# 2015–2016 Yellow U23
# SMART Approach Flight Path Trial
Draft Report 2017

# 1.0

# Introduction

Airways Corporation of New Zealand (Airways) and the Board of Airline Representatives New Zealand (BARNZ) – representing airlines – and Auckland International Airport Ltd (Auckland Airport) are considering the implementation of a new SMART Approach flight path, which is known as Yellow U23 and was trialled between 1 September 2015 and 31 August 2016.

SMART Approach flight paths use satellite-based navigation and enable aircraft to burn less fuel, emit less carbon dioxide and fly more quietly. SMART Approach flight paths contribute to international aviation carbon dioxide emission reduction proposals, and are aligned with the Government's National Airspace Air Navigation Plan.

The move to SMART flight paths is a global trend coordinated by the International Civil Aviation Organisation (ICAO) to drive the reform of airspace and air traffic management. In New Zealand the plan to modernise airspace is known as New Southern Sky.[1]

Four SMART Approach flight paths already operate at Auckland Airport (the airport): two approach the airport from the north and two approach from the south. Interested parties can learn more about the previous SMART Approach flight path trials and outcomes at www.aucklandflightpathtrial.co.nz .

The purpose of this draft report is to provide information on aviation and flight paths in New Zealand, present information on what the participating airlines, Airways and Auckland Airport learned during the 2015–2016 trial of Yellow U23 and to summarise the public feedback that has been received. This draft report also presents a number of recommendations and outlines the subsequent process for public consultation.

To assist interested parties in gaining a better understanding of the Yellow U23 trial, the following reports are available at www.aucklandflightpathtrial.co.nz :

- *Airways New Zealand – Airways New Zealand Uniform SMART Approach Trial Report*
- *BARNZ – Auckland Uniform SMART Approach Trial Review – An Airline Perspective*
- *Marshall Day Acoustics – Analysis and Assessment of Effects (Yellow U23).*

Airways, BARNZ and Auckland Airport are seeking public feedback on this draft report about the Yellow U23 trial, which evaluates: aircraft performance; airspace management; operational benefits, including time, distance, fuel and carbon emission savings; noise monitor results; and public feedback.

Members of the public are invited to provide feedback so their views can be considered before Auckland Airport makes a decision under Civil Aviation Rule (CAR) Part 173.201(d) on whether or not to agree with the recommendations contained in the draft report.

Feedback is welcome on any matter members of the public think is appropriate for Auckland Airport to consider when making its decision.

Airways, BARNZ and Auckland Airport will publish a final report on the Yellow U23 SMART Approach flight path trial, including the decision Auckland Airport makes in relation to the draft recommendations. The final report will be published in December 2017.

[1] See: www.nss.govt.nz

# 2.0

# Aviation influence, roles and responsibilities in New Zealand

# 2.0 Aviation influence, roles and responsibilities in New Zealand

## 2.1 Overview

There are several parties that either influence the management of or assume roles and responsibilities for aviation within New Zealand. These include:

- International Civil Aviation Organisation
- Ministry of Transport
- Civil Aviation Authority of New Zealand
- Airways Corporation of New Zealand
- Board of Airline Representatives New Zealand Inc
- Airports
- Airlines
- Pilots.

Below we outline the role each party plays in relation to flight paths and noise management at the airport.

## 2.2 International Civil Aviation Organisation

The International Civil Aviation Organisation (ICAO) is a specialised agency of the United Nations responsible for the safe and orderly development of the world's aviation industry. It sets standards and regulations necessary for aviation safety, security, efficiency and regularity, as well as for aviation environmental protection. These standards and regulations flow through to New Zealand's aviation-related legislation.

In 2010, the ICAO Assembly resolved that States (i.e. member countries) should achieve a two per cent per annum improvement in fuel efficiency until 2020 and have an aspirational goal of maintaining that rate through to 2050.

## 2.3 Ministry of Transport

The Ministry of Transport (the Ministry) is the New Zealand Government's principal transport advisor. The overriding objective of the Ministry is to:

1. Improve the overall performance of the transport system across New Zealand
2. Improve the performance of transport Crown entities
3. Achieve better value for money for the Government from its investment in the transport system.[2]

[2] See: www.transport.govt.nz/about/

The Ministry represents New Zealand's transport interests internationally, particularly in aviation. Therefore, the Ministry advises government on policy and legislation to make air travel in New Zealand safer. The Ministry also acts as the Minister's agent in the Government's relationship with the Civil Aviation Authority (CAA) and other transport agencies. An example of the Ministry's policy advice is the National Airspace Policy, as summarised below.

### National Airspace Policy 2012

The current National Airspace Policy was created in response to a Global Air Navigation Plan which the ICAO issued in 2007. It recognised the step-change from land-based navigational aids to performance-based navigation technology and global positioning satellites (GPS), which is the essence of the technology used in the SMART Approach flight paths.

The Policy aims to deliver an airspace system which is efficient, environmentally responsible, integrated and enhances the ability for systems and organisations within the aviation sector to work more collaboratively.

The Policy is consistent with the Government's goal for New Zealand's economic growth and the objective of an effective, efficient, safe, secure, accessible and resilient transport system that supports that growth. The Policy includes the principle of 'safe airspace', which is compatible with international standards and best practice.

## 2.4 Civil Aviation Authority of New Zealand

The Civil Aviation Authority of New Zealand (CAA) regulates civil aviation in New Zealand and enforces the ICAO's standards and regulations to the extent they are incorporated into relevant New Zealand legislation. The CAA was established by the Civil Aviation Amendment Act 1992 and operates under the Civil Aviation Act 1990. It is focused on establishing civil aviation safety and security standards, and monitoring adherence to those standards.[3]

The CAA develops Civil Aviation Rules (CARs) under the Civil Aviation Act 1990 and these govern how aircraft are to manoeuvre in New Zealand airspace, as well as how aircraft are to approach and depart from New Zealand airports.

The CAA led the development of the National Airspace and Air Navigation Plan – New Southern Sky – which was released in June 2014[4]. One of the Plan's most significant aspects is the proposed move from land-based systems to space-based satellite navigation and surveillance, or performance-based navigation (PBN).

New Southern Sky is about the practical steps aviation participants need to take to enable a safe and effective transition to new technologies as demand for airspace increases.

[3] See: www.caa.govt.nz/about_caa/about_the_CAA.htm
[4] See: www.nss.govt.nz/documents/web-national-airspace-and-air-navigation-plan-fa.pdf

## 2.5 Airways Corporation of New Zealand

Airways Corporation of New Zealand (Airways) manages 30 million square kilometres of airspace, providing air traffic control, surveillance, communication, flight inspections, mapping and airspace design services. Airways operates under rules set down by the CAA, which are developed using ICAO guidelines. Airways is a State-owned Enterprise, a fully-owned subsidiary of the New Zealand Government operating as a commercial business.

Airways' main role in relation to the Yellow U23 SMART Approach flight path trial was designing the flight path and the procedures for its use, as well as integrating the trial's aircraft into the overall air traffic approaching and departing from Auckland Airport.

## 2.6 Board of Airline Representatives New Zealand Inc

The Board of Airline Representatives New Zealand Inc (BARNZ) is an incorporated society comprised of 28 member airlines, which operate scheduled international and domestic services into and within New Zealand. BARNZ focuses on representing the airlines across the following four broad areas:

- Airport pricing
- Airport capital expenditure
- Government departments and agencies
- Noise issues around airports.

BARNZ's main role in regard to the Yellow U23 SMART Approach flight path trial was representing the airlines that use Auckland Airport.

## 2.7 Airports

Airports provide the infrastructure for aircraft to land and take off, and the facilities for processing passengers as they arrive and leave. An airport's main influence in respect to aircraft noise relates to its role in on-airport development, influencing off-airport development (e.g. through designations in District Plans), and the management of airline schedules.

Civil Aviation Rules (CARs) state that "an Instrument Flight Procedure must not be designed for an aerodrome or heliport unless the operator of the aerodrome or heliport agrees in writing that the aerodrome or heliport may be used for IFR [Instrument Flight Rules] operations using the intended instrument flight procedure".[5]

The main role of Auckland Airport in relation to the Yellow U23 SMART Approach flight path trial was agreeing to the instrument flight procedures and responding to concerns raised by the public about aircraft noise.

[5] CAR Part 173.201(d)

## 2.8 Airlines

Thirty international airlines fly into and out of Auckland Airport. Airlines decide their flight schedules, frequencies of operation, which markets to serve, what fares to charge, and the types of aircraft and equipment to operate. They do so in compliance with aircraft certification and operating requirements. In addition to the legal requirement to operate under New Zealand's CARs, airlines set their own standard operating procedures based on best business and operating practices. An airline's fleet replacement strategy determines the type of aircraft in operation and the time frames for using newer aircraft.

Five airlines participated in the 2015–2016 Yellow U23 SMART Approach flight path trial – Air New Zealand, Jetconnect,[6] Virgin Australia, Jetstar and Emirates[7]. Their main role in connection with the Yellow U23 SMART Approach flight path trial was managing their aircraft operating fleets and setting operating procedures that met CAR requirements.

## 2.9 Pilots

Pilots have the ultimate responsibility for the safe operation of their aircraft. Although each airline can adopt procedures and recommended best practices, pilots still retain the operational authority and discretion to make final decisions regarding the safe operation of their aircraft. Pilots are expected and encouraged to adhere to standard operating procedures for arrivals and departures. However, in the interest of safety, pilots may deviate from such procedures when necessary.

The main role of pilots in relation to the Yellow U23 SMART Approach flight path trial was adhering to CARs requirements, including noise abatement procedures set by regulatory authorities, Auckland Airport and their airlines.

[6] Jetconnect is an airline based in Auckland, New Zealand. The airline is a wholly-owned subsidiary of Qantas and was established in July 2002.
[7] Emirates joined the trial in November 2015.

# 3.0

# Legal framework for aviation in New Zealand

# 3.0 Legal framework for aviation in New Zealand

## 3.1 Overview

The Civil Aviation Authority (CAA) governs civil aviation in New Zealand. A number of Acts, Plans and Rules regulate the planning and operation of an airport also. Aviation legislation and rules focus on the safe and efficient operation of airspace and airports. Land-use planning legislation and policy protect an airport's functions and surrounding communities from the impacts of an airport's operations, particularly in regard to aircraft noise. Relevant Acts, Rules and Plans include:

- Civil Aviation Act 1990
- Civil Aviation Rules
- Resource Management Act 1991
- Auckland Unitary Plan.

## 3.2 Civil Aviation Act 1990

The Civil Aviation Act 1990 (the Act) is New Zealand's central piece of aviation legislation and is administered by the CAA. The Act promotes aviation safety by establishing rules of operation and divisions of responsibility within the New Zealand civil aviation system. It also ensures that New Zealand's obligations under international aviation agreements are implemented.

## 3.3 Civil Aviation Rules

The CAA sets rules relating to airports and aircraft operations using Civil Aviation Rules (CARs). These rules are developed under the Act and provide the framework within which to enact the requirements of the Act. CARs address matters such as aircraft, personnel, airspace, general operating and flight rules, and noise abatement procedures.

## 3.4 Resource Management Act 1991

The Resource Management Act 1991 (the RMA) is New Zealand's key planning and resource management statute. Under the RMA, aircraft noise is generally regulated through the imposition of controls in district plans on the emission of aircraft noise resulting from the take-off and landing of aircraft at airports. Noise generated by 'overflying' aircraft is outside the ambit of the RMA. The RMA also imposes a duty to adopt the best practicable option to prevent the emission of unreasonable noise and provides a number of ways in which to enforce adverse noise effects, including abatement notices and enforcement orders.

## 3.5 Auckland Unitary Plan

Auckland Airport is a requiring authority and has three designations in the Auckland Unitary Plan which govern Auckland Airport's operations. In particular, Designation 1100 imposes conditions on the level of aircraft noise that can be generated at the airport and imposes obligations on Auckland Airport to monitor and mitigate that noise. The Auckland Unitary Plan also establishes an Airport Noise Overlay that imposes controls on the establishment of activities sensitive to noise within the vicinity of the airport in order to protect the airport from reverse sensitivity effects, and to manage land uses around the airport.

# 4.0

# Flights into Auckland

# 4.0 Flights into Auckland

## 4.1 Operating procedures

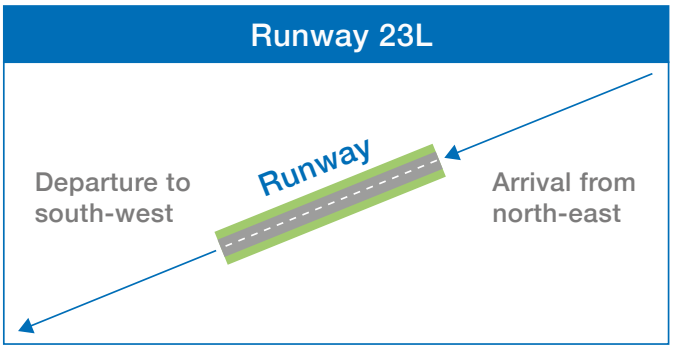
Each country has a set of operating procedures for aircraft operating within its designated airspace. General operating and flight rules for New Zealand are articulated in Civil Aviation Rule (CAR) Part 91. This CAR outlines general flight rules, visual flight rules (VFRs), instrument flight rules (IFRs) and other requirements to operate aircraft in New Zealand airspace.[8]

CAR Part 93 provides aerodrome traffic rules and noise abatement procedures for a number of New Zealand's airports, including Auckland Airport. These rules include requirements for pilots to approach and depart runways under certain conditions to minimise noise impacts from landing and take-off operations.

The runway at Auckland Airport is orientated north-east to south-west. The runway's mode of operation is called either 'Runway 23L' or 'Runway 05R', representing the abbreviated magnetic compass direction of the runway.

Aircraft must take off and land into the wind. In Auckland, the prevailing wind is from the south-west and under these conditions aircraft use Runway 23L, where departing aircraft take off towards the west over the Manukau Harbour, and arriving aircraft land on the eastern end of the runway, overflying Papatoetoe. This is shown is Figure 1 below.

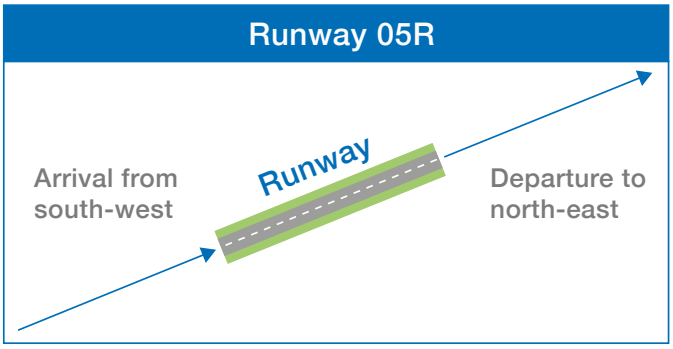
Figure 1: Runway 23L mode of operation




[8] IFR and VFR are the international requirements governing all aspects of aircraft operations. IFRs are established for aircraft that fly and navigate by reference to instruments in the cockpit. IFR-classified aircraft can operate in all flyable weather conditions day or night and within clouds. IFR-classified aircraft can also fly using visual references outside the cockpit (horizon, buildings, flora etc.); this may be done when they are close to an airport and positioning to land. Flights using a SMART Approach flight path operate under IFRs using cockpit instruments.
VFRs are established for aircraft that fly and navigate by visual references outside the cockpit. VFR aircraft usually fly in clear skies during the day, not within clouds or in adverse weather, and not normally at night.
Specific details for each airport's flight rules are published in New Zealand's Aeronautical Information Publication (AIP).

When the wind direction switches to easterly, the runway direction changes and aircraft use Runway 05R, where arriving aircraft land on the western end of the runway, overflying the Manukau Harbour, and departing aircraft take off to the east and overfly Papatoetoe. This is shown in Figure 2 below.

Figure 2: Runway 05R mode of operation




# 4.2 Traditional flight paths

Aircraft fly from origin to destination within designated flight paths, which are effectively 'highways' in the sky. These allow aircraft to fly along standard routes. Such routes are marked on published charts and are used by pilots to plan their flights. In the vicinity of an airport, there are additional routes which guide aircraft from and to runways under IFR conditions. Routes that guide aircraft from and to runways are known as Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs). SIDs and STARs have specified procedures, including directional and height limits, which pilots are required to observe when flying out of and into a destination, unless instructed otherwise by Airways.

While flight paths are often depicted as single lines on a map, it is usually not possible for all aircraft following a traditional flight path to fly precisely along the same line. In practice, individual flight paths tend to occur within flight corridors that can be a number of kilometres wide. The exception to this is when performance-based navigation (PBN) paths (referred to as SMART Approach flight paths in this draft report) are used. PBN utilises satellite technology on the aircraft and can follow flight paths to a far greater degree of accuracy.[9] There is considerable variation in what paths aircraft fly day-to-day, for reasons including weather, airspace congestion and activity at other aerodromes (e.g. Ardmore and Whenuapai). Most areas of Auckland experience overflight by arriving and/or departing aircraft.[10]

[9] Additional information about PBN is available on the Ministry of Transport's website: www.transport.govt.nz/ourwork/air/performancebasednavigation/

[10] 'Overflight' is a term used to describe the flight of an aircraft over a specific area or territory.

# 4.3 Movement numbers

The year to the end of August 2017 saw a 6.5 per cent rise in total aircraft movements at Auckland Airport,[11] compared with the previous 12-month period, which reflects New Zealand's growing air connectivity. During this period, there were 170,402 aircraft movements (115,412 domestic and 54,990 international). This growth follows a relatively static period in recent years, with an average of around 154,000 air movements every year, between 2011 and 2016.

International aircraft movements are mostly departing to/arriving from destinations north of Auckland, with 80 per cent of those departing to/arriving from the north-west (Australia/Asia). The diagrams below (Figures 3 and 4) show flight paths for two typical weeks of jet aircraft activity at Auckland Airport in July 2015 before the Yellow U23 SMART Approach flight path trial began. Red lines in the diagrams indicate aircraft approaches and blue lines indicate aircraft departures. Figure 3 shows aircraft using Runway 23L predominantly, where departing aircraft take off towards the west over the Manukau Harbour and arriving aircraft land on the eastern end of the runway, overflying Papatoetoe. Figure 4 shows aircraft predominantly using Runway 05R, where arriving aircraft land on the western end of the runway, overflying the Manukau Harbour, and departing aircraft take off to the east and overfly Papatoetoe.

Figure 3: Flight arrivals and departures using Runway 23L


Figure 4: Flight arrivals and departures using Runway 05R


[11] 'Movement' is the term used to describe either a take off or a landing of an aircraft.

# 5.0

# SMART Approach flight paths

# 5.0 SMART Approach flight paths

## 5.1 Global initiative

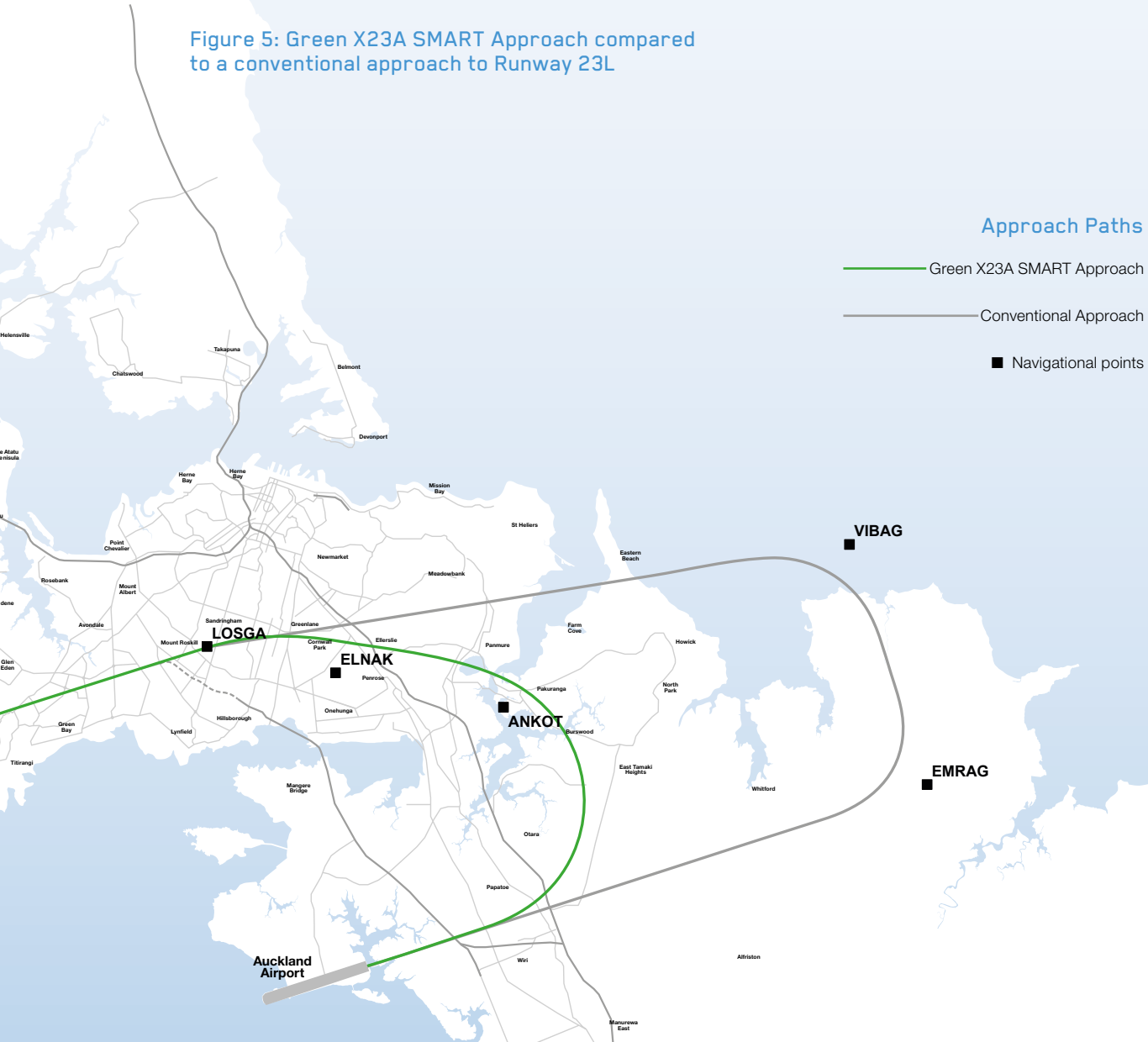
As discussed earlier, SMART Approach flight paths are part of a global move to modernise airspace and make air travel more efficient.

In 2007 the International Civil Aviation Organisation (ICAO) urged member countries, including New Zealand, to move to performance-based navigation (PBN), also known as SMART Approaches. It said:

"PBN is helping the global aviation community reduce aviation congestion, conserve fuel, protect the environment, reduce the impact of aircraft noise and maintain reliable all-weather operations, even at the most challenging airports. It provides operators with greater flexibility while increasing the safety of regional and national airspace systems." [12]

The New Zealand Government complied with that resolution, agreeing in August 2011 to develop a National Airspace Policy and a National Airspace and Air Navigation Plan – New Southern Sky.[13] The implementation of PBN is a key component of New Southern Sky, allowing safer and more efficient airspace management.

Figure 5: Green X23A SMART Approach compared to a conventional approach to Runway 23L



# 5.2 SMART Approach benefits

Satellite navigation technology can be used for approaches as well as departures. The technology enables curved approach paths to runways – allowing aircraft to be established on the extended runway centreline, much closer to the runway than is possible using a ground-based instrument landing system (ILS). This means there are opportunities to avoid sensitive urban areas.

Satellite-based navigation has been used in aviation for many years, and the ICAO first issued a comprehensive manual on its use (Doc 9849 AN/457 Global Navigation Satellite System (GNSS) Manual) in 2005. A second edition of that manual was published in 2013.

The ICAO's GNSS Manual sets standards for accuracy, integrity and continuity. A high degree of accuracy is required for safe navigation. Integrity is about being sure that the GNSS position meets the accuracy standards required. Continuity is about ensuring that once a GNSS procedure has commenced, the GNSS position will be available for the full duration of the procedure. Aircraft system-generated alerts are required to be issued when accuracy, integrity or continuity standards are not being met, and alternative non-GNSS-based navigational aids are required to be available in these cases.

Satellite-based approach procedures are commonplace around the world today, and have been used in New Zealand since the 1990s. PBN technology was first used at Auckland Airport in 2012.[14] It has also been used by Queenstown Airport since 2003. The requisite integrity and continuity standards are required to be in place before an aircraft can begin an approach.

In westerly wind conditions, most international aircraft approaching Auckland Airport must fly over the Auckland isthmus to align with the appropriate runway to be able to land into the wind. Satellite-based navigation provides the opportunity for shorter approach paths, resulting in fewer residents being overflown and creating fuel and carbon emission savings and less aircraft noise.

Traditional land-based navigational technology requires flights approaching the runway to join the extended runway centreline seven to 10 nautical miles from the runway. Satellite-based SMART Approach technology allows a curved approach with aircraft joining the extended runway centreline within three to four nautical miles of the runway. The maximum benefits from PBN technology are achieved when flight paths join the extended centreline as close as practical to the runway, thereby reducing the distance flown as much as possible.

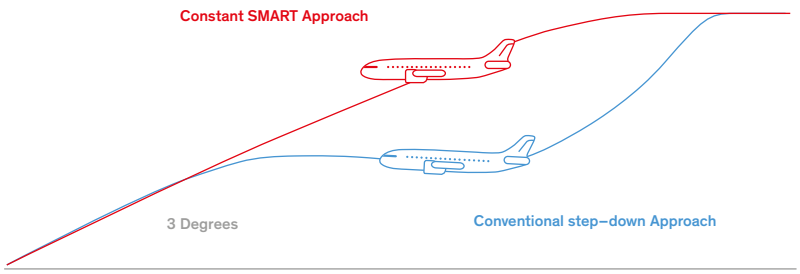
Figure 5 (on page 24) compares Auckland Airport's traditional ground-based instrument landing arrival path to Runway 23L (the grey line) to a shorter SMART Approach flight path (the previously approved Green X23A flight path). The diagram also shows the waypoints that aircraft use to guide them into the airport.

[12] See: www.icao.nt/safety/pbn/pages/default.aspx
[13] See: www.nss.govt.nz/
[14] SMART Approach flight paths are technically known as Required Navigation Performance, which is a type of PBN.

SMART Approach technology also allows constant descent when aircraft are on final approach to a runway, which enables aircraft engines to run close to flight idle when the SMART Approach flight path design is correctly integrated with the relevant Standard Terminal Arrival Route (STAR). SMART Approach technology almost eliminates the traditional step-down approach, where aircraft descend in steps separated by intervals of level flight with normal engine thrust (see Figure 6 below).

As a result of the longer flight path and level flight engine thrust of traditional approaches, more fuel is used, delivering more carbon dioxide emissions into the environment, and more noise is generated.

### Figure 6: Difference between a SMART Approach and a conventional step-down approach



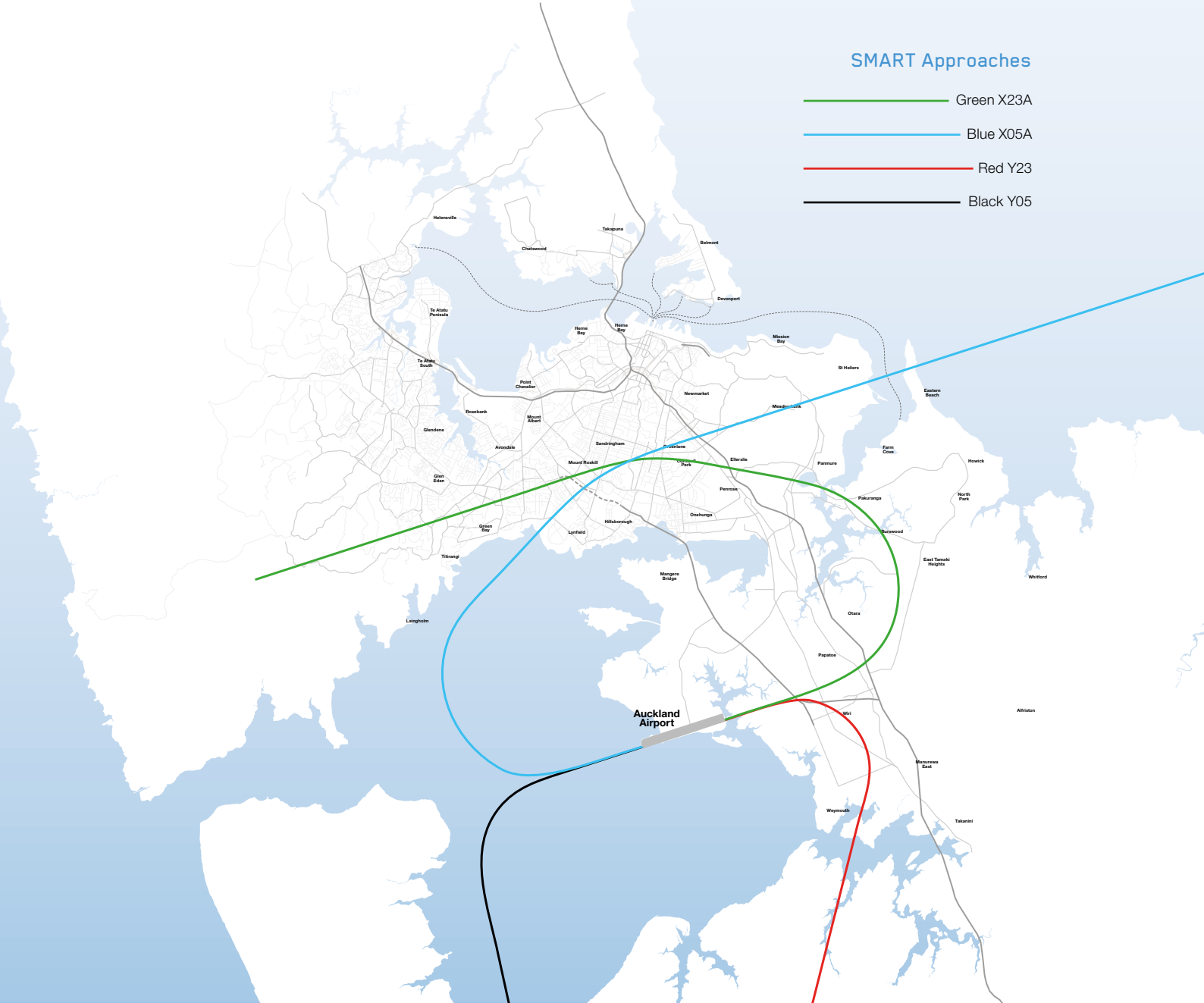

In summary, SMART Approaches enable aircraft to burn less fuel, emit less carbon dioxide and fly more quietly.

# 5.3 Auckland Airport's SMART Approach flight paths

Four SMART Approach flight paths currently operate at Auckland Airport, two from the north and two from the south. Figure 7 (below) shows the SMART Approach flight paths. Green X23A descends from the north to Runway 23L. Red Y23 descends from the south to Runway 23L. Blue X05A descends from the north to Runway 05R. Black Y05 approaches Runway 05R from the south.

Airways designed and proposed these four SMART Approach flight paths in line with civil aviation requirements at the request of the participating airlines. Civil Aviation Rule (CAR) Part 173 required Auckland Airport to agree that the airport could be used for the SMART Approach flight paths before any flight path was implemented. After an assessment of the routes, in 2011, Auckland Airport agreed to the implementation of one SMART Approach flight path from the south onto Runway 05R (Black Y05), and to the trial of the three other SMART Approach flight paths (Green X23, Blue X05 and Red Y23).

Figure 7: SMART Approaches to Auckland Airport



During the SMART Approach flight path trial conducted between 2012 and 2013, a total of 11,822 flights used the three trial SMART Approach flight paths, flying 138,285 fewer nautical miles and resulting in:

- A 3.1 million kilogram reduction in carbon dioxide emissions
- A 1.01 million kilogram reduction in fuel use
- A saving of 27,610 minutes (more than 460 hours) of flying time.

Noise experts Marshall Day Acoustics (MDA) measured the impact of the SMART Approach flight path trial on noise levels in residential areas. They determined that while individual SMART Approach flights had marginally higher maximum noise ($L_{Amax}$) levels, approximately three decibels higher on average, the difference in noise exposure ($L_{dn}$) levels for a day on which SMART flights were operating and when they were not was small (less that one decibel $L_{dn}$).[15] This difference was not regarded as significant and would only be just perceptible to the human ear. The one exception to this was at Reinheimer Place in Flat Bush, where the difference in the $L_{Amax}$ level was a perceptible seven decibels, however the change in the $L_{dn}$ level at this location was only 0.3 decibels higher, similar to other locations.

A draft report on the above trial was published in May 2014 and Aucklanders were invited to provide feedback on it. A series of consultation forums was held to receive submissions and a final report on the trial was published in December 2014. As a direct result of feedback from the trial and subsequent public consultation, the two trial SMART Approach flight paths from the north (Green X23 and Blue X05) were modified to a higher altitude and a wider approach curve – to reduce aircraft noise, use less fuel and increase efficiencies. The two modified SMART Approach flight paths from the north, known as Green X23A and Blue X05A, came into permanent operation on 28 May 2015. The SMART Approach flight path from the south, known as Red Y23, continued to be flown after the trial's conclusion and was approved to come into permanent operation in the trial's final report in December 2014.

The Blue X05A and the Green X23A SMART Approach flight paths can only be used by aircraft between 7am and 10pm. A maximum of 10 flights per day can use each of the Blue X05A and Green X23A SMART Approach flight paths. The Black Y05 SMART Approach flight path from the south to Runway 05R and the Red Y23 SMART Approach flight path from the south to Runway 23L are available 24 hours a day uncapped.

[15] For more information about $L_{Amax}$ and $L_{dn}$ see page 42.

# 6.0

# The 2015-2016 Yellow U23 SMART Approach trial

# 6.0 The 2015-2016 Yellow U23 SMART Approach trial

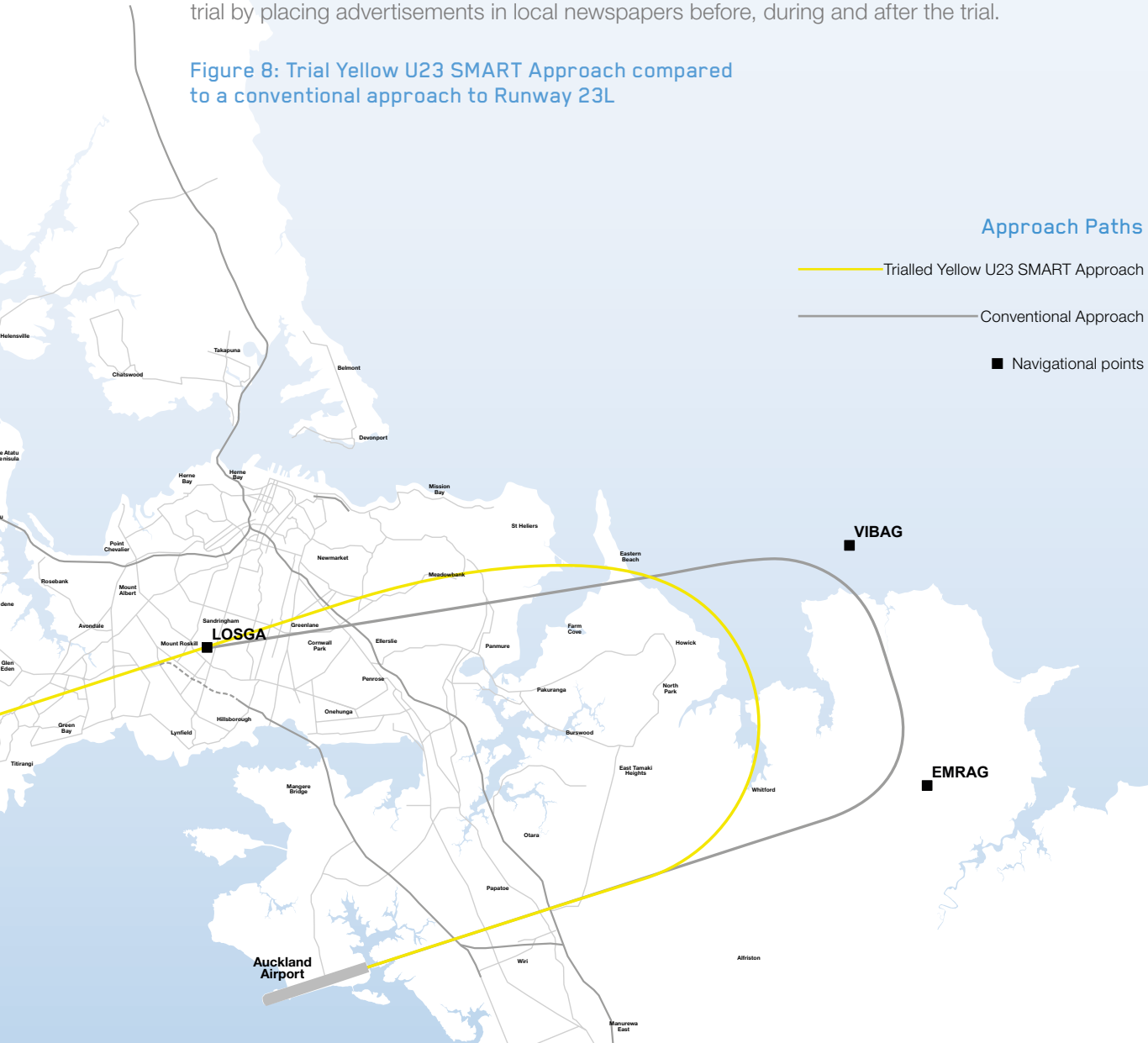
## 6.1 Why the Yellow U23 SMART Approach flight path was trialled

As explained earlier in this draft report, there is a much higher demand for approaches from the east onto Runway 23L at Auckland Airport than from the other direction. This is because the predominant wind direction is westerly and aircraft generally need to land into the wind.

At the time of approving Green X23A in 2014, Airways Corporation of New Zealand (Airways), the Board of Airline Representatives New Zealand (BARNZ) and Auckland Airport recognised that future demand for that SMART Approach would exceed the daily limit of 10 flights. As a result, it was recommended that an additional SMART Approach flight path for Runway 23L from the north be identified and trialled from September 2015. That additional SMART Approach flight path became known as Yellow U23.

After signalling the trial of Yellow U23 in the SMART Approach Flight Path Trial Final Report in December 2014, Auckland Airport published media releases about the trial on 28 April 2015, 28 May 2015, 25 August 2015, and 1 September 2016, and communicated information about the trial by placing advertisements in local newspapers before, during and after the trial.

Figure 8: Trial Yellow U23 SMART Approach compared to a conventional approach to Runway 23L



## 6.2 The Yellow U23 SMART Approach flight path

Incorporating lessons from Auckland Airport's first SMART Approach flight path trial, the trial Yellow U23 SMART Approach flight path was designed higher and its approach curve wider than the SMART Approach flight paths trialled in Auckland during 2012 and 2013.

As Figure 8 (on page 32) shows, the Yellow U23 SMART Approach flight path followed a long-established visual arrival flight path, or Standard Terminal Arrival Route (STAR), from the north-west. However, aircraft using Yellow U23 were required to pass over the LOSGA navigation point at or about 6,000 feet, 1,000 feet higher than other aircraft using the STAR, and were therefore quieter.

## 6.3 The Yellow U23 SMART Approach trial

As part of the permanent introduction of the SMART Approach flight paths at Auckland Airport, Airways and BARNZ agreed to stop instrument-based visual approaches by jet aircraft from the north. This means that aircraft from the north-west had to use either the Green X23A SMART Approach flight path or the full STAR, which takes aircraft some 12 nautical miles east of Runway 23L. The Yellow U23 SMART Approach flight path was designed to effectively follow the old visual approach from the north-west – but aircraft have to fly higher and on a more precise track.

The Yellow U23 SMART Approach flight path was trialled from September 2015 to August 2016, and was limited to a maximum of 10 flights per day between 7am and 10pm.

Only Civil Aviation Authority-approved airlines and A380, A320, B737, B777 and B787 aircraft with qualified crews were permitted to fly the Yellow U23 SMART Approach flight path. It was the first time A380s could take part in a SMART Approach trial at Auckland Airport. Earlier SMART Approach trials were not designed to accommodate aircraft of the A380's size.

Specifically, the Yellow U23 SMART Approach flight path trial sought to evaluate: aircraft performance; airspace management; operational benefits, including time, distance, fuel and carbon emission savings; noise monitor results; and public feedback.

# 7.0

# Trial results

# 7.0 Trial results

## 7.1 Use

The Yellow U23 SMART Approach flight path was used 440 times during the 12-month trial.

A month-by-month summary of use is outlined in the table below:

| Month | Number of Yellow U23 SMART Approaches |
|---|---|
| Sep 2015 | 19 |
| Oct 2015 | 31 |
| Nov 2015 | 25 |
| Dec 2015 | 18 |
| Jan 2016 | 15 |
| Feb 2016 | 0 |
| Mar 2016 | 0 |
| Apr 2016 | 19 |
| May 2016 | 65 |
| Jun 2016 | 113 |
| Jul 2016 | 80 |
| Aug 2016 | 55 |
| **TOTAL** | **440** |

The initial uptake of the Yellow U23 SMART Approach flight path by airlines was slow. This was primarily because aircraft operating systems only allow pilots to load two possible approaches from the north and west. One of those approaches is required to be the conventional instrument landing approach. Initially almost all pilots chose to load the shorter Green X23A SMART Approach flight path as the second approach.

In addition, the trial was paused during February and March 2016 due to runway maintenance at Auckland Airport, which caused a reduction in the length of runway available for aircraft landing to the west.

In May 2016, airline participants in the trial agreed that aircraft from northern Australia and Asia would load the Yellow U23 SMART Approach flight path as the second approach and aircraft from Sydney and southern Australia would load the Green X23A SMART Approach flight path as the second approach.

The Yellow U23 SMART Approach flight path was used most frequently in June and July 2016.

The maximum number of Yellow U23 SMART Approaches flown on a single day during the trial was nine. This occurred on 18 June and 19 June 2016.

The maximum number of Yellow U23 SMART Approaches and Green X23A SMART Approaches flown on a single day was 16. This occurred on the following dates:

- 3 May 2016 (six Yellow U23 and ten Green X23A)
- 12 June 2016 (six Yellow U23 and ten Green X23A)
- 18 June 2016 (nine Yellow U23 and seven Green X23A).

# 7.2 Airways' feedback

During the Yellow U23 SMART Approach flight path trial, Airways' key objective was to ensure that Yellow U23 SMART Approach flight path trial procedures could successfully be developed and safely integrated into the existing air traffic management system without affecting the pre-existing airport and airspace capacities.

Airways reported the following feedback about the Yellow U23 SMART Approach flight path trial:

- From an Airways' air traffic systems management and objectives perspective the trial successfully met its objectives.
- It was a demonstration of the value of collaboration, and brought measurable and sustainable efficiencies and environmental benefits.
- A total of 440 Yellow U23 SMART Approaches were flown:
    - This equates to 3,175 nautical miles of distance saved by factoring the accumulated mileage difference between the Yellow U23 SMART Approach and conventional approach paths.
    - A total of 76,536 kilograms of fuel was not burned, and there were 241,852 kilograms of reduced carbon emissions as a result of airlines using the Yellow U23 SMART Approach flight path instead of the conventional approach paths into Auckland.
- An average of 44 flights per month used the Yellow U23 SMART Approach flight path when it was available.
- The highest utilisation month was June 2016, with 113 flown.
- Initially four operators – Air New Zealand, Qantas (Jetconnect), Virgin Australia and Jetstar – participated. Emirates joined the trial in November 2015.
- All flights using the Yellow U23 SMART Approach flight path during the trial operated within the daily time window of 7am to 10pm.
- The permitted number of daily flights (10) was never exceeded.
- The International Civil Aviation Organisation's (ICAO) Global Air Navigation Plan, Aviation System Block Upgrade Block 0 and Performance-Based Navigation (PBN) doctrines were able to be achieved. The New Zealand Government's Ministry of Transport Airspace Policy and New Zealand National Airspace and Air Navigation Plan were correctly referenced and considered during the Yellow U23 SMART Approach flight path trial, and also for any future long-term initiatives.

In total, Airways had eight objectives for the Yellow U23 SMART Approach flight path trial. As set out on page 39, Airways considers those objectives were all met.

## Airways' key objectives

| | |
|---|---|
| Be aligned with the International Civil Aviation Organisation's (ICAO) Global Air Navigation Plan – 4th Edition | Achieved |
| Be aligned with ICAO Aviation System Block Upgrade Block 0 – Performance-Based Navigation, Continuous Descent Operations, Continuous Climb Operations | Achieved |
| Be aligned with ICAO PBN – Safety, Capacity, Efficiency, Environment and Access – with a focus on Environment and Access | Achieved |
| Have alignment with the New Zealand Government's Ministry of Transport Airspace Policy and New Zealand National Airspace and Air Navigation Plan documents | Achieved |
| Operate, validate and integrate SMART Approach traffic in Air Traffic Management real-world operations for A320, A380, B737, B777 and B787 | Achieved |
| Measure lateral and vertical flight paths for conformance to design profiles | Achieved |
| In conjunction with Auckland Airport, assess aircraft noise feedback to ensure recorded values are as expected for the SMART Approach flight path trial | Achieved |
| Determine the suitability of the Yellow U23 SMART Approach for continued use beyond the trial period | Achieved |

A detailed summary of Airways' feedback is contained in the publication *Airways New Zealand Uniform SMART Approach Trial Report*, which can be found online at www.aucklandflightpathtrial.co.nz .

# 7.3 Airline feedback

The Board of Airline Representatives New Zealand (BARNZ) advises that the purpose of the trial from the airlines' perspective was to assess two key operational elements:

- The performance of aircraft flying the approaches in the various weather conditions across a year
- How effectively Airways would be able to utilise the SMART procedure and merge aircraft on the SMART flight paths with aircraft on conventional tracks onto the extended centreline for final approach. In assessing this, the airlines also wanted to ensure that the runway capacity in terms of aircraft movements per hour was not adversely affected.

Five aircraft types took part in the Yellow U23 SMART Approach flight path trial:

- Air New Zealand and Emirates Boeing 777s
- Air New Zealand Boeing 787s
- Jetconnect and Virgin Australia Boeing 737s
- Air New Zealand and Jetstar Airbus A320s
- Emirates Airbus A380s.

The airlines considered that the flyability for all aircraft types was acceptable and correspondingly recommended no design changes for the Yellow U23 SMART Approach.

Of more importance, they considered that the objective of achieving a profile that delivers near idle engine power with minimal need for use of other noise-generating pilot actions (e.g. speed brake application) had been achieved by the procedure design.

The airlines considered the reinstatement of procedures used in the trial from May 2016 – when pilots of participating aircraft originating from certain destinations agreed to select Yellow U23 rather than Green X23A – would improve usage of the Yellow U23 SMART Approach flight path.

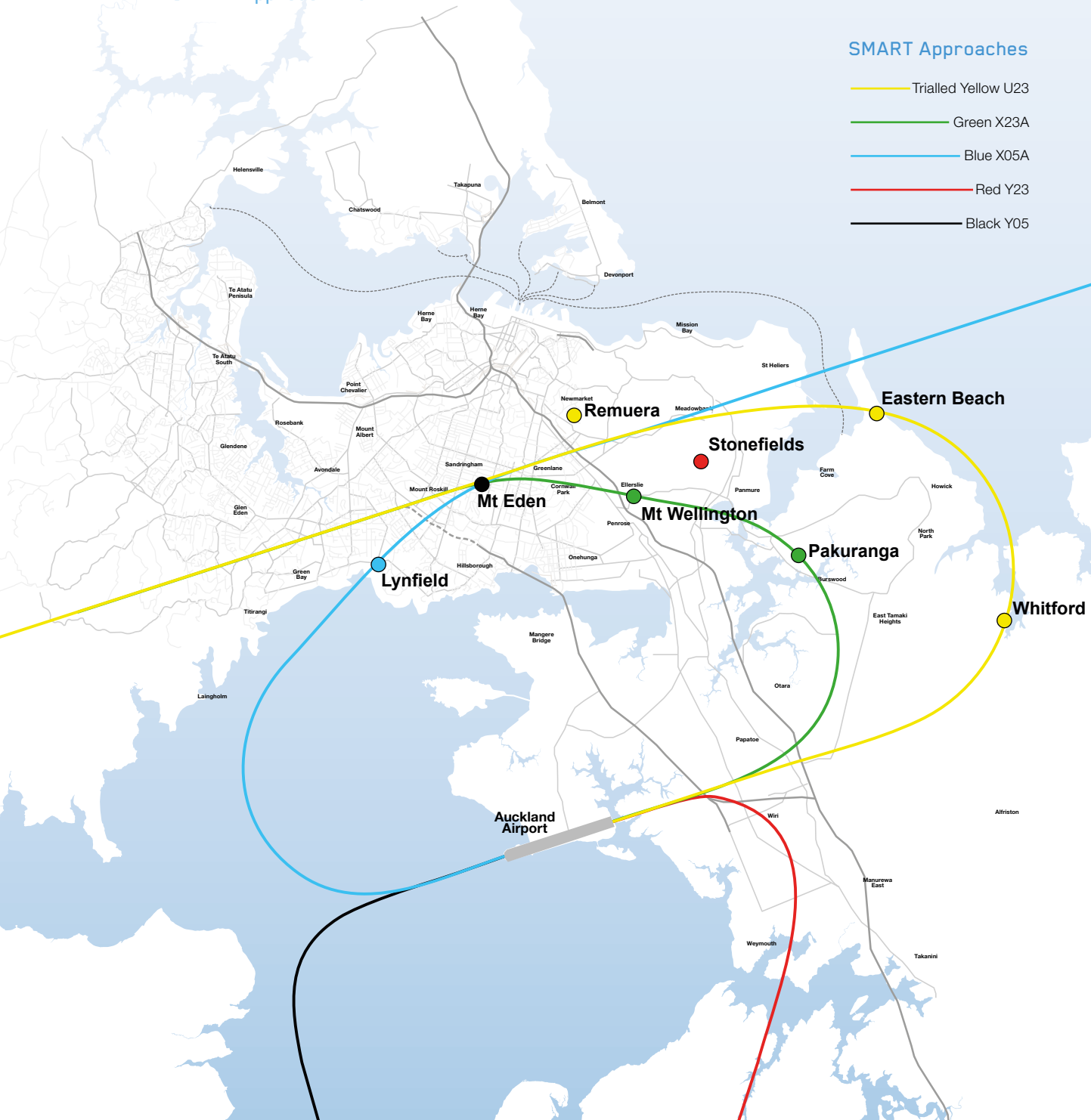
A detailed summary of BARNZ's feedback is contained in the report *Auckland Uniform SMART Approach Trial Review – An Airline Perspective*, which can be found online at www.aucklandflightpath.co.nz .

# 7.4 Noise monitor results

Over the course of the 12-month Yellow U23 SMART Approach flight path trial, data was gathered by noise experts Marshall Day Acoustics (MDA), on behalf of Auckland Airport, from eight noise monitors in the community. The monitors were sited in the following locations:

- Gilletta Road, Lynfield
- Ridings Road, Remuera
- Kauriki Terrace, Stonefields
- Hostel Access Road, Eastern Beach
- Landscape Road, Mt Eden
- Wilkinson Road, Mt Wellington
- Marriott Road, Pakuranga
- Wades Road, Whitford.

Figure 9: Location of noise monitors during the Yellow U23 SMART Approach trial



Seven noise monitors were in position prior to the commencement of the trial, as follows:

- Two under the trial Yellow U23 SMART Approach flight path
- Two under the operational Green X23A SMART Approach flight path
- One under the operational Blue X05A SMART Approach flight path
- One at the intersection of the Green X23A SMART Approach, Yellow U23 SMART Approach and Blue X05A SMART Approach flight paths
- One under a non-SMART Runway 23L Approach, between the Yellow U23 and Green X23A SMART Approach flight paths.

One additional monitor was installed in Remuera in April 2016 to monitor the Yellow U23 SMART Approach flight path trial. This followed preliminary analysis which showed that some aircraft using the Yellow U23 SMART Approach flight path were flying over Remuera and joining the approach closer to Auckland Airport rather than flying straight from Piha.

The exact correlation between objective noise measurements and public response is a difficult process, as the relationship is a complex interaction between many attitudinal, social and noise-related factors. However, a large amount of research has been carried out overseas and there is general consensus that annoyance due to aircraft noise depends on both the number of noise events and the loudness of such events.

This draft report refers to two internationally recognised noise metrics: $L_{Amax}$ and $L_{dn}$.

- $L_{Amax}$ (Maximum Noise Level) is the highest noise level experienced during an aircraft overflight. $L_{Amax}$ is useful for comparing the noise level of one individual aircraft event with another aircraft event at the same point.
- $L_{dn}$ measures the 'noise energy' of each event and then combines the events over a 24-hour period, with a 10 decibel penalty applied to any noise events at night (10pm to 7am). This penalty recognises the increased annoyance, and also sleep disturbance at night-time. $L_{dn}$ is the most widely-used metric for aircraft noise in Europe, the USA and New Zealand.

In addition, the Person-Event Index (PEI) represents the number of people multiplied by the number of events each person is exposed to. For instance, if 20 people were located within the N65 10-event contour (i.e. exposed to 10 events per day above 65 $L_{Amax}$), the PEI would be 20 people x 10 events = 200 PEI. Similarly, if four people were located under the N65 50-event contour (i.e. exposed to 50 events per day above 65 $L_{Amax}$) the PEI would be 4 people x 50 events = 200 PEI.

Using these measures, MDA undertook considerable noise analysis of SMART and non-SMART Approach flights during the trial.

A detailed summary of MDA's feedback is contained in the report *Analysis and Assessment of Effects (Yellow U23),* which can be found online at www.aucklandflightpathtrial.co.nz .

Using the measured single-event noise levels at each site, noise exposures ($L_{dn}$) were calculated for a day on which 10 Yellow U23 SMART Approaches were operating and a day when no Yellow U23 SMART Approaches were in operation. These calculations are for aircraft noise only and do not include the general ambient noise (e.g. road traffic). The findings of these calculations showed that the difference in the noise exposure ($L_{dn}$) between a day on which 10 Yellow U23 SMART Approaches were operating and when no Yellow U23 SMART Approaches were in operation was less than one decibel at most sites. There were two exceptions to this finding, in Whitford and Remuera.

The Whitford noise monitor showed the predicted difference between a day with no Yellow U23 SMART Approaches and 10 Yellow U23 SMART Approaches was an additional four decibels ($L_{dn}$). This change in noise is described by noise experts as “just perceptible” and is not regarded as significant.

The Remuera noise monitor showed a predicted increase of 2.2 decibels ($L_{dn}$) between a day with no Yellow U23 SMART Approaches and a day with 10 Yellow U23 SMART Approaches. This change in noise is described by noise experts as “imperceptible” and is not regarded as significant.

At all of the trial’s eight noise monitoring locations, the calculated $L_{dn}$ noise exposure for aircraft was 35 to 40 decibels, 10 and 18 decibels below the measured ambient noise (which comprises the background sounds present at a location).

# 7.5 Community feedback

Between September 2015 and August 2016, a total of 109 people provided Auckland Airport with aircraft noise feedback on 1,724 occasions:

- 1,519 (or 88 per cent of feedback) related to specific aircraft events
- 205 (or 12 per cent of feedback) were of a generic nature.

Analysis shows approximately 60 per cent of all feedback was received from two people. Both of these people were located in Onehunga, approximately three kilometres from the Yellow U23 SMART Approach flight path – but close to Green X23A SMART Approach flight path.

Figure 10 (on page 45) shows the locations of those people providing feedback throughout the trial. Each circle represents one person and the colour of the circle indicates how many times each person provided feedback during the trial, as shown in the legend.

Auckland Airport launched its new flight monitor and enquiry system during the Yellow U23 SMART Approach flight path trial. The flight monitor gives anyone online the ability to view the aircraft arriving at or departing from Auckland Airport and to enquire about aircraft noise. The flight monitor system combines information from Airways' air traffic control radar and Auckland Airport's noise monitoring system to give an accurate picture of air traffic movements.

During the trial, 1,519 pieces of feedback which could be attributed to identifiable flights were received through the new flight monitor and enquiry system. Only 15, or one per cent, related to the Yellow U23 SMART Approach flight path. The amount of feedback related to the Yellow U23 SMART Approach trial was significantly lower than that related to the previous trial.
The 15 pieces of feedback on the Yellow U23 SMART Approach flight path were provided by eight people. One person accounted for more than 50 per cent of the feedback.

The feedback came from two distinct locations: Cockle Bay (three people) and Onehunga (five people). The three people in Cockle Bay and two of the five people in Onehunga were located near the Yellow U23 SMART Approach flight path. However, the remaining three people in Onehunga were located approximately three kilometres from the Yellow U23 SMART Approach flight path. Feedback was attributed to the Yellow U23 SMART Approach if the person providing the feedback specifically referenced the Yellow U23 SMART Approach.

### Generic feedback

The nature of generic feedback often makes it difficult to determine the cause of concern. On many occasions disturbance could have been due to many factors, which may include one or more of the SMART Approaches.

Analysis showed:

- 86 per cent of generic feedback related to non-SMART flights (68 comments)
- 8 per cent related to Yellow U23 SMART Approaches (17 comments)
- 6 per cent related to Green X23A SMART Approaches (11 comments).

## Figure 10: Location of feedback during the Yellow U23 SMART Approach trial

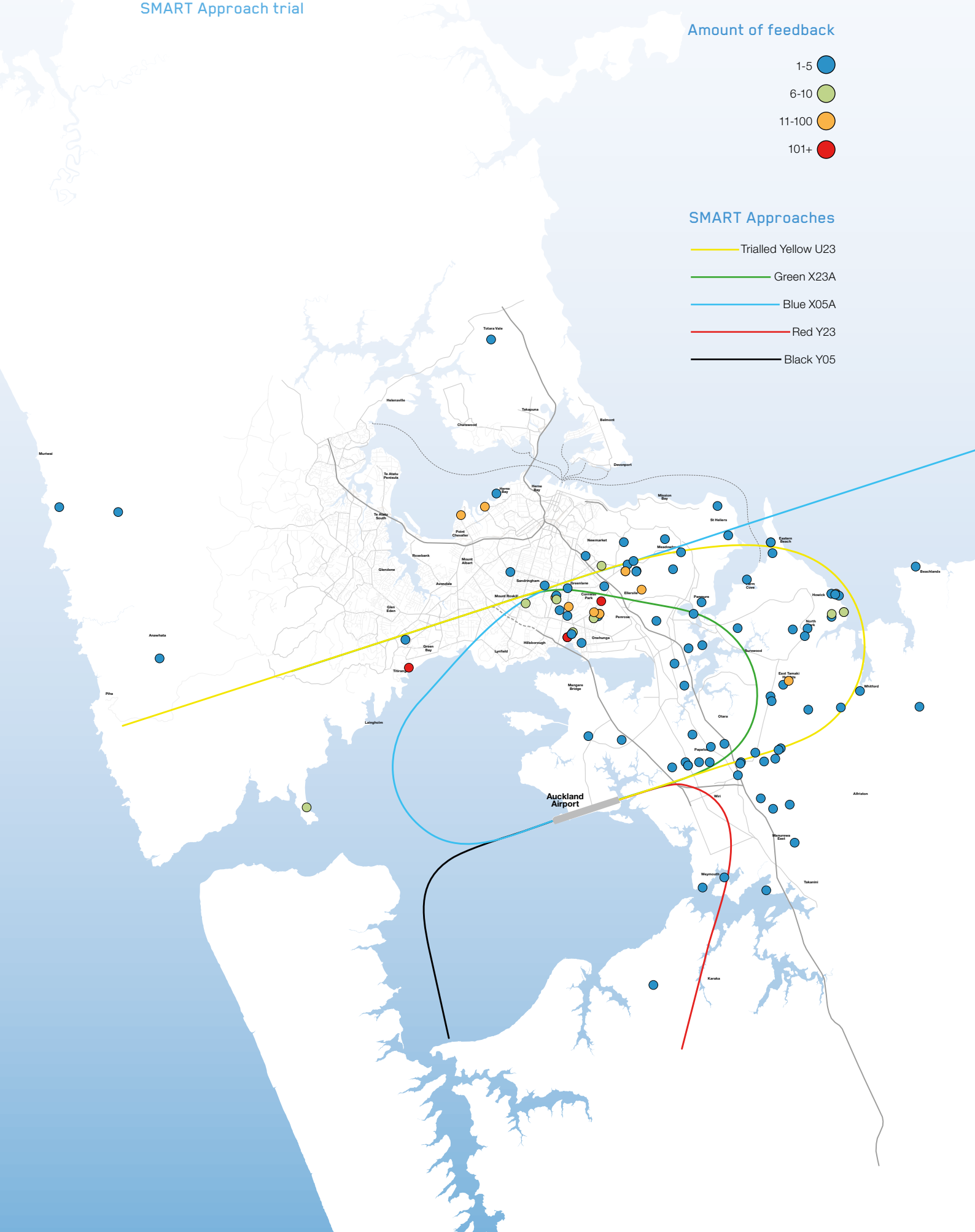
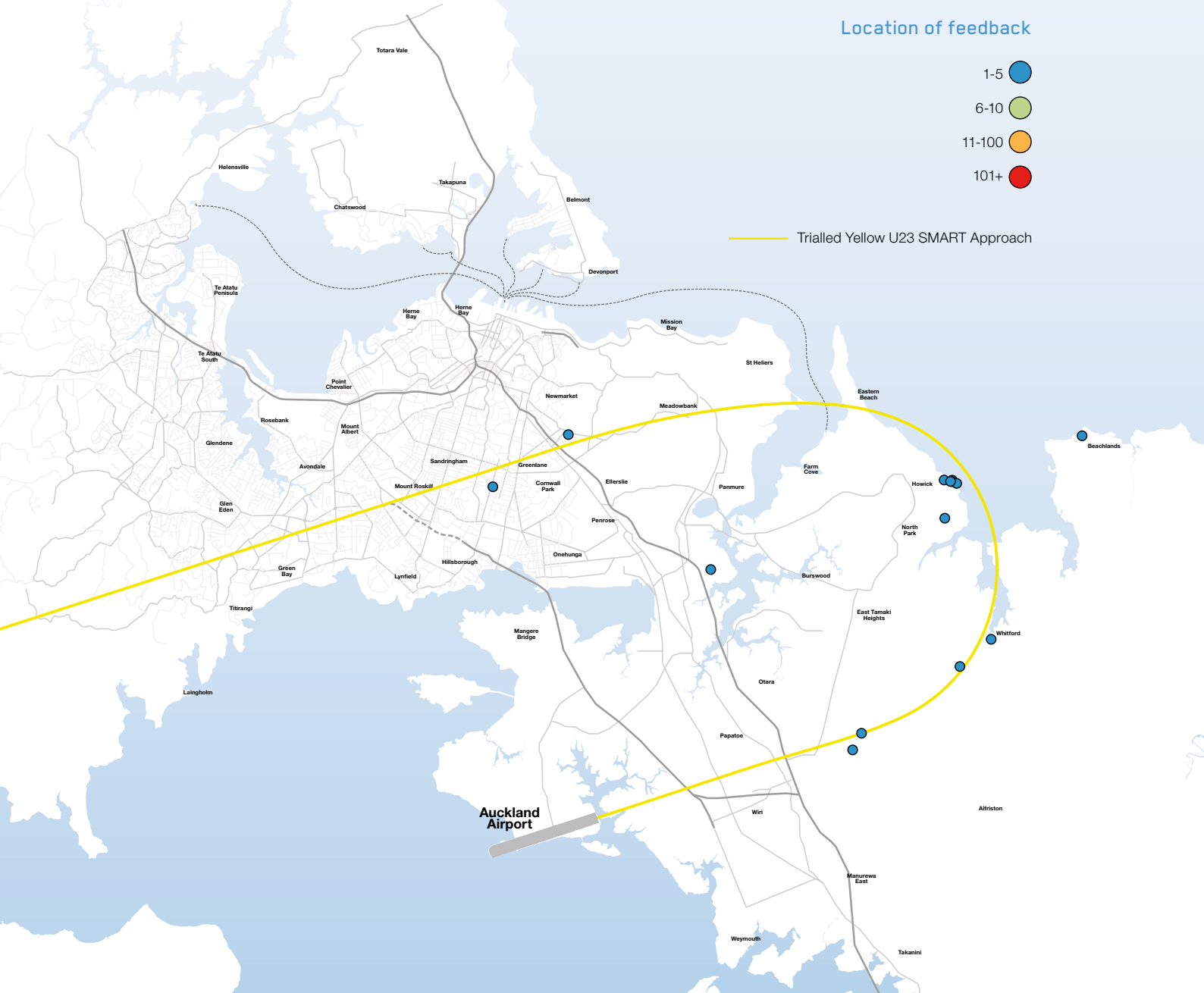


Figure 11 below shows the locations of all generic feedback about the Yellow U23 SMART Approaches trial. The colour of each circle indicates how much feedback each person provided throughout the trial. All 11 people provided feedback fewer than five times. Feedback mainly came from Onehunga, Cockle Bay, Whitford and Flat Bush. Most of the people providing feedback were located near the Yellow U23 SMART Approach, however one person was located in Mt Wellington, several kilometres away from the trial SMART Approach.

In addition to the feedback provided directly to Auckland Airport through its new flight monitor and enquiry system, a group of Whitford residents provided feedback to Auckland Council and gave a presentation to the Aircraft Noise Community Consultative Group (ANCCG) at its September 2016 meeting. Following that presentation, Auckland Airport met with representatives of the Whitford residents group. As well as concerns regarding increased aircraft noise, the residents were concerned that local wildlife and their property values would negatively be affected by the Yellow U23 SMART Approach flight path. Airways, BARNZ and Auckland Airport have investigated these concerns and with the assistance of expert advice have concluded the Yellow U23 SMART Approach flight path does not significantly disturb local wildlife nor negatively impact property prices.

Figure 11: Map of generic feedback during the trial which related to the Yellow U23 SMART Approach



# 7.6 Draft trial conclusion

Airways, BARNZ and Auckland Airport are satisfied that the trial proved:

- The flyability of the Yellow U23 SMART Approach flight path
- That the Yellow U23 SMART Approach flight path has the potential to provide benefits to airlines, in terms of reduced fuel burn and lower carbon dioxide emissions
- That the Yellow U23 SMART Approach flight path has the potential to provide benefits to Airways, in relation to enhanced airspace management.

However, the trial did not demonstrate that there is currently a demand for 10 Yellow U23 SMART Approaches per day. The Green X23A SMART Approach flight path provides a shorter flight path for approaches from the north-west, and that flight path will always be the preferred one for airlines. During the trial, the maximum daily number of SMART Approaches from the north-west (both Yellow U23 and Green X23A) was 16.

Despite the limited number of Yellow U23 SMART Approaches that were flown, Marshall Day Acoustics (MDA) was able to extrapolate aircraft noise data gathered during the trial to assess the effects of 10 Yellow U23 SMART Approaches per day. MDA determined that the increase in noise levels would not be perceptible throughout the Auckland region, with the exception of Whitford where it would be just perceptible (four decibels more).

A Person-Event Index (PEI) study assessed the impact of Yellow U23 SMART Approach-related noise on the community Auckland wide. This study showed no change overall as the small increases in noise in the Whitford area were balanced out by decreases elsewhere.

Because of the low level of aircraft noise measured at the noise monitors and the measured ambient noise levels (49 to 56 decibels $L_{dn}$), negative community concern is unlikely. However, due to the low uptake of the Yellow U23 SMART Approach throughout the trial, there is a possibility that residents underneath the flight path could notice an increase from one approach per day to 10 approaches per day. Therefore, it is recommended that a staged introduction of the Yellow U23 SMART Approach track be undertaken.

# 7.7 Future initiatives

The decision in the December 2014 SMART Approach Flight Path Trial Final Report included a requirement that an investigation be undertaken to determine the feasibility of a second SMART Approach flight path from the south to Runway 23L.

Airways, BARNZ and Auckland Airport have completed that investigation and believe that a second SMART Approach flight path from the south to Runway 23L (known as Orange T23) should be trialled.

# 8.0

# Draft decision

# 8.0 Draft decision

The following recommendations have been made to Auckland Airport by the trial partners as a result of the 2015-2016 Yellow U23 SMART Approach flight path trial:

1. The Yellow U23 SMART Approach flight path to Auckland Airport should be adopted for operational use in late 2017.
2. A maximum of six flights per day may use the Yellow U23 SMART Approach flight path.
3. Aircraft may only use the Yellow U23 SMART Approach flight path between the hours of 7am and 10pm.
4. The number of Yellow U23 SMART Approaches per day may be increased to a maximum of 10, provided that:
    a) Auckland Airport is satisfied that there is a consistent and ongoing demand for the additional Yellow U23 SMART Approaches
    b) Any increase in the maximum number of Yellow U23 SMART Approaches above six per day is staged
    c) The Aircraft Noise Community Consultative Group (ANCCG) has been consulted on the proposal to increase the maximum number of Yellow U23 SMART Approaches to above six per day.

In addition to the above recommendations relating to the Yellow U23 SMART Approach flight path, the following recommendation is also made to Auckland Airport by the trial partners:

5. A further SMART Approach flight path to Auckland Airport from the south to Runway 23L (Orange T23) should be trialled from July 2018, provided that all trial methodology and assessment criteria have been confirmed including public notification prior to the trial and a public consultation process at its conclusion.

Before making a final decision on the above recommendations, Auckland Airport will consider all public feedback on the Yellow U23 SMART Approach trial, the proposed Orange T23 SMART Approach flight path trial, and this draft report.

When the public consultation process is complete and a decision has been made, it will be communicated to the public and stakeholders. Auckland Airport intends to do this in December 2017.


AIRBUS A380-800
B737
A320

# 9.0

# Public consultation

# 9 Public consultation

Auckland Airport welcomes feedback on this draft report and its recommendations.

You can send a written submission to:

**Auckland Flight Path Trial**
**C/- Auckland Airport**
**PO Box 73020**
**Auckland Airport**
**Manukau 2150**

or complete a submission online using the form at www.aucklandflightpathtrial.co.nz .

Written submissions will be accepted until 5pm on 15 November 2017.

There will be opportunities for members of the public who have made a written submission to present their submissions to the participants in the trial personally, should they wish to do so. Members of the public may book a 15-minute slot for their presentation. Submitters will be asked to keep to their allocated time to ensure that all members of the public wishing to provide feedback are able to do so.

Presentations from members of the public who have made written submissions will be heard at:

**Whitford Community Hall**
1 Whitford Maraetai Road, Whitford
Thursday 16 November 2017
5pm-8pm

**Nixon Park Community Hall**
70 Sale Street, Howick
Friday 17 November 2017
10am-3pm

If you wish to make a booking to present your submission, please do so online at: www.aucklandflightpathtrials.co.nz .

Time-slots will be allocated to the public on a ‘first come, first served’ basis.

Airways, BARNZ and Auckland Airport will consider all feedback before publishing a final report in December 2017.