**Twenty Ninth Meeting of the
Informal South Pacific ATS Co-ordinating Group
(ISPACG/29)**

**Santiago, Chile
4-6 March 2015**

Agenda Item 6 - Other Business

Managing Google Balloon Operations in NZZO FIR

Presented by Airways New Zealand

SUMMARY

This paper provides information on a message set that is being implemented between Google Operations and Airways New Zealand to manage Google Balloon operations in the NZZO FIR.

1. INTRODUCTION

1.1 Google balloon operations normally take place above the NZZO oceanic FIR but we need to manage the situation where an emergency or planned cut-down of a balloon occurs, Google operations request descent for a balloon into controlled airspace to allow maneuvering, or Google operations advise that they have lost communications with a balloon that will cut-down automatically in 6 hours.

1.2 With the large number of balloons that may be launched Airways Airways are in discussion with Google to implement a message set that will be used to manage Balloon operations.

2. DISCUSSION

2.1 Google and Airways will exchange messages via the Amazon Simple Queue service. To send a message to Airways, Google will format the SQS message using whatever format is agreed for the SQS service to encapsulate the messages described in this document, and submit the message to an SQS queue. A gateway server at Airways would be notified of a pending message, and would then retrieve the message. The message is delivered to our AFTN switch then via AFTN to the OCS ATM system. Conversely, if a message is sent from Airways to Google, it is sent to our gateway server which would then submit it to an SQS queue for pickup by Google.

2.2 The message set will support the following loon scenarios:

a) Advice is received that a Loon is in an uncontrolled descent from its current float altitude to sea level

b) Advice is received that a Loon termination is being requested.

c) Advice is received that a controlled entry to the Oceanic CTA is requested to a lower level of F500 with the expectation that the Loon will leave the CTA climbing above F600 in the future.

d) Advice is received that communications have been lost with a Loon and that the balloon will automatically terminate in 6 hours.

2.3 Google Loon operations will be responsible for notifying OCS operations of any Loon balloon that is expected to enter the Auckland Oceanic CTA in descent from its float altitude. Only Loons expected to enter the CTA will be notified.

2.4 The message format used for messages will be based on existing ICAO formats defined in ICAO PANS-ATM Doc 4444 to facilitate processing by OCS and minimise software development. New message designators LRQ (Loon Request), LRS (Loon Response), LRP (Loon Report), LAK (Loon Acknowledge), LDK (Loon Dark), and LTE (Loon Terminate), will be used to specify the different messages.

2.5 Existing ICAO field definitions from ICAO PANS/ATM Doc 4444 are used where possible. However, two new fields have been created to support Loon operations: Field 11 specifying current position, time, and level; Field 12 specifying clearance information regarding entry to controlled airspace.

2.6 A brief description of the messages is as follows:

a. The LRQ (Loon Request) message will be used to request a balloons entry into the CTA from its float level above controlled airspace.

b. The LRS (Loon Response) will be used to indicate either a clearance or denial for entry to the CTA in response to a LRQ message from Google.

c. The LRP (Loon Report) message will be used to provide updates on any balloon entering the CTA. This may be an uncontrolled descent, a controlled and approved cut down, an approved entry into the CTA with the intent of subsequently leaving the CTA to a float altitude above, or an unapproved entry into the CTA.

d. The LTE (Loon Terminate) message will be used to indicate that a balloon has landed or vacated controlled airspace above F600 and the airspace reservation can be cancelled.

e. The LDK (Loon Dark) message will be used to indicate that communication has been lost with a balloon. It will provide position, time and flight level for current position, cut-down position, and one hour post cut-down.

f. The LAK (Loon Acknowledge) message will be automatically sent by OCS on receipt of a valid LRQ, LRP, LDK, or LTE message.

2.7 Details of the message formats are attached.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) Note the information in this paper.

Attachment 1: Google Message Set

Attachment 1:

Google Loon Project

Proposed Message Set

27 February 2015

Purpose of this document

This document proposes a message set that will facilitate the management of Google Loon balloon operations within the controlled airspace of the Auckland Oceanic Flight Information Region.

Overview

Google and Airways will exchange messages via the Amazon Simple Queue service. To send a message to Airways, Google will format the SQS message using whatever format is agreed for the SQS service to encapsulate the messages described in this document, and submit the message to an SQS queue. A gateway server at Airways would be notified of a pending message, and would then retrieve the message. Conversely, if a message is sent from Airways to Google, it is sent to our gateway server which would then submit it to an SQS queue for pickup by Google.

The message set will support the following loon scenarios:

e) Advice is received that a Loon is in an uncontrolled descent from its current float altitude to sea level

f) Advice is received that a Loon termination is being requested.

g) Advice is received that a controlled entry to the Oceanic CTA is requested to a lower level of F500 with the expectation that the Loon will leave the CTA climbing above F600 in the future.

h) Advice is received that communications have been lost with a Loon and that the balloon will automatically terminate in 6 hours.

Google Loon operations will be responsible for notifying OCS operations of any Loon balloon that is expected to enter the Auckland Oceanic CTA in descent from its float altitude. Only Loons expected to enter the CTA will be notified.

The message format used for messages will be based on existing ICAO formats defined in ICAO PANS-ATM Doc 4444 to facilitate processing by OCS and minimise software development. New message designators LRQ (Loon Request), LRS (Loon Response), LRP (Loon Report), LAK (Loon Acknowledge), LDK (Loon Dark), and LTE (Loon Terminate), will be used to specify the different messages.

Existing ICAO field definitions from ICAO PANS/ATM Doc 4444 are used where possible. However, two new fields have been created to support Loon operations: Field 11 specifying current position, time, and level; Field 12 specifying clearance information regarding entry to controlled airspace.

A brief description of the messages is as follows:

g. The LRQ (Loon Request) message will be used to request a balloons entry into the CTA from its float level above controlled airspace.

h. The LRS (Loon Response) will be used to indicate either a clearance or denial for entry to the CTA in response to a LRQ message from Google.

i. The LRP (Loon Report) message will be used to provide updates on any balloon entering the CTA. This may be an uncontrolled descent, a controlled and approved cut down, an approved entry into the CTA with the intent of subsequently leaving the CTA to a float altitude above, or an unapproved entry into the CTA.

j. The LTE (Loon Terminate) message will be used to indicate that a balloon has landed or vacated controlled airspace above F600 and the airspace reservation can be cancelled.

k. The LDK (Loon Dark) message will be used to indicate that communication has been lost with a balloon. It will provide position, time and flight level for current position, cut-down position, and one hour post cut-down.

l. The LAK (Loon Acknowledge) message will be automatically sent by OCS on receipt of a valid LRQ, LRP, LDK, or LTE message.

Message Set

LRQ - Loon Request

The LRQ message will be used by Google to request entry into the CTA for a controlled descent to sea level, or a controlled entry into the CTA within specified levels for manoeuvring purposes with the intention that the balloon will climb above the CTA at a later time, or where the balloon is unable to maintain altitude and entry to the CTA is required to a specified level and intention is balloon will climb above the CTA in the future.

The LRQ message will contain following standard fields per ICAO PANS-ATM Doc 4444:

3 - Message Type: LRQ

7 – Identification: Balloon Identifier in alpha-numeric format e.g. HBAL315 (max 7 characters)

11- Current Position: Current Position/time & level

11a Current Position/11b Current Time at Position 11c Flight Level

Note: Field 11 is not currently used in ICAO PANS-ATM Doc 4444 and has been specified to define the current position of the balloon using the same syntax rules for the subfields as the Doc 4444.

12- Clearance Information

12a/REQ/12b Position/12c Time12d Flight Level12e Flight Level/12f Position + 1 hour/12g Time 12h Flight Level

Note: 12a will contain the designator REQ (Request) for the LRQ message sent by Google or CLR/DNY (Cleared/Denied) for the LRS message sent by Airways.

Note: 12e is the lower Flight Level requested and 12f is the upper Flight Level requested.

Note: Field 12 is not currently used in ICAO PANS-ATM Doc 4444 and has been specified to define the clearance using the same syntax rules for the subfields as Doc 4444.

18- Other Information: RMK/ Plain Language Designators detailing type of entry into CTA.

a) RMK/ CONTROLLED DESCENT - Advice that a Loon is requesting descent from its current float altitude to sea level (flight level in planned/estimated position will be current float altitude)

b) RMK/ CONTROLLED ENTRY - Advice that a Loon controlled entry to the Oceanic CTA is requested to a lower level per field 12c with the expectation that the Loon will leave the CTA climbing above F600 in the future.

c) RMK/ UNABLE MAINTAIN - Advice that a Loon is unable to maintain height and entry to the Oceanic CTA is requested to a lower level per field 12b with the expectation that the Loon will leave the CTA climbing above F600 in the future.

Note: Controller will assess traffic and if entry is approved will send a LRS message. Subsequent LNR messages for this balloon will contain current and estimated levels.

e.g. (LRQ-HBAL315-3630S17702E/2234F630
-REQ/3630S17730E/2334F000F630/3635S17734E/0034F150
-RMK/CONTROLLED DESCENT)

Note: Current position of balloon HBAL315 is 3630S17702E at 2234 at F630, planned commencement of controlled descent from F650 to sea level is requested at 3630S17730E at 2334. Estimated position at 0034 +1 hour after commencement of descent is planned is 3635S17734E with Balloon expected to be at F150 at this time.

e.g. (LRQ-HBAL431-4730S17702E/2335F630
-REQ/4735S17734E/0035F500F630/4735S17759E/0135F450
-RMK/CONTROLLED ENTRY)

Note: Current position of balloon HBAL431 is 4730S17702E at 2335 at F630, a request for controlled entry for maneuvering is requested at 47350S17734E at 0035 between F500 and F630. Estimated position at 0135 +1 hour after commencement controlled entry is planned is 4735S17759E with Balloon expected to be at F450 at this time.

e.g. (LRQ-HBAL467-5630S17545W/0100F620
-REQ/5630S17545W/0105F500F620/5630S17735W/0205F510
-RMK/UNABLE MAINTAIN)

Note: Current position of balloon HBAL467 is 5630S17545W at 0100 at F620*, a request for entry is requested as the Loon is unable to maintain altitude. The Balloon is expected to descend into the CTA at* 5630S17545W at 0105 operating down to a lower level of F500 with the upper level F620*. Estimated position at 0205 +1 hour after entry is planned is* 5630S17735W *with Balloon expected to be at F510 at this time.*

LRS – Loon Response

The LRS message will be used by Airways to indicate to Google that a Loon Request (LRQ) is approved (Cleared to enter CTA at specified levels) or denied (Clearance to enter CTA cannot be approved)

The LRS message will contain following standard fields per ICAO PANS-ATM Doc 4444:

3 - Message Type: LRS

7 – Identification: Balloon Identifier in alpha-numeric format e.g. HBAL315 (max 7 characters)

11- Current Position: Current Position/time & level - Extracted from LRQ message.

11a Current Position/11b Current Time at Position 11c Flight Level

Note: Field 11 is not currently used in ICAO PANS-ATM Doc 4444 and has been specified to define the current position of the balloon using the same syntax rules for the subfields as Doc 4444.

12- Clearance Information - If the controller can approve levels requested in LRQ message, then:

12a CLR/12b Position/12c Time 12d Flight Level12e Flight Level/12f Position + 1 hour/12g Time at Request Position + 1 hour 12h Flight Level

e.g. (LRS-HBAL222-3630S17702E/2234F630-CLR/3635S17734E/2334F500F630/3635S17759E/0034F450

Note: A response to a clearance request received from HBAL22 at position 3630S17702E at 2234 cruising at F630 requesting entry into the CTA. HBAL22 is cleared to enter the CTA at 3635S17734E at 2334 *operating between F500 and F630.*

OR; If controller cannot approve levels requested in LRQ message, then:

12a DNY

e.g. (LRS-HBAL783-5903S15002W/1234F630-DNY)

Note: A response to a clearance request received from HBAL783 at position 5903S15002W at 1234 cruising at F630 *requesting entry into the CTA. HBAL783 is denied entry to the CTA*.

LRP – Loon Report

The LRP message will be sent by Google at 15 minute intervals when a balloon is on an emergency (uncontrolled) descent until the balloon has landed; OR at 15 minute intervals commencing on receipt of a Loon Response (LRS) message to a controlled entry or controlled descent request from Google using the Loon Request (LRQ) message until the balloon has landed or vacated above the CTA; OR at any other time a balloon is operating in the CTA and communicating position and level to Google operations.

The LRP message will contain following standard fields per ICAO PANS-ATM Doc 4444:

3 - Message Type: LRP

7 – Identification: Balloon Identifier in alpha-numeric format e.g. HBAL315 (max 7 characters)

11 - Current Position: Current Position/time & level

11a Current Position/11b Current Time at Position 11c Flight Level

Note: Field 11 is not currently used in ICAO PANS-ATM Doc 4444 and has been specified to define the current position of the balloon using the same syntax rules for the subfields as Doc 4444.

14 - Estimate Data: 14a Position /14b Time at Position 14c Flight Level

Note: Estimate data will always reflect planned position/level 1 hour after current position.

18 - Other Information: RMK/ Plain Language Designators detailing type of entry into CTA.

a) RMK/ EMERGENCY DESCENT - Loon is in an uncontrolled descent from its current float altitude to sea level.

e.g. (LRP-HBAL134-0023N17226W/0403F630-0035S17220E/0503F130-RMK/EMERGENCY DESCENT)

Note: No LRQ is used for an emergency descent and the LRP is the first indication that the controller will receive.

b) RMK/ CONTROLLED DESCENT – Loon is in an approved controlled descent from its current float altitude to sea level

c) RMK/ CONTROLLED ENTRY – Loon is on a controlled entry to the Oceanic CTA with the expectation that the Loon will leave the CTA climbing above F600 in the future.

d) RMK/ UNABLE MAINTAIN –- Loon is unable to maintain height and entry to the Oceanic CTA has occurred.

Note: LRP messages will be sent at 15 minute intervals until the balloon has landed or vacated the CTA above F600.

LTE – Loon Terminate

The LTE message will be sent by Google to indicate that a balloon has landed or is estimated to have landed or has left controlled airspace. On receipt of an LTE message OCS will deactivate the airspace reservation for that Loon.

The LTE message will contain following standard fields per ICAO PANS-ATM Doc 4444:

3 - Message Type: LTE

7 – Identification: Balloon Identifier in format HBAL315

e.g. (LTE-HBAL315)

LAK – Loon Acknowledge

The LAK message will be sent by OCS automatically immediately on receipt of a valid LRQ, LRP, LTE, or LDK message from Google.

The LAK message will contain following standard fields per ICAO PANS-ATM Doc 4444:

3 - Message Type: LAK

7 – Identification: Balloon Identifier from message being acknowledged

11- Current Position: Current Position/time & level - From message being acknowledged (if included).

e.g. (LAK-HBAL315-3630S17702E/2234F630)

LDK – Loon Dark

The LDK message will be sent by Google when they have lost communications with a balloon.

The LDK message will contain following standard fields per ICAO PANS-ATM Doc 4444:

3 - Message Type: LDK

7 – Identification: Balloon Identifier in format HBAL315

11 - Current Position: Current Position/time & level

11a Current Position/11b Current Time at Position 11c Flight Level

Note: Field 11 is not currently used in ICAO PANS-ATM Doc 4444 and has been specified to define the current position of the balloon using the same syntax rules for the subfields as Doc 4444.

12- Clearance Information

12a REQ/12b Position/12c Time 12d Flight Level 12e Flight Level/12f Position + 1 hour/12g Time 12h Flight Level

Note: Requested position in 12b is the estimated position of the Loon at the automatic cut-down point (6 hours after loss of communication in oceanic airspace).Requested position in 12f is the estimated position 1 hour after cutdown.

18- Other Information: RMK/ Plain Language Designators detailing type of entry into CTA.

a) RMK/ DARK – Designator indicating that communications have been lost.

e.g. (LDK-HBAL315-3630S17702E/2234F630-REQ/3635S17734E/0434F000F630/3655S17756E/0534F000-RMK/DARK

Note: Google have lost communications with loon HBAL315. The last known position of balloon HBAL315 was 3630S17702E at 2234 at F630*. The Balloon is expected to automatically cut-down at* 3635S17734E at 0434 and entry to controlled airspace is requested between F000 and F630 . The e*stimated position at 0534 +1 hour after cut-down is estimated at* 3655S17756E *with Balloon expected to be at F000 (i.e. landed) at this time.*

Note: LDK messages will be sent at 60 minute intervals after the initial LDK is sent until the balloon is estimated to have landed when a LTE will be sent.

Note: We are unsure if Google updates the planned automatic cut-down position based on changes in wind forecasts. Even if no update can be provided we expect to receive the hourly LDK message updates as we will modify the reservation based on the current position in each update.

Detail of Fields

Field Type 3 – Message Type

Format:

OPEN BRACKET (

Message Type Designator – 3 LETTERS as follows:

LRQLoon Request

LRPLoon Report

LRSLoon Response

LDKLoon Dark

LTELoon Terminate

LAK Loon Acknowledge

Previous type of field or symbol	This type of field is used in	Next type of field or symbol
(	LRQ	7
(	LRP	7
(	LRS	7
(	LDK	7
(	LTE	7
(	LAK	7

Example: (LRQ

Field Type 7 – Balloon Identification

Format:

SINGLE HYPHEN(-)

Balloon identification – NOT MORE THAN 7 ALPHA-NUMERIC CHARACTERS being the identification of the balloon.

Previous type of field or symbol	This type of field is used in	Next type of field or symbol
3	LRQ	11
3	LRP	11
3	LRS	11
3	LDK	11
3	LTE	)
3	LAK	11

Example: -HBAL457

Field Type 11 – Current Position

Format:

SINGLE HYPHEN (-)

11a – Position.

4 NUMERICS describing latitude in degrees and tens and units of minutes. Followed by “N” (meaning “North”) or “S” (South) followed by 5 numerics describing longitude in degrees and tens and units of minutes, followed by “E” (EAST) or “W” (WEST). The correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. “4534S04006W” “0034S16400E”

OBLIQUE STROKE (/)

11b – Time at Position.

4 NUMERICS giving the UTC time at the position in 11a.

11c – Level

F followed by 3 NUMERICS which indicates a flight level number and gives the flight level at the position in 11a, i.e. Flight Level 330 (33,000ft) is expressed as “F330”. Flight Level 295 (29,500ft) is expressed as F295.

Previous type of field or symbol	This type of field is used in	Next type of field or symbol
7	LRQ	12
7	LRP	14
7	LRS	12
7	LDK	12
7	LAK	)

Example: -2905S17425W/0346F561

Field Type 12 – Clearance Information

Format:

SINGLE HYPHEN (-)

12a – Clearance type designator – 3 LETTERS as follows

REQ Request

CLR Cleared

DNY Denied

This field is terminated here if DNY is the clearance type designator used.

OBLIQUE STROKE (/)

12b - Position

4 numerics describing latitude in degrees and tens and units of minutes. Followed by “N” (meaning “North”) or “S” (South) followed by 5 numerics describing longitude in degrees and tens and units of minutes, followed by “E” (EAST) or “W” (WEST). The correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. “4534S04006W” “0034S16400E”

OBLIQUE STROKE (/)

12c – Time at Position.

4 numerics giving the UTC time at the position in 12b.

12d – Level

F followed by 3 NUMERICS which indicates a flight level number and gives the **lower** requested flight level at the position in 12b, i.e. Flight Level 330 (33,000ft) is expressed as “F330”. Flight Level 295 (29,500ft) is expressed as F295.

12e – Level

F followed by 3 NUMERICS which indicates a flight level number and gives the **upper** requested flight level at the position in 12b,

Note 1. - If the lower requested Flight Level is 400 (40,000ft) and the upper requested flight level is 500 (50,000ft) this is expressed as “F400F500”.

OBLIQUE STROKE (/)

12f – Position

Estimated position 1 hour after position in 12b. 4 numerics describing latitude in degrees and tens and units of minutes. Followed by “N” (meaning “North”) or “S” (South) followed by 5 numerics describing longitude in degrees and tens and units of minutes, followed by “E” (EAST) or “W” (WEST). The correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. “4534S04006W” “0034S16400E”

OBLIQUE STROKE (/)

12g – Time at Position.

4 numerics giving the UTC time at the position in 12f.

12h – Level

F followed by 3 NUMERICS which indicates a flight level number and gives the requested flight level at the position in 12f, i.e. Flight Level 330 (33,000ft) is expressed as “F330”. Flight Level 295 (29,500ft) is expressed as F295.

Previous type of field or symbol	This type of field is used in	Next type of field or symbol
11	LRQ	18
11	LRS	)
11	LDK	18

Example: -REQ/2905S17425W/0346F450F550/2935S17415W/0446

-CLR/2905S17425W/0346F450F550/2935S17415W/0446

-DNY

Field Type 14 – Estimate Data

Format:

SINGLE HYPHEN (-)

14a - Position

4 NUMERICS describing latitude in degrees and tens and units of minutes. Followed by “N” (meaning “North”) or “S” (South) followed by 5 numerics describing longitude in degrees and tens and units of minutes, followed by “E” (EAST) or “W” (WEST). The correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. “4534S04006W” “0034S16400E”

Note 1. – In a LRP message the estimated position is the predicted position one hour after the current balloon position given in Field 11a.

OBLIQUE STROKE (/)

12c – Time at Position.

4 numerics giving the UTC time at the position in 14a.

12d – Level

F followed by 3 NUMERICS which indicates a flight level number and gives the flight level at the position in 12b, i.e. Flight Level 330 (33,000ft) is expressed as “F330”. Flight Level 295 (29,500ft) is expressed as F295.

Previous type of field or symbol	This type of field is used in	Next type of field or symbol
11	LRP	18

Example: -2905S17425W/0346F450

Field Type 18 – Other Information

Format:

SINGLE HYPHEN (-)

18a – Remarks – 3 LETTERS indicating remarks designator

RMK

OBLIQUE STROKE (/)

Plain language indicating type of entry into controlled airspace from following:

EMERGENCY DESCENT

CONTROLLED DESCENT

UNABLE MAINTAIN

DARK

CLOSE BRACKET)

Previous type of field or symbol	This type of field is used in	Next type of field or symbol
12	LRQ	)
14	LRP	)
12	LDK	)

Example: -RMK/EMERGENCY DESCENT)