Determining a safe and efficient runway alignment

Airspace and flight track design: Preferred runway alignment

August 2023

Airport planning aims to meet the future needs of communities and regions

Airports are intergenerational assets and exploring the creation of a new airport is a detailed and complex task.

Airport planning is future focussed, providing a balance between reliance on known technological advances in areas such as air traffic control, avionics and security, the possibility of innovations enabling new ways of operating an airport, as well as the transition of New Zealand's aviation network to a low carbon future.

Key features of a safe and efficient modern airport at the proposed site are:

Airport is relatively free of infrastructure constraints

- a single runway of at least 2,200m and up to 3,000m,
- associated taxiways and aircraft parking aprons,
- fully compliant 240m runway end safety areas,
- resilience to natural hazards including those associated with climate change.

Airlines have the ability to match best aircraft to route

- maximum flexibility to enable airlines to use the wide range of aircraft anticipated to be in operation at the airport over its lifetime.

Airport infrastructure enables greener aviation

- ability to use the latest generation of aviation technology to maximise safety and efficiency, and to mitigate the effects of operations on communities and the environment.

Airport infrastructure enables operational efficiencies

- ability to incorporate smart technology and innovation to enhance the user experience and improve the reliability of flight schedules by enabling safe operations to continue during low visibility conditions.

Airport planning aims to meet the future needs of communities and regions

Runway length and location determines the aircraft types that can be used, the number of passengers, and weight of freight and fuel (payload) that can safely be carried. Site geography and boundaries, surrounding terrain and weather are all factors in determining the runway length for a particular site.

Runways are one of the most expensive and significant pieces of infrastructure on an airport. Considering the maximum runway length that is feasible for the site at the planning stage reduces the need for disruption later in the life of the airport.

The location of a runway considers prevailing wind patterns, topography, and surrounding airspace. An optimal runway location enables safer aircraft operations and enhances aircraft performance. The right location within the airport layout ensures efficient operation by reducing taxiing times and minimising congestion.

For this project, runway lengths of 2,200m and 3,000m have been considered as the most realistic shortest and longest options available for the site.

A runway of between 2,200m and 2,600m is likely to be feasible for the site and surrounding terrain. At this length, the runway would enable airlines to use a broad range of aircraft types for domestic, trans-Tasman, South Pacific and some Southeast Asian operations.

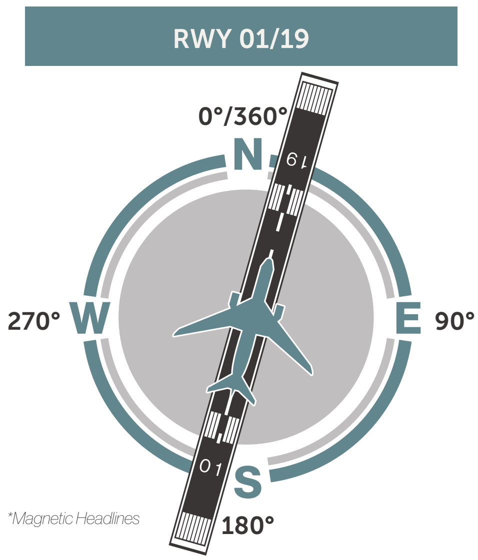
There are two options for runway alignment on the site near Tarras

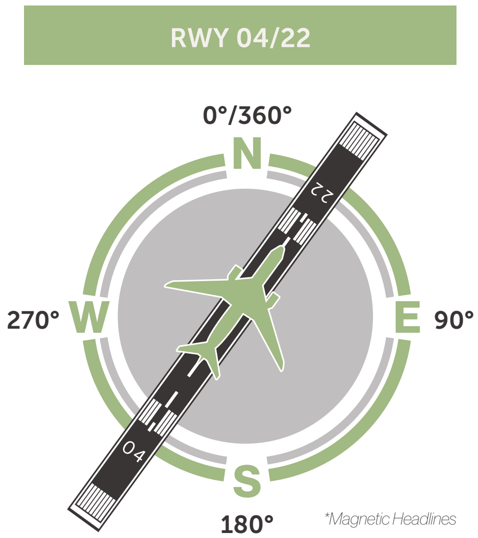
Option 01/19 aligned north to the Hāwea Valley and south to the Lake Dunstan Valley.

Option 04/22 aligned northeast to the Lindis Valley and south to the Lake Dunstan Valley.

In order to determine a preferred alignment, feasible flight path options and flight procedures must be designed. Flight tracks were designed with six principles in mind:

- Keep design as simple as possible
- Place safety as the primary consideration.
- Be compliant with relevant International and New Zealand Civil Aviation Standards.
- Be suitable for a range of aircraft types and potential airlines, for operations to and from likely destinations, in New Zealand and internationally, based on selected proxies.
- Mitigate impact on areas which have levels of potential social sensitivity to having aircraft flight paths overflying, such as potential noise effects and impacts on visual amenity, i.e. over communities and sensitive heritage and ecological areas.
- Be efficient in terms of flight track distance and connections to the established New Zealand domestic and international enroute air navigation structure, which affects carbon emissions.





Determining a preferred alignment involved assessment against four criteria

Key steps to determining a preferred runway alignment involved detailed assessments of flight paths, airspace integration, aircraft performance, environmental performance and noise impacts. This work helped establish which runway alignment option is best suited to the types of aeronautical operations that could be expected.

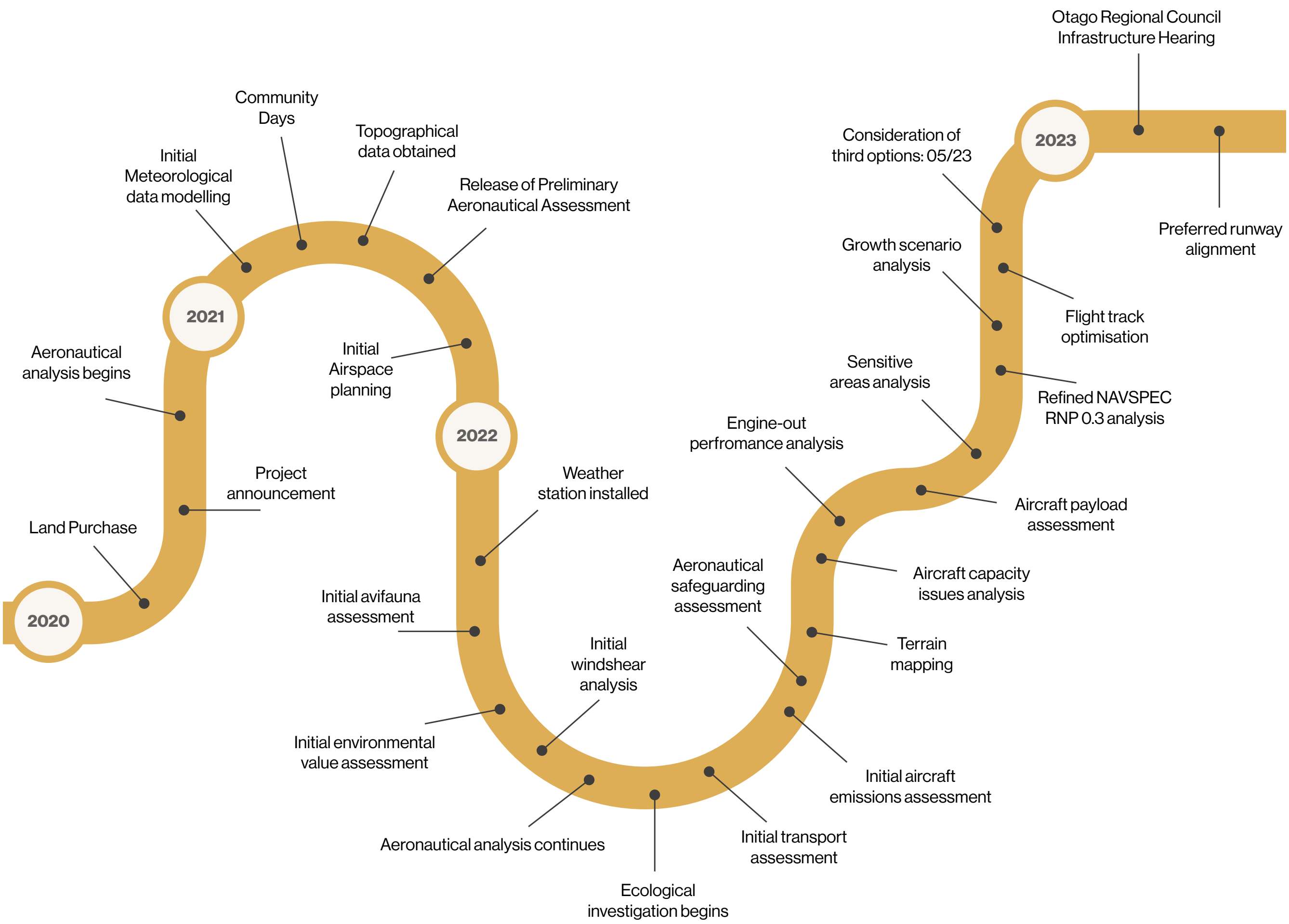
Once flight tracks and flight procedures had been designed, they were assessed against four lenses:

1. Safety is the most important consideration. Flight paths must be feasible, safe and compliant with relevant International and New Zealand Civil Aviation Standards.

2. Efficiency predicts a measure of individual aircraft and overall airspace system performance.

3. Environment measures noise impacts, visual effects from aircraft overflight (for both communities and sensitive heritage and ecological areas) and carbon emissions.

4. Capacity assesses the ability of the airspace system and air traffic management procedures to minimise inter-dependencies of flight paths flight procedures to achieve a consistent processing rate of aircraft arrivals and departures at the airport.



Runway alignment option 04/22 performed better than 01/19

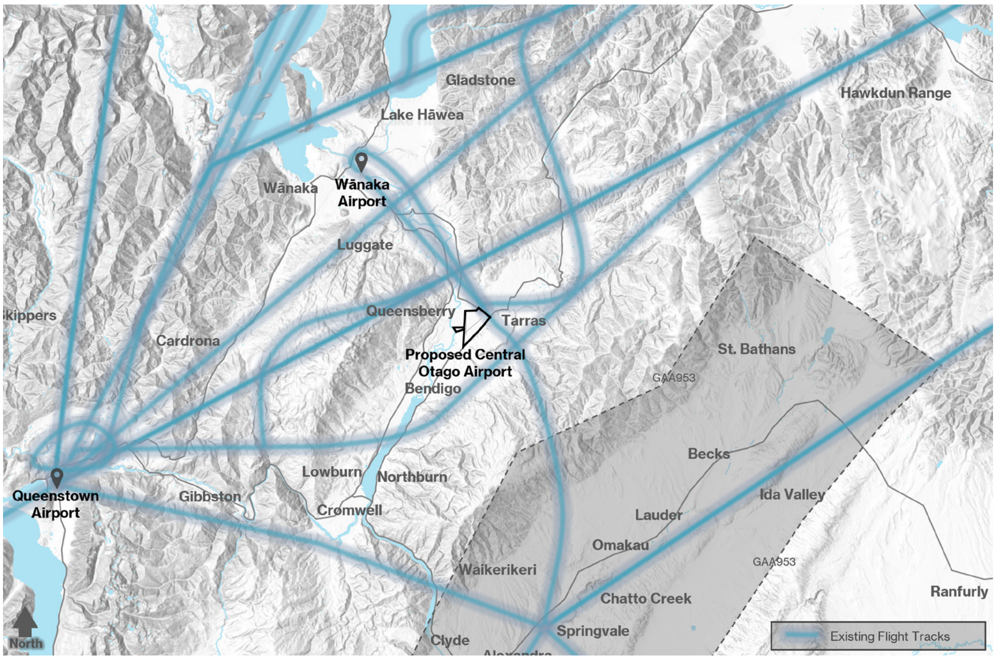
Our assessment concluded that both runway alignment options performed relatively equally against most requirements. However, 04/22 is likely to have lesser noise impacts, and performed better on a number of efficiency measures.

Benefits of this alignment are:

- greatest flexibility for aircraft types and operating parameters, an important factor for long-term resilience, especially with unknown performance capabilities of next generation aircraft,
- enhanced reliability for low visibility conditions due to lower decision heights,
- greater payload capacity than 01/19,
- reduced community noise impact.

	Hāwea Valley - Lake Dunstan 01/19	Lindis Valley - Lake Dunstan 04/22
Flight Tracks		
	• Able to connect to and from the existing flight paths in the area and beyond. • Avoids overflying main residential areas of Cromwell, Ardgour Valley, Arrowtown, Queenstown and Lake Wānaka, Hāwea and Wakatipu. Flight paths track close to Wānaka and Hāwea.	• Able to connect to and from the existing flight paths in the area and beyond. • Avoids overflying main residential areas of Wānaka, Hāwea, Cromwell, Arrowtown, Queenstown and Lakes Wānaka, Hāwea and Wakatipu. Flight paths track close to Ardgour Valley.
Runway Navigation Technology		
	• Aircraft navigation systems RNP-AR 0.1, and 0.2 NAVSPEC are achievable for this alignment option with limitations. • The more accurate RNP 0.3 NAVSPEC is not possible on Runway 19.	• Aircraft navigation systems RNP-AR 0.1, 0.2 and 0.3 are achievable for this alignment option.
Safety considerations		
	• Substantial breach of the Obstacle Control Surface (OCS). • Weather is within normal operating parameters. • EOSID - Engine Out Standard Instrument Departure (a process for safely clearing take off with one engine) is achievable on Runways 01 unrestricted for domestic, Tasman and long haul routes. Runway 19 would require payload restrictions of below 80% for domestic and Tasman routes, and likely unworkable restrictions for long haul operations.	• Weather is within normal operating parameters. • EOSID - Engine Out Standard Instrument Departure (a process for safely clearing take off with one engine) achievable on Runways 04 and 22 unrestricted for domestic and Tasman routes, with possible payload restrictions for some long haul operations.
Efficient operations		
	• Able to support full or near full payloads for all expected aircraft types across domestic and trans-Tasman routes. • Efficient for short routes (Wellington and Christchurch). Similar performance for Auckland and international routes compared to 04/22. • Restrictions would be required for turboprop operations to Wellington.	• Able to support full or near full payloads for all expected aircraft types across domestic and trans-Tasman routes. • Some payload limitations would be expected for some long haul routes. • Efficient for short routes (Wellington and Christchurch). Similar performance for Auckland and international routes compared to 01/19.
Considering our environment		
	• Exposes more households to noise compared to 04/22 option. • Comparable emissions output with 04/22.	• Exposes fewer households to noise compared to 01/19 option. • Comparable emissions output to 01/19 option.
Capacity and air traffic management		
	• The design process has not proceeded sufficiently for capacity to be a differentiator.	

Flight tracks are on-ramps linking to existing flight paths



Notes:

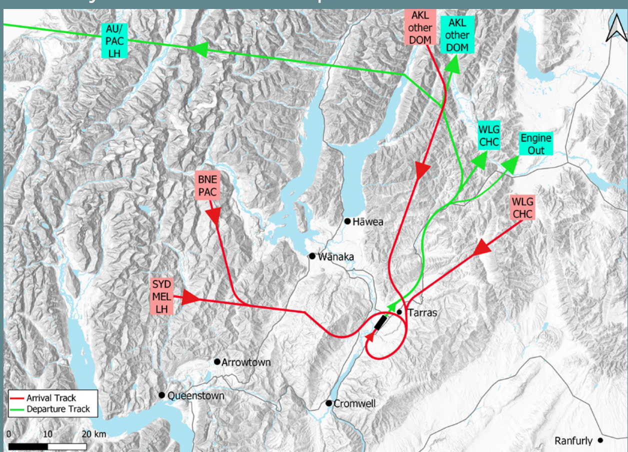
- This graphic is illustrative.
- GAA953 is an area of controlled airspace released by air traffic control for glider activity.
- Flight tracks are a general representation of some of the key scheduled aircraft flight tracks in the area.
- Preliminary new flight tracks are not illustrated.

The flight tracks depict the approach and departure tracks which would link into existing flight paths. The airspace around the site is already used by scheduled aircraft accessing other airports in the region or enroute to other destinations.

A Standard Terminal Arrival (STAR) would be developed which connects from the established enroute network to the start of the landing approach.

As the approach begins well above the terrain, no significant design issues are anticipated for the future design of the STARs.

Runway 04 Arrival and Departure



Runway 22 Arrival and Departure