. This would also provide time for the rates to settle down and to see if the rates were right given that they had only recently been applied.
	Concern regarding demand in South therefore South regulation reduced to 45/60.
06:30	Now AM shift in seat conversations were had with some Airline Operators (AOs) regarding utilising low level airspace within TC Midlands and TC East. LAS W2 (at PC) proactively identified traffic that could be contained with PC airspace by virtue of restricting the cruising level of the flight.
	Early AIM was considered regarding the availability to fly at FL200 or below in TC East however had to be discarded due to potential significant shift in demand and threatened additional regulations in TC and Amsterdam.
	CFMU asked to contact Amsterdam and Brussels to highlight the probability of AOs level capping.
06:50	ATICCC Chair requested review of regulations specifically possibility of moving from global rates to combined rates which could reduce delay further. Throughout the morning FMP constantly reviewed regulations to maximise capacity, manage workload and reduce delay impact.
07:00	Request for ATICCC Chair to dial into BA Silver Team call. BA seeking status update on technical failure and possible duration.
07:25	First external customer teleconference. Advised problem being investigated and resolution sought. Airlines requested to use customer website for most up to date information. Advised next call would be 90 minutes.
07:55	Review of all regulations resulted in increase of the South flow rate to 49/60.
07:30-08:00	Numerous discussions held on other ways of improving traffic situation including use of Western Radar in Class G, further use of TC and PC airspace, deactivation of Danger Areas and other assistance that Military could provide. Instigated these options. Also during this time Engineering confirmed (again) that we must maintain the current configuration and could not confirm the behaviour of the original sector if a split was attempted.
08:09	CFMU issued an AIM requesting westbound oceanic flights to avoid London airspace wherever possible.
08:20	Constant review of regulations which resulted in increase of the West flow rate to 34/60.
09:00	FMP updated current delay (mins) at; LKN 19,113 CTY 54,176 South 66,481 West 13,933
	Continuing conversations being had with AOs regarding flight level capping and Manchester TMA (MTMA) into North Sea (NOR) airspace excluded from the regulation.

Time	Action Taken
	Request at teleconference to contact CFMU regarding re-route advice. PC advised that Danger Area in Hebrides was being deactivated (with the exception of D701A) to allow additional westbound tracks to be published. Additionally the Oceanic South East Corner was seeing excess demand but following analysis by the Oceanic Area Control Centre (OACC) at PC, traffic was moved onto Oceanic Entry Point BEDRA to balance out the loading – the FAA was advised.
09:15	Second external customer teleconference. Customer advised that other options available; Western Radar would be available, level cap in TC airspace to exit UK, additional airspace in PC and major Danger Areas deactivated.
09:20	Increase in West flow rate to 36/60.
09:30	Western Radar operational. Further conversations with Military who offered to bring in extra staff and offered to provide a service to civil aircraft on 121 co-ordinations. FMP and Ops team aware.
10:00	Elected to change the regulation configuration from global rates to combined rates to better manage the demand and complexity of traffic. Regulations were applied to Dover sector (DVR) 16/60 Lydd sector (S17) 14/60 and the Hurn sector (HRN) 16/60 and the South regulation was cancelled. Additional short term measures were applied to manage demand through the Seaford sector (S18). To ensure that demand on the South group was effectively controlled an additional regulation was applied on S18. The result of the regulation change was a net reduction in delay.
10:50	Regulation applied to the Lakes sector (LAK) at 24/60 and NOR sector at 21/60 so that LKN global rate could be cancelled at 1120. Associated delays further reduced.
11:30	Third external customer teleconference. Encouraged AOs to use capacity in TC level caps. Also requested that if any priority flights to inform FMP so they could assist. Confirmed that no airport was being regulated inbound or outbound and all affected by same enroute regulations (see Appendix B for further information). Discussed plan to cancel the CTY regulation and utilise Clacton sector (CLN) and Daventry sector (DTY) regulations instead however due to high demand at opposite ends of this large piece of airspace it was decided to put this plan on hold for the time being. This would be reviewed again later in the day.
11:40	All regulations now extended until 20.00 and CTY reduced to 53/60 due to demand and complexity caused by some AOs applying unusual routings.
12:00	Staffing issue identified regarding validations mix for later in afternoon due to current configuration. Manning options explored and issue resolved.
13:55	CTY regulation reviewed and subsequently cancelled with regulations applied to DTY at 15/60 and CLN at 35/60.
14:15	West regulation cancelled and regulations applied to BCB at 22/60 and BSLU at 32/60. These are alternative regulations that control demand through the West group whilst minimising delay.
14:30	LAK and NOR regulations cancelled as demand through the group is now low enough to no longer require regulation.
15:37	LAS W2 at PC identified further 10 flights that could operate at FL180 below AC airspace. All AOs had already been advised of the option to re-file and had not yet amended their flight plans to take up this option.
15:50	British Airways asked for assistance on three flights which were experiencing flight planning issues and still subject to regulation. Assistance provided.
16:03	All current regulations extended until 2359.
18:08	Three flights re-routed from the Channel Islands to the Solent area and Gatwick.
20:00	All regulations now cancelled.

C4. Log of Flow Management Position (FMP) Actions on 7th December 2013

This log is reproduced to show the nature and extent of the dialogue with airlines, airports and the Eurocontrol Network Manager (DNM). Similarly, technical terms are not explained in all circumstances.

Time	Area	Tactical Commentary
0600		Night time configuration in place due technical issues with the telephone system. CTY 55/60 LKN 35/60 WEST 30/60 SOUTH 45/60
0630	CENTRAL	EGBB given TONB due to short period of high demand on LMU
0630		Initial conversations with AOs regarding utilising low level airspace within TC Midlands and TC East. LAS W2 extremely proactive in identifying traffic to get out of the regulations. Consideration given to level capping scenarios, but not applied given their limited scope - early AIM considered regarding FL200 into TC East but concern that this could lead to regulations in TC and Amsterdam. CFMU asked to contact Amsterdam and Brussels to highlight the probability of AOs level capping.
0809		CFMU issued an AIM requesting oceanic flights to avoid London airspace wherever possible.
0900		Teleconference - current delays LKN 19,113 / CTY 54,176 / SOUTH 66,481 / WEST 13933 continuing conversations with Aos regarding level cappint and excluding from regulations - MTMA into NOR put on MDI 1/4 and excluded from the regulation. Request at teleconference to contact CFMU/VIR/BAW/BEE regarding re-route advice. PC advised that EGD701 complex was being cancelled with the exception of D701A to allow additional westbound tracks to be published. Additionally the SEC was seeing excess demand but following analysis by OACC, traffic was moved onto BEDRA to balance out the loading - FAA advised.
1050	LKN	Elected to apply EGLAK @ 24/60 and EGNOR @ 21/60 - LKN cancelled @ 1120 - associated delays reduced markedly.
1140	CTY	All regulations extended until 2000 and CTY reduced to 53/60 due demand and complexity caused by some AOs applying unusual routings. Consideration given to utilising the FCM on all regulations from 1600 to ensure good data is available.
1200		AIM issued by CFMU relating to capacity in TC East and TC Midlands - this was requested by ATICC earlier, but we were swamped and unable to issue the AIM.
1220	OACC	CFMU asked to issue an AIM on behalf of OACC to clarify oceanic picture.
1300		Reviewing the morning - 60+ flights appear to have been excluded from the regulations for various reasons - multiple phone calls advising Aos of solutions to regulations. Profiling issues at UK boundary and into CTY appear to have been a problem and need reviewing asap. In the case of traffic level capping into TC airspace and exiting through REDFA, a speed/level change at that point is still back profiling into S12 and therefore being caught by the EGCTN reg. Not sure whether this is usual for ENV, or if there's a capture problem with EGCTN
1537	W2	W2 listed 10 flights that could be happily accepted at FL180 north/southbound - all flights/operators have already been advised of the option to refile and have not yet amended plans. EGHI advised to inform the crew on contact. Just looking at these 10 flights alone, 1,070 minutes could've been saved had these refiled earlier
1550	INFO	BAW ask for assistance on three flights; with two of them (BAW69V and BAW297) they're going on EGLL WOBUN departures so the max FL180 until TNT should work. However, BAW297 has filed as such (with FL200 at TNT) but has still been caught by the EGDTY reg. Either the ENV capture is wrong or the ENV is profiling the level changes in advance of the point where the change is filed.
1603	ALL REGS	All regulations extended until 2359
1808	HRN	3 JB/JJ TO KK/HI FLIGHTS EXCLUDED (FL120) SAVING 750+MINS

Time	Area	Tactical Commentary
1920		Now able to split bandboxed sectors. South can open 3 positions. DTY & LKS able to split.
1925	EGS18	CAP +
1925	EGDVR	CAP +
1925	EGLYD	CAP +
1925	EGHRN	CAP +
1930	EGBCB	CANX no requirement for step out due low demand
1930	EGBSLU	CANX no requirement for step out due low demand
1940	EGDTY	CAP:+ Sector now split from previous bandboxed config. Rate increased with view to canx
1940	EGCLN	CAP:+ Sector now split from previous bandboxed config. Rate increased with view to canx
1955	ALL REGS	All remaining regs on South, East & North canx
		Numerous flights excluded from regs by routing through TC airspace. Eastbounds advised to file FL210 til REDFA, N/Bounds adv to cap at FL180 til POL, EIDW to LTMA adv to cap at FL190 via LIFFY, EGHI/HH/KK to/from EGJ* adv to route ORTAC-SAM below FL120. Total mins reduced throughout the afternoon from approx 180,000 to approx 144, 000 through exclusions and cancellations of slots due to the suggested re-routes and level caps.

Appendix D
Independent Assessment of the Engineering Response

D1. Summary of Technical Findings in the TRC Report to the NATS Board – March 2014

Summary of observations by the TRC's technical systems expert

Names of individuals and commercial information have been redacted [marked in square brackets]

Issue	Observation
What failed & how?	The Comms PC could not communicate with the Server due to corruption of the [network] load files in the Server. Therefore the Comms PC failed to boot.
How did it present?	Nothing would communicate.
How many systems were upgraded?	20, but only the TMCS upgrade was relevant.
Was TMCS being upgraded?	Minor software upgrade. Principally changes for the [reason]. These changes didn't cause the problem.
Were there SOPs?	Yes, very detailed, and they were followed.
Was TMCS isolated?	After it failed, yes.
Are staff trained?	Yes, the engineers were TEAM B rated.
How many staff are authorised?	Five. If there were more it would be hard to sustain their recency.
Experience of previous failures?	A number of unexplained, minor problems since April. One more serious failure, which appeared similar to this one, but TMCS had recovered.
Who was in charge?	[Supervision chain in original report not reproduced here]
Are the steps logged?	Yes.
Is the log useful for subsequent analysis?	Yes, but some of the logs were deleted when disks were used as extra backups. Nevertheless, the steps taken and the failures are now understood.
How are failures managed?	Standard procedures followed if the system does not recover automatically.
Differences/Similarities?	The one previous case was similar but the system recovered.
What is a simple recovery?	One in which following procedure leads to the system recovering. This is good practice. If it recovers, the fault should not propagate. However, this fault had already propagated to all disks, including backups.
System architecture?	Hot standby, dual links: clients – servers with mirrored disks – link PCs – comms PCs – switches (phone/radio).
Is TMCS fit for purpose?	It is old, fragile and slow because of limited memory and slow machines. It is due for replacement. The current upgrade should increase resilience markedly.
[Commercial questions]	[not reproduced here]
RAID technology? (Redundant Array of Independent Disks)	No, mirrored disks.
Was the severity of problem understood?	Yes, and its implications, which were that bandboxed configurations could not be split out.
SOP for recovery?	Yes.

Issue	Observation
Control of recovery process?	Until 0340 [engineer team names not reproduced]. Then Engineering management with ATC management.
Was escalation procedure clear?	Yes. Decision to escalate was Engineering Service Manager's. He works closely with Operations Supervisor. It worked as planned.
Frequentis role?	They were on the case, with the ADA from 0800. They advised on the recovery procedure – go back to the April image and apply adaptations; provided the image.
Sufficient resources?	Yes, more engineering heads would not have helped.
Right resources?	Yes, TEAM B rated [detail not reproduced here]
Options considered?	Initial recovery attempts followed procedure until everything had failed. The engineers were not allowed to do anything else. Subsequent recovery depended on reloading and updating the April image. Other options such as Contingency were considered but rejected as they would have made the situation worse for longer.
Decision on escalation.	The ESM waited until the engineers had exhausted all possibilities. Then, when the Ops Supervisor [highlighted traffic impacts], he escalated. 0340 was a reasonable time. They had until 0500, given the traffic.
Course of action?	It was safe, timely, effective eventually. The time taken could probably not have been materially reduced.
Sequence of splitting out?	Operations Supervisor's decision. They tested on military first.
Were customers consulted?	Continual customer communication but the decisions were NATS'.
Could failure have been anticipated?	In theory, but the unexpected continually arises. If they had always tested booting cloned disks, they would have known, but it had run for many years without.
Changes planned?	New configuration with iPos terminals. All newly built disks to be boot tested. Comparable systems checked.
Will remedial actions be effective?	New configuration should be highly resilient. Reduced dependence on TMCS.
Will impact be mitigated?	Yes, because there will be multiple levels of fallback and because of the shorter time to reload iPos. If both iPos terminals and both TMCS servers fail, a new iPos terminal can be installed in 15 minutes.
Other systems with similar vulnerability?	Flight Plan Suite Automation System has similar architecture. There may be other systems with dissimilar architecture but comparable vulnerability. NATS Engineering is working on resilience generally.
Anticipated level of resilience?	Varies by system. Not fully investigated: this exercise has focused on TMCS. No systems are safety-critical except ILS.
Resilience measures appropriate?	Principally resilience relates to protection against hardware failure: replication of CPUs, disks, networks, etc. Less attention appears to be given to the risk of software failure or file corruption, which are harder to protect against and recover from. However, many systems are old and have been running satisfactorily for many years. The risk is lower but evidently there.
Are system failures properly reported?	Yes. There is a good culture of following up on failures. Analyses have been detailed and frank.

Appendix E
Evidence of Historic System Resilience Levels

E1. Engineering Delay Performance since 2009
as an indicator of whether risk management has been effective

Each year there are approximately 12700 unplanned engineering events. These span a wide variety of engineering activity that ranges from minor faults, through to major incidents. Examples include a cooling fan failure on a computer rack, a password reset, a fire alarm at a radar site and the TMCS failure in 2013. Due to the nature of the system architecture and the other proactive resilience barriers put in place, almost all (99.8%) are quickly resolved without any adverse impact on customers. Some are more challenging to address and fewer still lead to any service impact or customer delay.

The list below shows every engineering incident that has resulted in delays to flights in the last 5 years up to 7th December 2013. These represent the events where 'resilience barriers' were not effective in avoiding an impact on customers. However, in many cases, the 'reactive barriers' are effective in mitigating and resolving the situation quickly such that resultant delays are kept to a low value as shown in the table.

Engineering Events Causing Delays

Date	Delay (mins)	Cause
12 March 2009	191	AC Sector 25 Bandbox / Split difficulties
14 March 2009	547	LL frequency problem
20 March 2009	1,861	LTC VCCS failure
21 March 2009	885	LTC VCCS failure
14 August 2009	866	SS frequency problem
03 October 2009	1,193	SAATS failure
15 January 2010	20	Lowther Hill radar failure
15 March 2010	1,619	NODE DSC inadvertent switch off
24 April 2010	512	Telephone outage – BT equipment at Ealing
21 May 2010	1852	Debden radar
29 June 2010	17	Stornoway radar RoJo / encoding issues
26 July 2010	218	Cable & Wireless bearer failure
17 August 2010	588	Debden radar (planned change)
15 February 2011	17,561	EFD at PC
29 March 2011	170	NAS adaptation
3 August 2011	121	triple WFD failure
8 August 2011	8,813	FPRSA
27 September 2011	937	FPRSA
4 June 2012	1,098	SAATS
7 July 2012	2	Triple WFD failure
9 July 2013	6,631	iFACTS
TOTAL DELAY	45,702	

The TMCS failure on 7 December 2013 caused 126,080 minutes of delay.

The contribution of engineering delay to NATS' overall average delay per flight (T1 regulatory performance metric) over the period is as follows:

Year	Engineering Delay Contribution to T1 (seconds per flight)
2008	1.70
2009	0.25
2010	0.16
2011	0.80
2012	0.03
2013	3.60 (of which the incident on 7 December caused 3.51 seconds)

The data shows that NATS' engineering system has delivered a good level of performance overall (until this event). It was also significantly better than performance achieved during the early part of the last decade when failures creating high levels of delay were much more commonplace.

This performance has been achieved by a combination of factors including improved equipment reliability and a closer method of working between ATC and Engineering teams which allows NATS to better manage the impact of failure. The overall strategy has been to focus holistically on the barriers that prevent failures, those that make them less likely, and also those that are reactive such that they make them less severe.

Reporting, Investigation and Corrective Action

Each incident where 'resilience barriers' were not effective in avoiding an impact on customers is investigated and specific measures taken to reduce the likelihood of re-occurrence. These include, for example, changes to system design, changes to support arrangements and new procedures to reduce the effect or rapidly recover if failures occur.

For every event that actually, or could reasonably have, increased safety risk, caused a delay or was otherwise out of the ordinary, a report is created, reviewed, classified and appropriately investigated. This occurs around 25 times in a typical year for unplanned engineering events.