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Evaluation | Analytics | Insights

PREPARED FOR
Aviation Industry Association New Zealand and Ringa Hora

Aviation workforce insights
Summary of approach and findings

October 2024

Scarlatti.co.nz

Report contents

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IDI disclaimer

Results presented in this document are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) and the Longitudinal Business Database (LBD) which are carefully managed by Stats NZ. For more information about the IDI and LBD please visit https://www.stats.govt.nz/integrated-data/.

Access to the data used in this study was provided by Stats NZ under conditions designed to give effect to the security and confidentiality provisions of the Data and Statistics Act 2022. The results presented in this study are the work of the author, not Stats NZ or individual data suppliers.

About this report

This report presents the results from a series of modelling exercises and data analyses from the Aviation Workforce Insights Platform project undertaken by Scarlatti for the Aviation Industry Association of New Zealand (AIANZ) and Ringa Hora.

Detailed modelling sets out to examine the supply and demand of pilots and aviation maintenance engineers through stocks and flows modelling, and to provide a snapshot of the characteristics of other important occupations such as flight attendants and baggage handlers/ground crew. For pilots and aviation engineers, the workforce insights platform project is also undertaking scenario analyses, to provide the sector with a view of the impact that a range of interventions may have on resolving the shortages. It is intended that platform will provide an evidence-base to support decision making around responses to meeting projected workforce needs.

This report is intended to provide a comprehensive account of the modelling and data analyses undertaken and can be utilised as a standalone document or used alongside the interactive dashboard developed, accessible here.

This report also accompanies three other documents:

- An executive summary of findings from model (available on request from AIANZ or Ringa Hora)
- Excel model for pilots (available on request from Scarlatti)
- Excel model for engineers (available on request from Scarlatti)

Introduction

Context of challenges within New Zealand's aviation sector

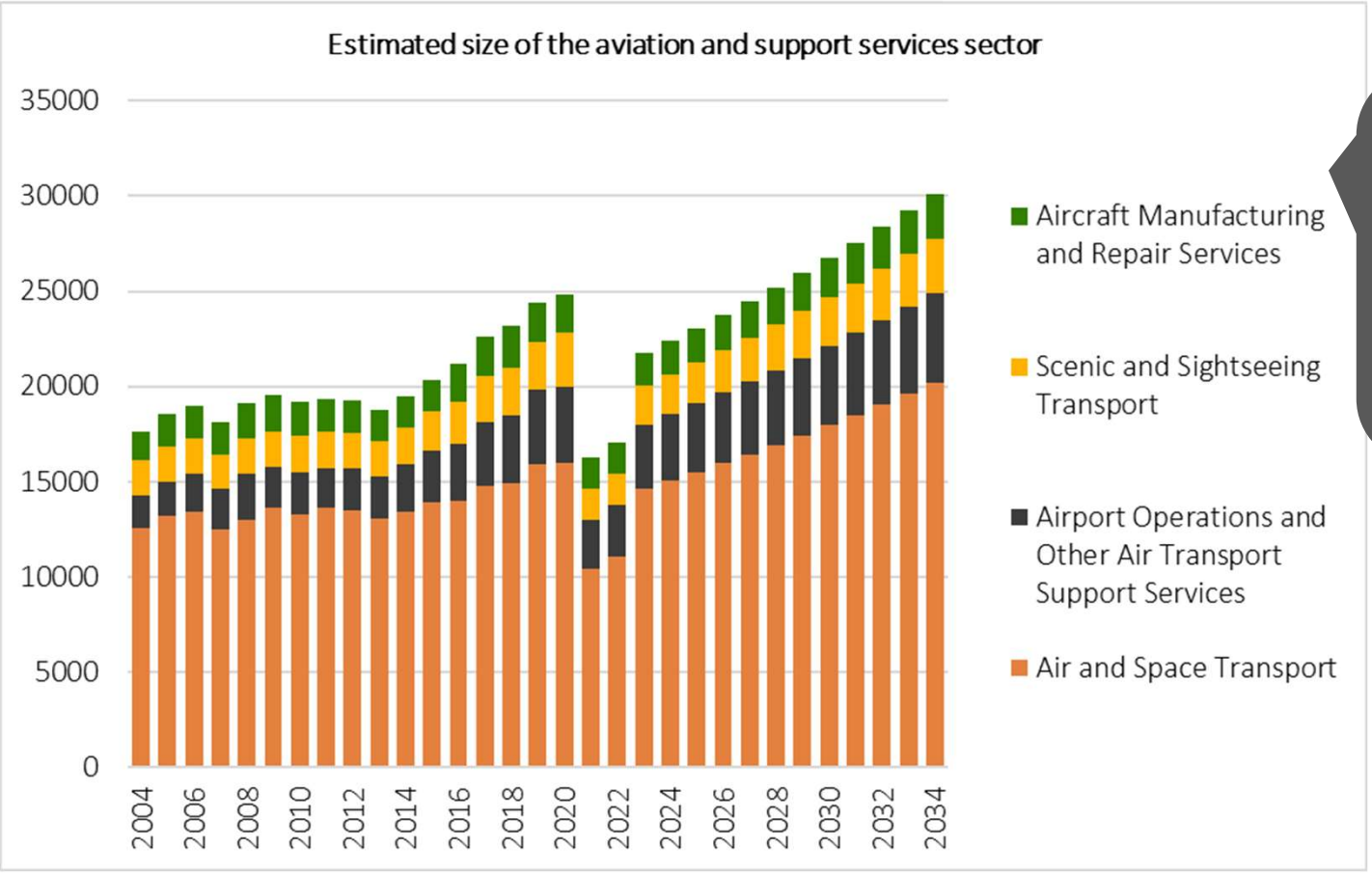
The aviation sector in New Zealand forms a crucial part of the national economy, serving as a key connector to the global markets. Although, historically, New Zealand has been considered as a global leader in the aviation industry, recent years have been challenging for the sector. There are many factors at play, with external events such as COVID-19 impacting both supply and demand of the aviation workforce; and the rigidity and high costs of training, and slow career progression adding further challenges. As the sector moves through its recovery, demand for workers in the aviation sector, both domestically and internationally, is expected to grow, which may amplify the supply-shortages in New Zealand.

Although there are challenges across the aviation sector in New Zealand at large, there are specific challenges faced by certain occupations within the sector:

- Fixed-wing pilot shortages across operator types and pilot roles. Although it has become more evident recently, partly due to external shocks such as COVID-19, the shortage is the result of a mismatch of long-term trends in the demand and supply of pilots.
- Helicopter pilot shortages. The situation for helicopter pilots is qualitatively like that for fixed-wing pilots although, if anything, the observable shortage is relatively greater.
- Aviation engineer shortages. Akin to pilots, a current pain point is shortages in the aviation engineering workforce. However, unlike pilots, addressing this shortage is likely to need different approaches, with a greater focus on workforce attraction.
- Flight attendants and baggage handlers and ground crew. These are other occupations essential to the aviation sector. Although no modelling was undertaken, statistics of workforce composition indicate there are opportunities to promote workforce diversity.

Introduction

Overview of the aviation workforce



Between 2013 to 2020, the workforce increased by around 33%, followed by the COVID-19 'blip' in 2021 and 2022. We estimate that from2024 the workforce will grow by ~3% each year.

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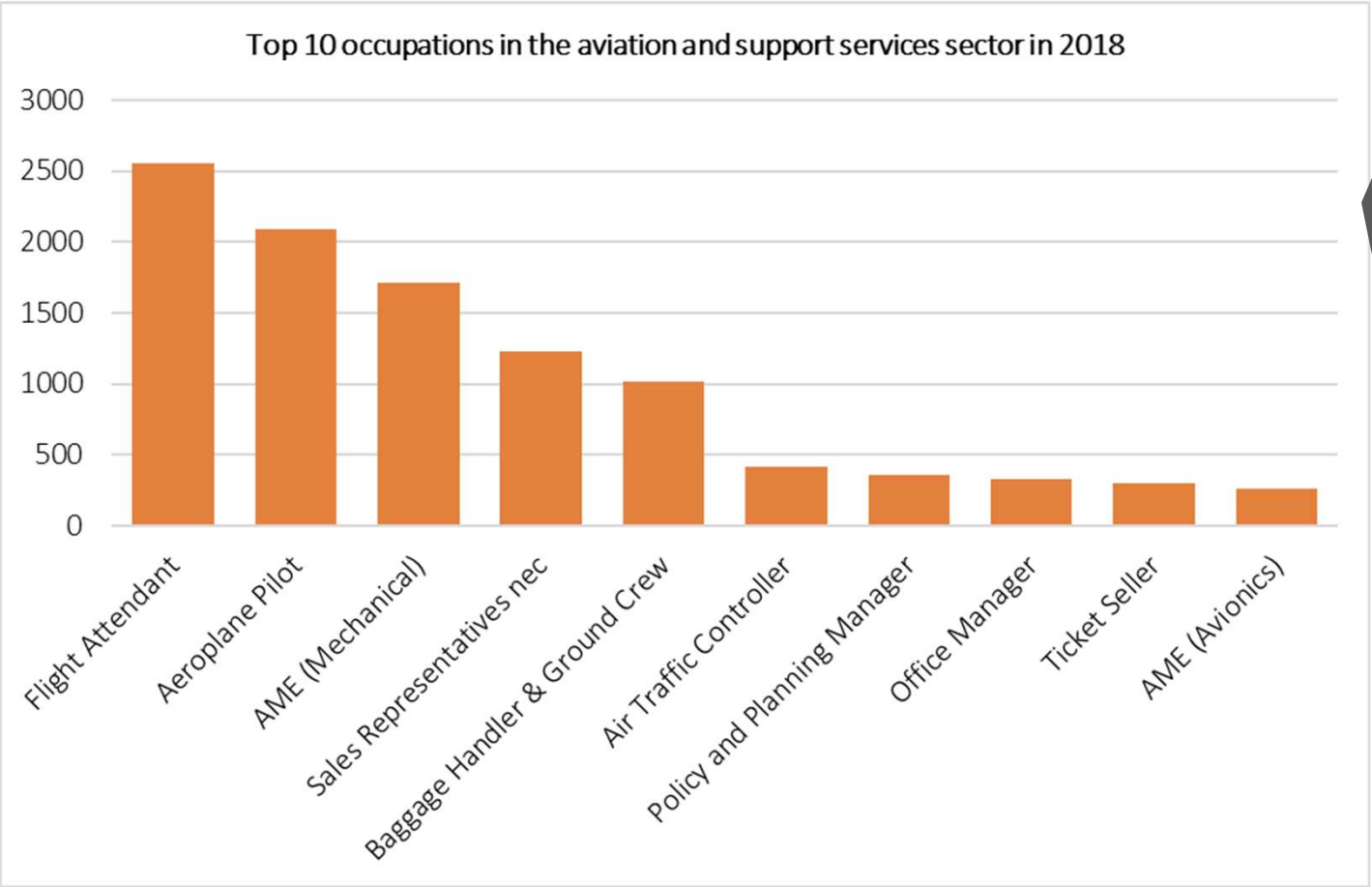
Introduction

Occupations within the aviation workforce



Although the aviation and support services is made up of a range of occupations, the scope of this work will be limited to a critical few.

Modelling analyses will be undertaken for:

- Pilots (both fixed wing & helicopter)
- Aviation maintenance engineers (mechanical, avionics, component overhaul),

with workforce composition analyses completed for:

- Flight attendants
- Baggage handlers and ground crew.

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Introduction

International demand

COVID-19 has played a leading factor in impacting both the supply and demand of the aviation workforce globally.

As the sector moves through its recovery, demand for workers, both domestically and internationally, is expected to grow, which may amplify the supply-shortages in New Zealand.

Historically, global demand has not been a major issue for New Zealand, but as operators are competing for the same pool of talent, international demand for aviation workers may become increasingly problematic.

Boeing pilot and technician outlook 2024 forecast personnel demand to grow by 2043:

- 674k new pilots
- 716k new aviation technicians
- 980k new cabin crew.

Australian government aviation whitepaper towards 2050, notes key shortages for:

- Pilots
- Flight instructors
- Aviation engineers
- Cabin crew
- Baggage handlers.

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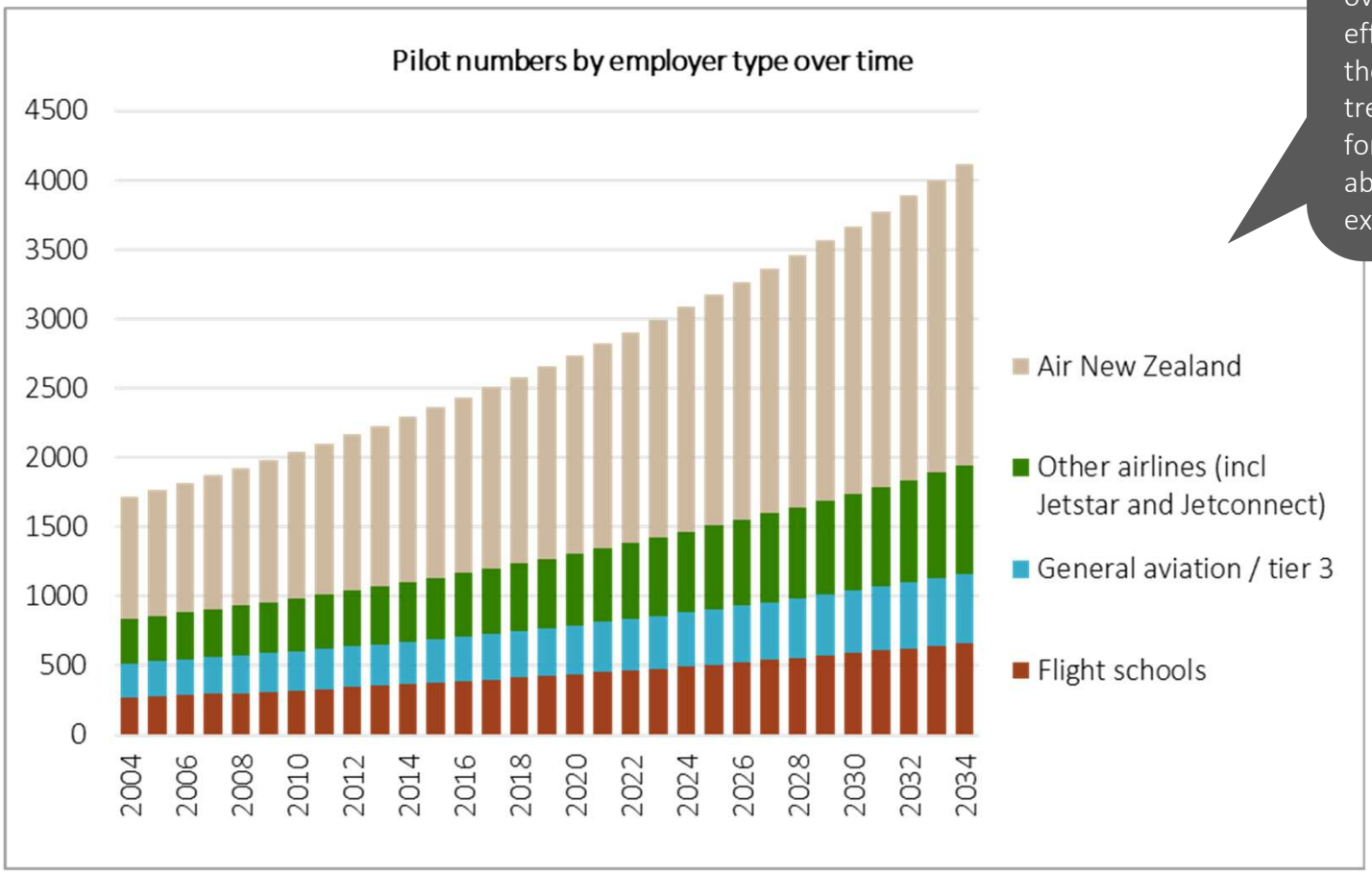
Pilots – Summary of findings

How is the demand for pilots changing over time?



Based on changes in the fleet size over time (ignoring temporary effects of COVID-19 for now, as these did not influence long-term trends), average growth in demand for pilots has been increasing by about 2-3% per year. This trend is expected to continue.

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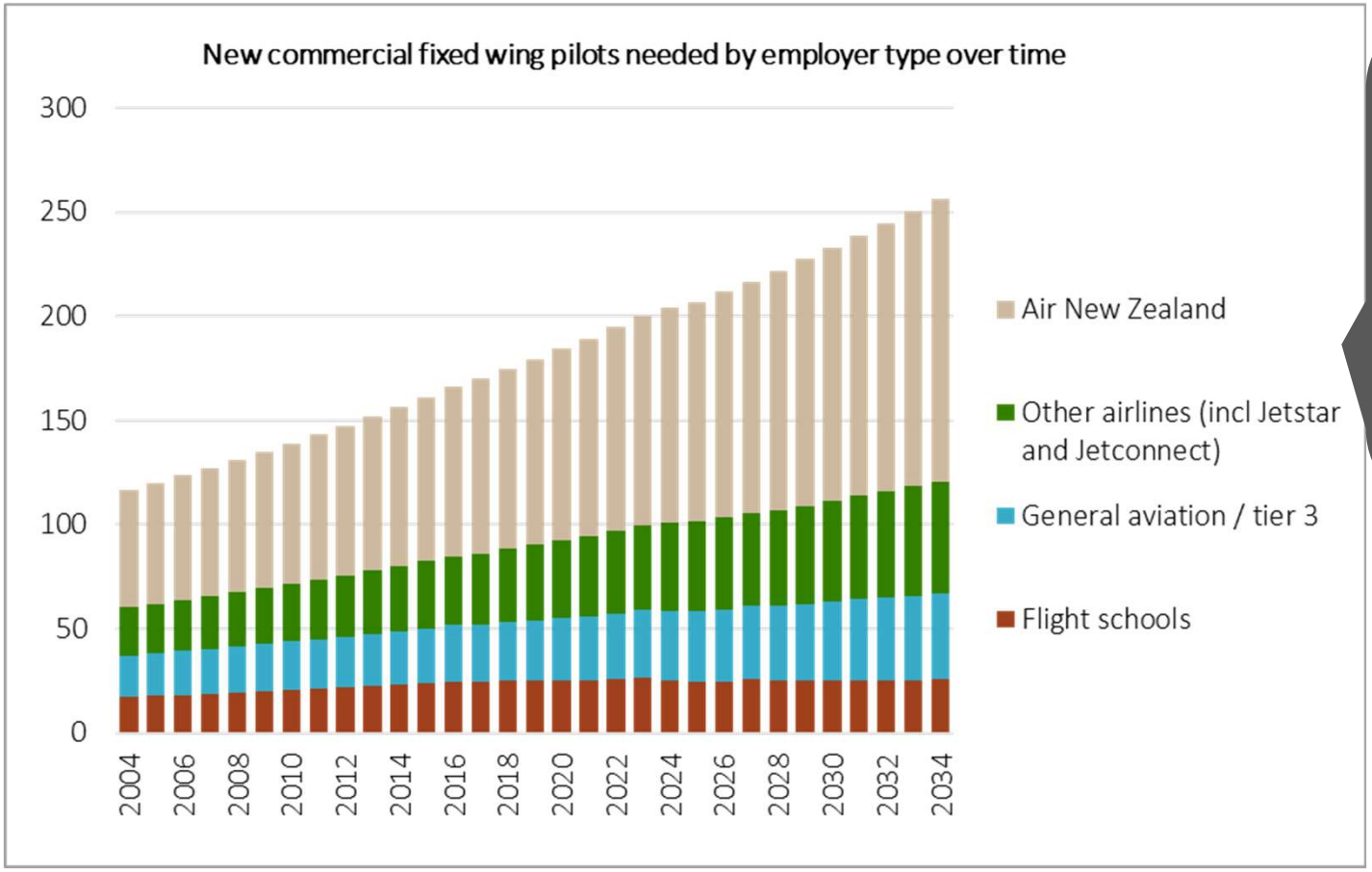
Pilots – Summary of findings

How many new pilots are needed each year?



On average, the workforce currently requires approximately 200 new pilots each year. This number is expected to rise to about 250 new pilots each year over the next ten years.

In reality though, demand is not this constant, and airlines hire larger numbers than indicated in one year and smaller numbers in the next.

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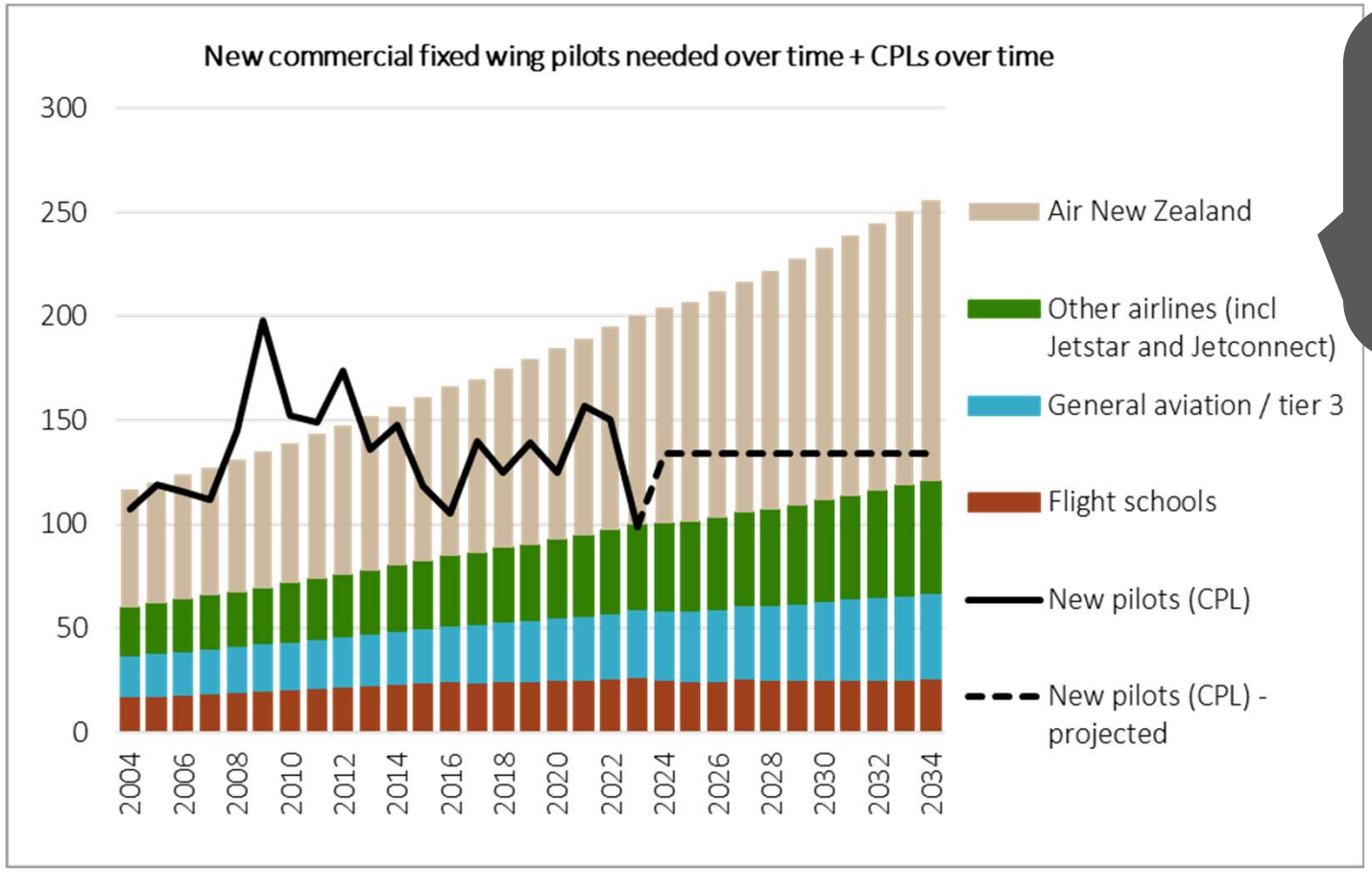
Pilots – Summary of findings

How many new pilots are supplied each year?



Over the past ten years the supply of new pilots has varied, but the long-term trend has stayed constant around 150 new pilots per year.

It is immediatly evident that supply is not meeting current demand.

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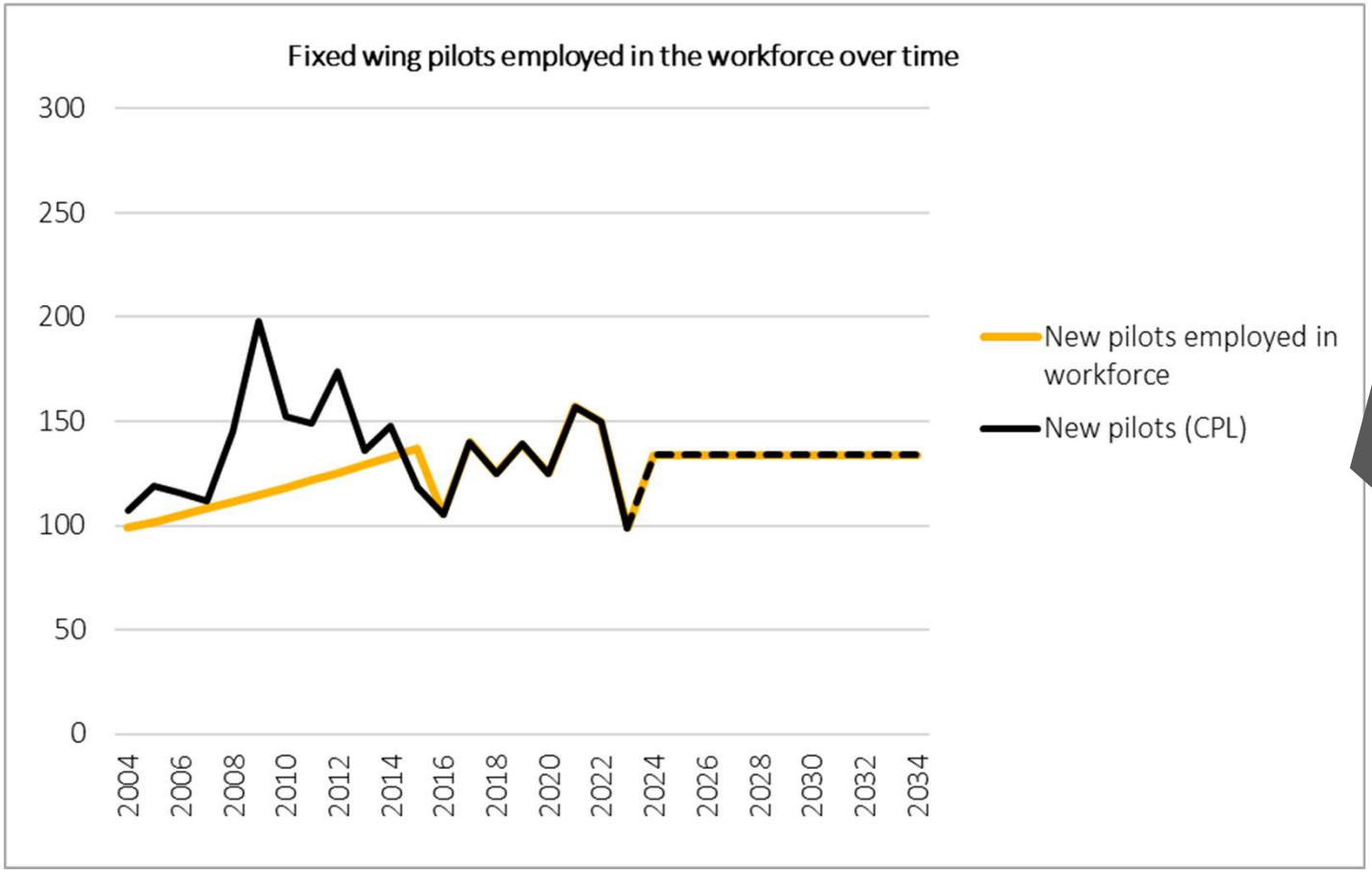
Pilots – Summary of findings

How many new pilots are employed in the workforce over time?



In a period from about 2007 to 2015 more pilots were trained than could be placed into the commercial New Zealand workforce. Over the past 10 years though, the local workforce typically has been able to absorb all the new pilots available to enter the workforce.
That said, demand has been variable year-by-year, there may have been years where fewer positions were available than there were new pilots.

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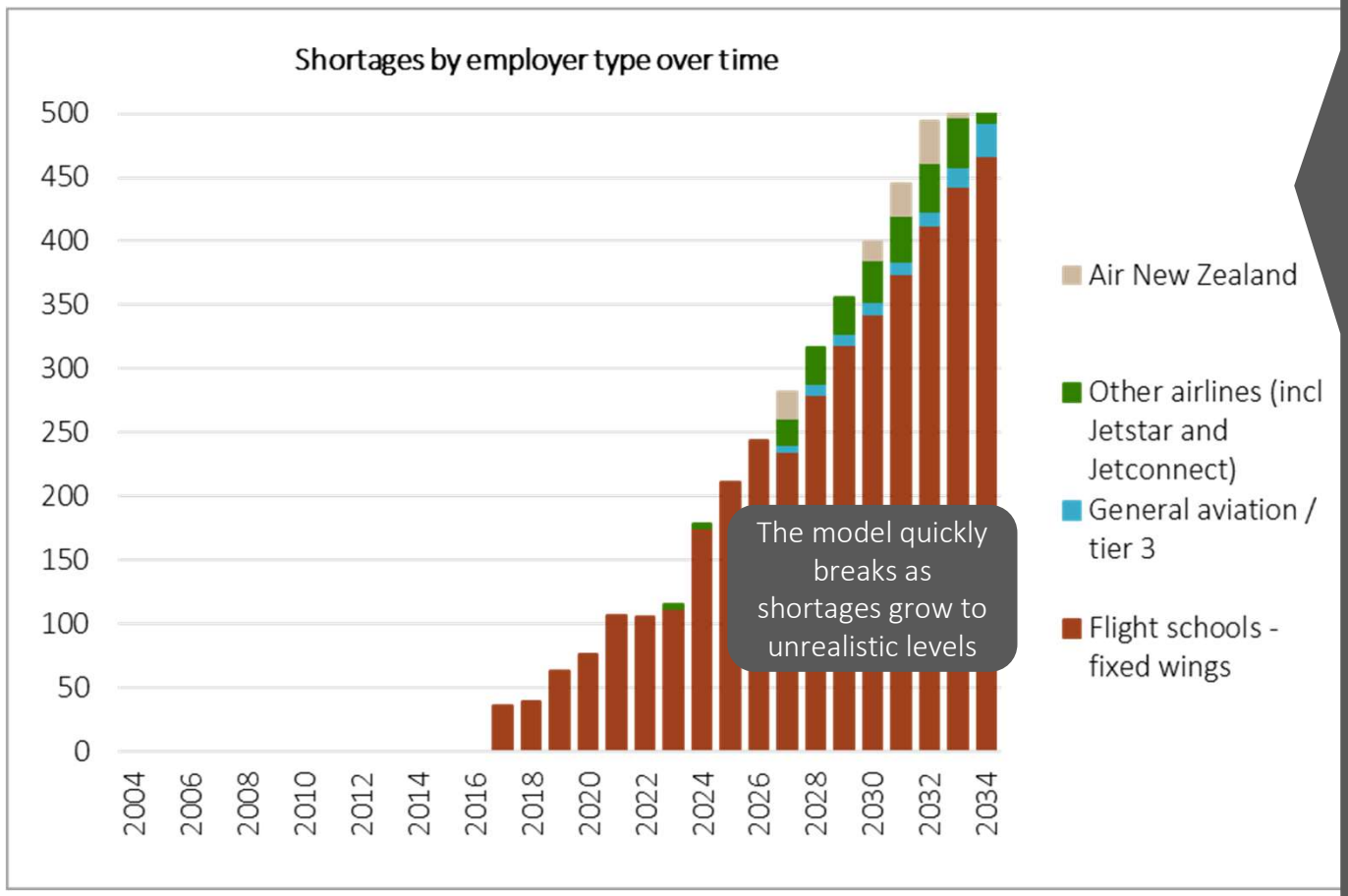
Pilots – Summary of findings

How will workforce shortage change over time?



INDICATIVE ONLY

For the reasons discussed in the ***Modelling approach*** *section (next), quantitative estimates of workforce shortages need to be treated as indicative only. Nevertheless, important conclusions can still be drawn from this chart.*

An underlying workforce shortage probably began to form 8-10 years ago and may have built to approximately 100-150 pilots today.

The way that typical pilot career pathways progress – with a net flow from roles as flying instructors, to general aviation and small airlines, to Air New Zealand and other airlines – means that shortages 'flow down' and fall mainly on flight schools / aero clubs in the first instance.

If current trends continue, flying schools will quickly become unsustainable due to lack of instructors (that is, the model quickly breaks as it projects ever growing shortages which will not be sustainable in practice).

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Overview of modelling approach

A 'stocks and flows' model provides an analytical framework to understand the dynamics of workforce changes over time, accounting for supply-side factors such as recruitment and training, movement between the different parts of the workforce, and workforce exits. Within this work:

- Stocks are considered as the total number of pilots employed by operator and plane type at a given point in time. The maximum number of pilots (stocks) needed changes over time as the number of planes changes.

- Flows represent the movements into or out of a stock at a given point in time. This includes inflows (e.g., recruitment of new pilots) and outflows (e.g., pilots retiring or moving to a different role).

The stocks and flows model becomes a powerful tool when combined with a demand-side model, which represents the number of workers needed at each stock at a given point in time. By overlaying these models, an assessment can be made of how well pilot supply meets demand across a range of scenarios and where we expect to see shortages. The pilots' stocks and flows model has been developed to support the following applications.

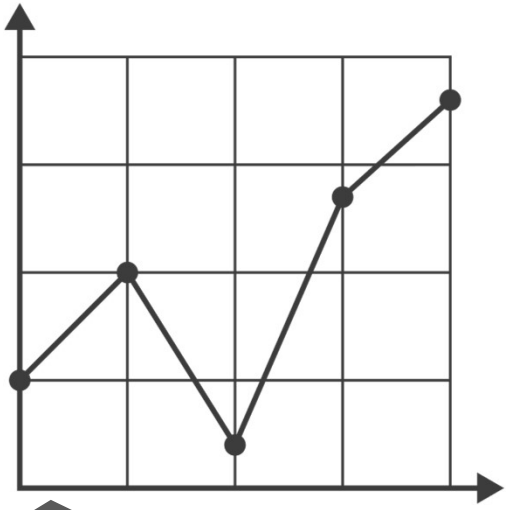
- Workforce projections: The model has been developed covering the period 2004-2034. Future projections of the workforce enable AIANZ, Ringa Hora and other interested industry stakeholders to understand the size of the projected workforce and potential shortages, which are key inputs into workforce planning, funding and/or structure of training, and advocacy of the aviation sector.

- 'What-if' analysis: The model has been developed with the functionality to assess the impacts of workforce interventions on the supply and demand of pilots over time. For example, what-if internationally qualified pilots were able to work at any commercial operator in New Zealand? The ability to undertake a range of these what-if analyses could also support the planning of and deciding on interventions to investigate further.

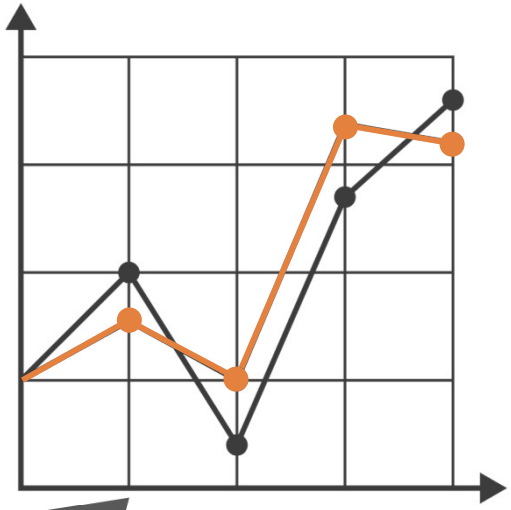
Baseline and scenarios

The model estimates the workforce under several scenarios, including:

Baseline



The baseline scenario shows the model's projections under standard conditions, without any other interventions. It reflects expected trends and transitions in the workforce, serving as a reference point for comparing the impact of different interventions.

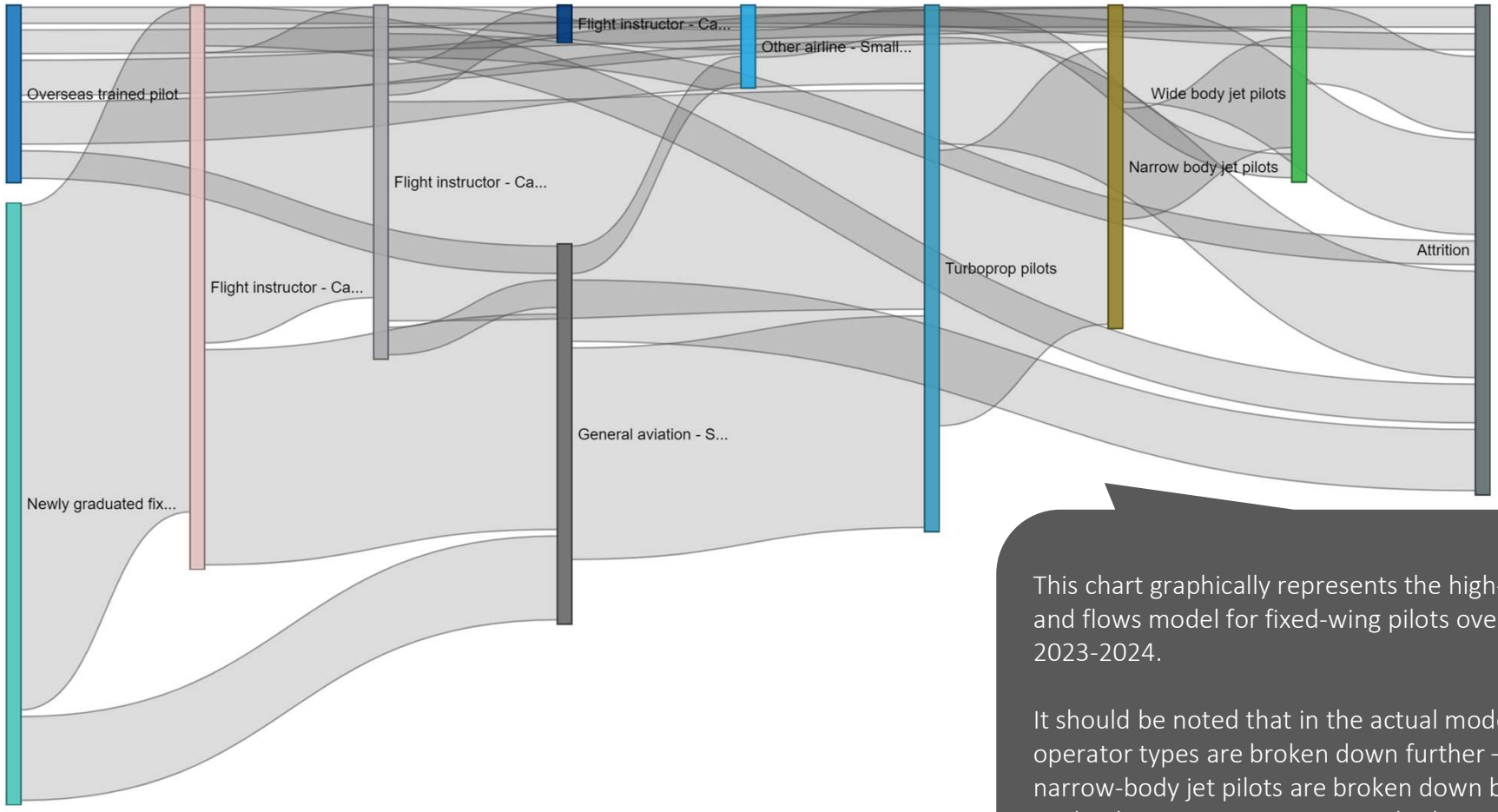


These scenarios allow for the exploration of different assumptions and interventions and their effects on the workforce. Users can specify various parameters, including the:

- Number and growth of airplanes and therefore the demand for pilots
- Retention rate of pilots and recruitment paths by operator type
- Number of students who attain a CPL each year or the Air New Zealand cadet scheme

The model will reflect these changes in the resulting demand and shortages and help evaluate the impact different intervention strategies will have on the workforce.

Pilots – Modelling approach
Stocks and flows



This chart graphically represents the high-level stocks and flows model for fixed-wing pilots over the year 2023-2024.

It should be noted that in the actual model some of the operator types are broken down further – for example narrow-body jet pilots are broken down by Air New Zealand, Jetstar, Jetconnect, and other airlines.

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Offshore vs New Zealand market

The model focusses on the New Zealand workforce. However, it does also consider the international market at several places in the model:

- The starting point of the *demand model* is the number aeroplanes registered in New Zealand. We additionally added numbers for the New Zealand-based fleets of Jetstar and Jetconnect which are registered in Australia.
- The starting point for the *supply model* are the new pilots (CPLs) trained as domestic students in New Zealand. We assume that a portion of New Zealand students with CPLs leave and are not available for the New Zealand workforce, including those that move offshore.
- We consider pilots leaving the workforce to work internationally as part of the total attrition by operator type. This increasing is one of the scenarios.
- A small portion of trained pilots each year is assumed to enter the workforce from international sources. However, this is not very significant (<10% of new pilots).

Estimating shortages

- Like most workforces, the *stocks* of supply and demand in the aviation workforce, and hence in our model, are finely balanced (although this is not true for the *flows* – see earlier slide). This means that any estimate about the size of a labour market **shortage** made by comparing estimates of the supply and demand stocks will be sensitive to small errors in either estimates.

- To reduce the risk of misrepresenting shortages, all of the data and assumptions going into the model have been discussed with experts from the industry including in our project steering group.

- One way to calibrate an estimate of a workforce shortage, is to identify a point in time when experts judge that the industry had about the right number of people – neither an under or over-supply. The shortage at this point can be set to zero and used as a reference. Supply and demand trends are tracked from that reference point to provide an estimate of the current shortage. Our steering group felt this reference point last occurred about 10 years ago.

- The remaining uncertainty in the model is about exactly how big the current shortage is, not about whether there is one. Estimates in the model of when it will begin affecting airlines, in addition to flight schools, only differs by a few years.

- This approach means that we can still draw useful conclusions even with small inaccuracies in the input data and assumptions, and with simplifications to input data and model logic.

Pilots – Modelling approach

Modelling one-off effects and volatility

- The are many sources of volatility in the data that influence both supply and demand. For example,

  Long-term

  - Sharp changes in fleet-sizes of airlines as, for example, new aircraft are introduced
  - Variation in the number of commercial pilots trained each year
  - Changes to airlines' requirements to be considered for recruitment and promotion
  - Variation in the number of pilots hired or promoted in a given year – this ranges changes from <10 in one year to >100 in the next

  Recent

  - Furloughing of pilots due to COVID-19, and subsequent return, between 2020 and 2025
  - Departure of L3 Harris – a large flight training school during COVID-19

- In the short-term these effects are large relative to long-term trends and the inflow of new pilots, leading to small short-term shortages. This leads to a complex overlay of long-term trends and short-term events, obscuring what is relevant and what is just a symptom of the volatility.

- Rather than trying to model all the short-term effects we focus on building a model that will provide a fair indication of medium to long-term supply and demand movements. In particular, we deliberately 'smooth' over a many of the short-term demand-side changes by using averages. This includes, for example, Air New Zealand's furloughing pilots during COVID-19. Most pilots returned meaning that there was, in effect, both 'shadow supply' and 'shadow demand' during this time.

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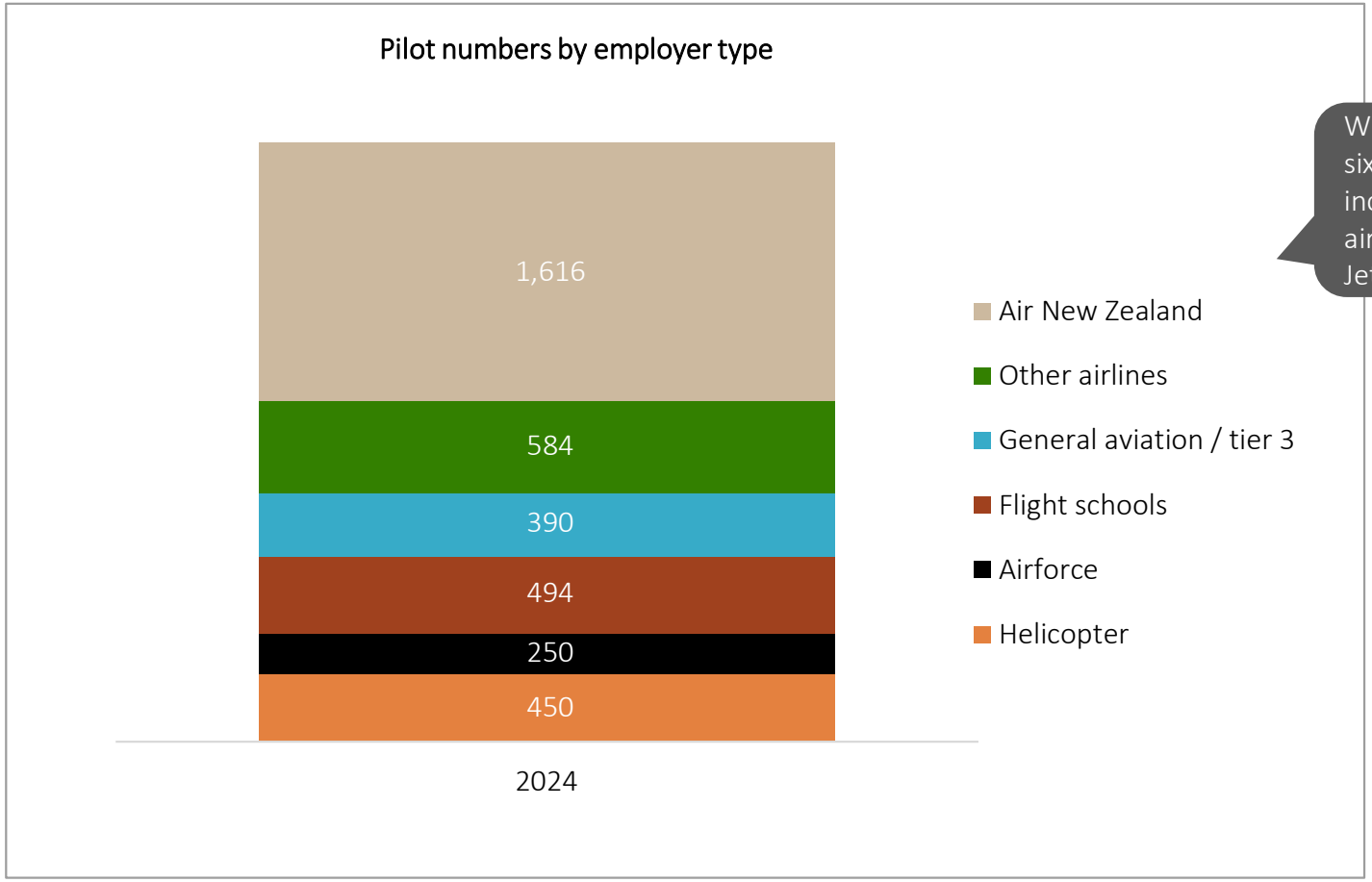
Pilots – Model findings – baseline scenario

Where are pilots employed in New Zealand?



We segment the pilot workforce into six parts; General Aviation / tier 3 includes Agricultural, and Other airlines includes Jetstar and Jetconnect.

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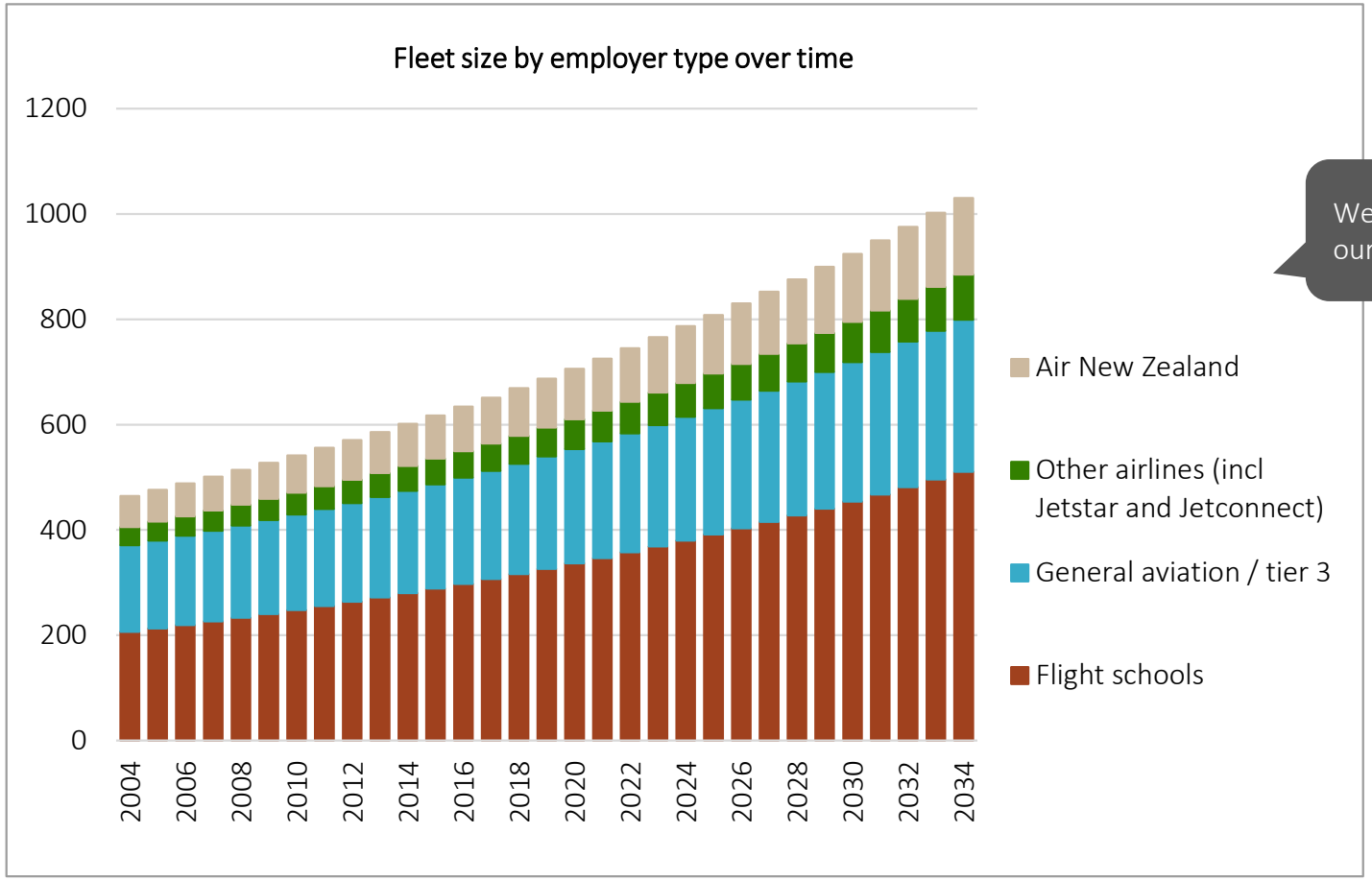
Fleet size – long-run historic and projected growth by operator type



We use fleet size as the basis for our demand model.

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Pilots – Key inputs and assumptions

Pilots per aircraft

The number of pilots needed per aircraft varies greatly by operator and aircraft types.

Operator type	Plane type	Pilots per plane
Air New Zealand	Wide body jet	25
	Narrow body jet	13
	Turboprop	12
Other airlines	Narrow body jet	12
	Turboprop	12
	Medium Aeroplane	4
	Small Aeroplane	2
General aviation / tier 3	Medium Aeroplane	2
	Small Aeroplane	2
Flight school - fixed wing	Mixed	1.3
Agricultural	Mixed	1
Air Force	Mixed	5
Helicopter	Helicopter	1
Jetstar Airways and Jetconnect	Narrow body jet	12
Flight school - Helicopter	Helicopter	1

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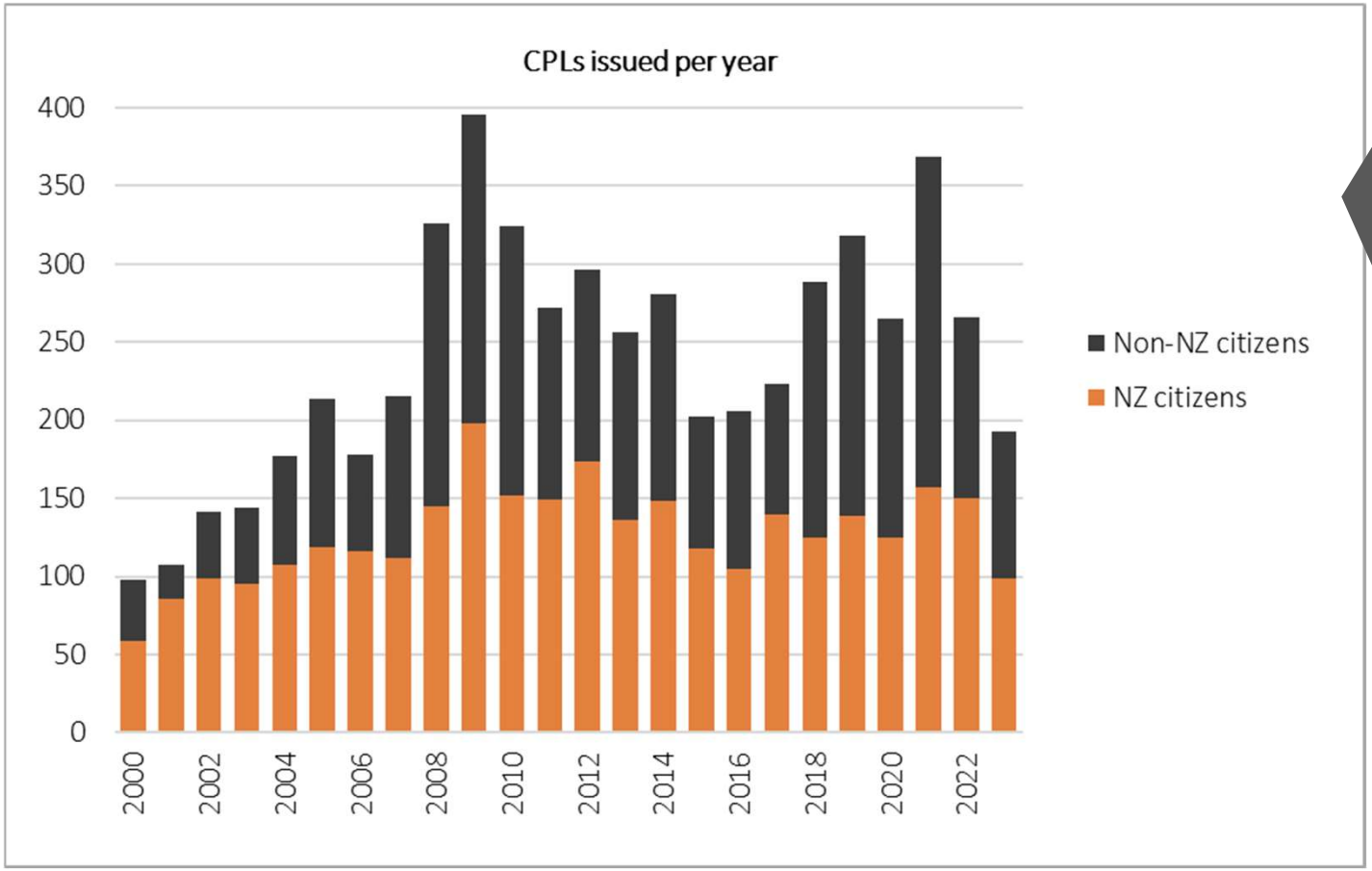
Pilot retention and turnover

Operator type	Plane type	Retention rate
Air New Zealand	Wide body jet	97%
	Narrow body jet	97%
	Turboprop	96%
Other airlines	Narrow body jet	96%
	Turboprop	95%
	Medium Aeroplane	95%
	Small Aeroplane	94%
General aviation / tier 3	Medium Aeroplane	95%
	Small Aeroplane	94%
Flight school - fixed wing	Mixed	97%
		97%
		97%
Agricultural	Mixed	94%
Air Force	Mixed	98%
Helicopter	Helicopter	91%
Jetstar and Jetconnect	Narrow body jet	97%
Flight school - Helicopter	Helicopter	92%

The retention rates presented here consider pilots leaving due to switching to working overseas, changing careers, or retiring for various reasons.

Compared to most other occupations, pilots are more likely to stay in their occupation for their entire career.

CPLs issued per year



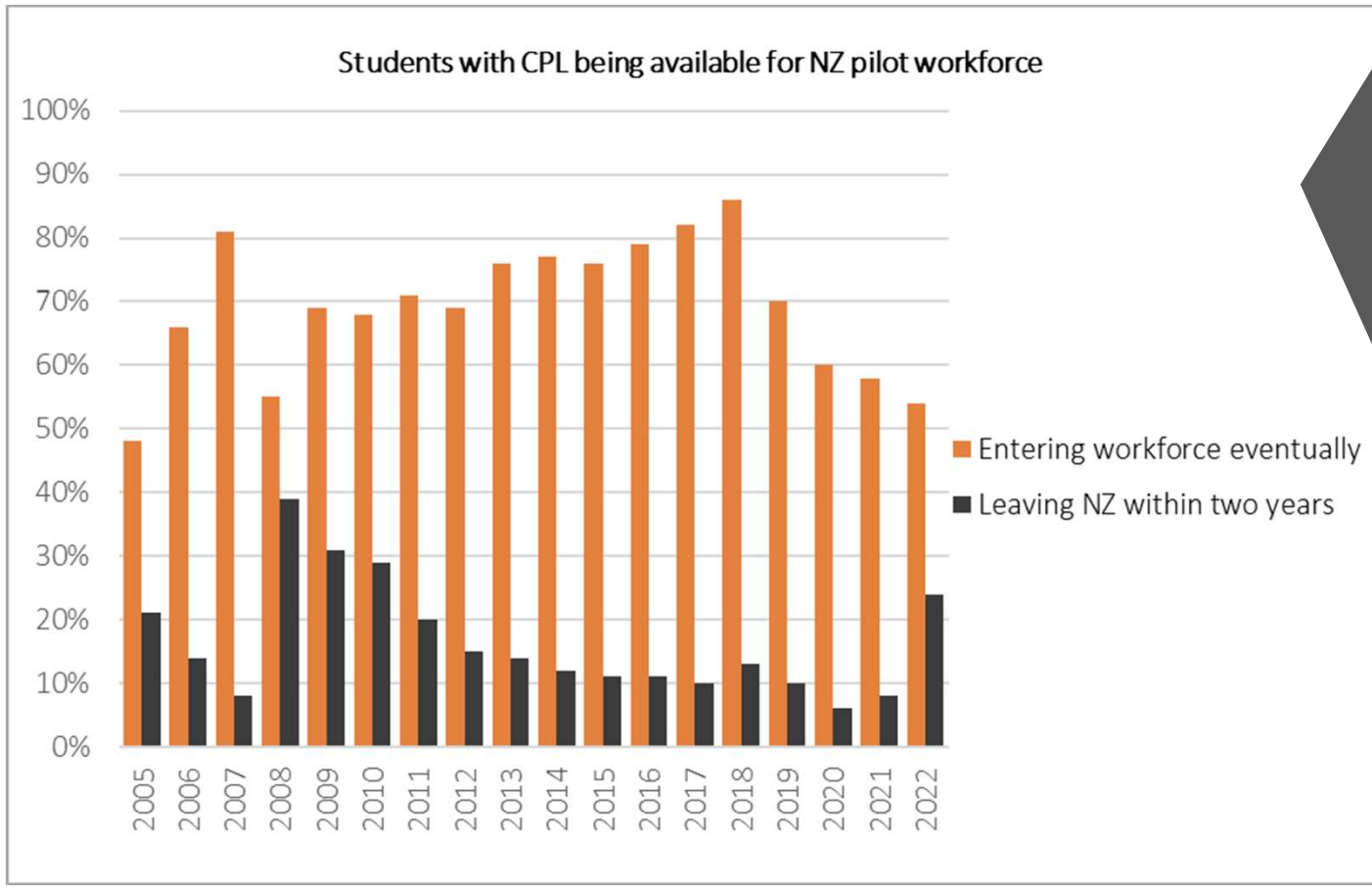
We use data on new commercial pilot licenses (CPLs) as the basis of our new supply.

We assume 80% of new commercial pilots that are New Zealand citizens are available to the New Zealand workforce. The remaining 20% includes those leaving overseas or not being suitable for civil aviation.

We also assume a proportion of non-New Zealand citizens with CPLs *are* available to the New Zealand workforce. In effect, this appears to roughly balance the New Zealand citizens that do not enter the workforce. Therefore, in the model we use the full number of CPLs for New Zealand citizens as a proxy for supply of new pilots.

Pilots – Key inputs and assumptions

Percentage of students with CPLs entering the workforce or leaving New Zealand



This graphs shows the proportion of people with new CPLs that enter the workforce eventually. It also shows the proportion that leave New Zealand for at least one year within two years of gaining a CPL. There is some fluctuation and the data from the last three to four years is incomplete because only limited time has passed (meaning students may yet enter the workforce or return to New Zealand).

Additionally, the data from 2019 to 2022 is heavily affected by COVID-19, during which most aviation operators where not hiring. Furthermore, as seen earlier, from about 2007 to 2014 more students gained CPLs than there was demand for pilots. This graph shows that when there is sufficient demand (as there was from 2016 to 2018), around 80% of students with CPL enter the New Zealand pilot workforce eventually, and around 10% leave New Zealand within 2 years for at least a year. The percentage not returning within 4 years of leaving is under 5%.

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Key aspects of the baseline scenario

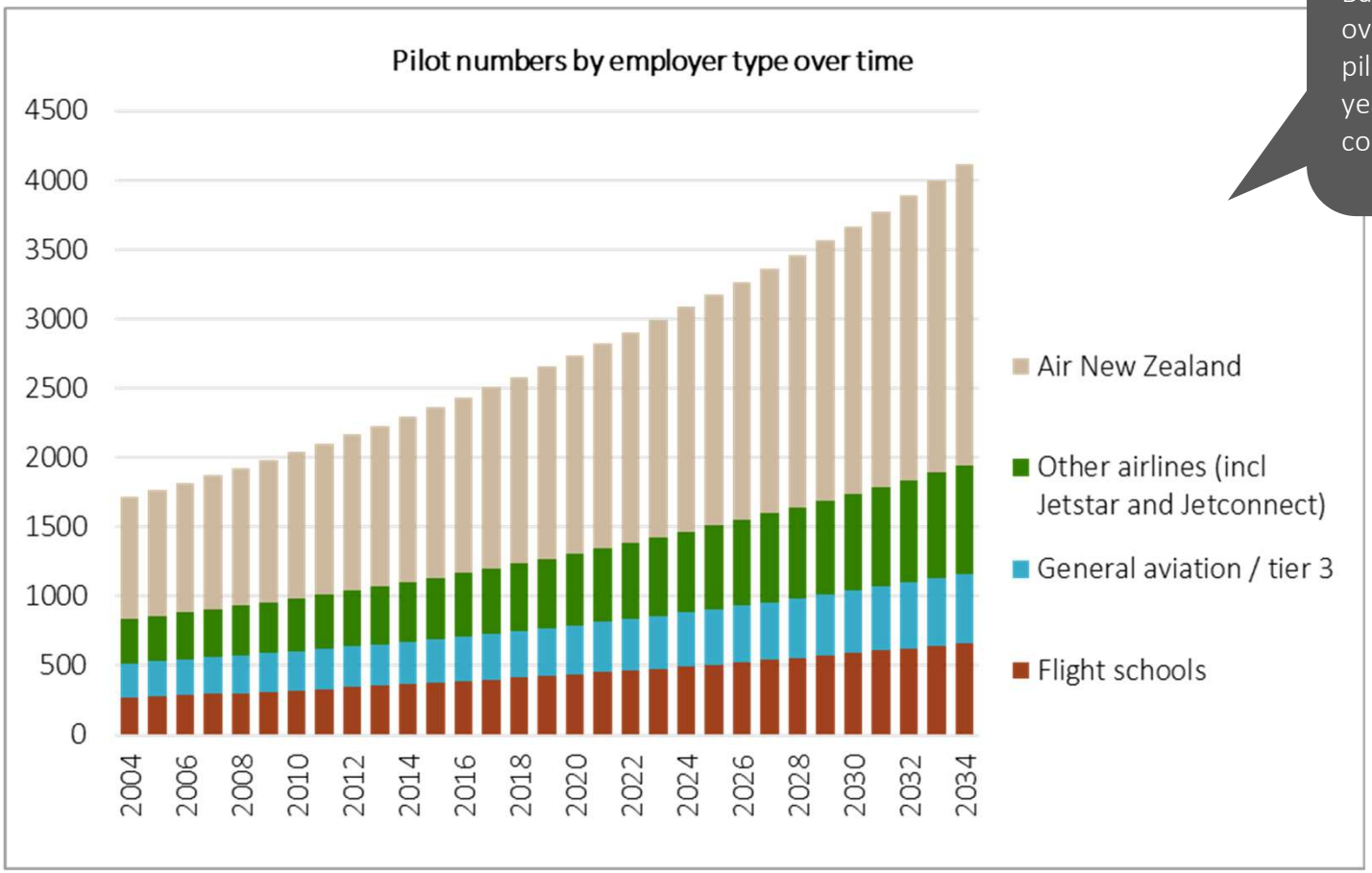
The baseline scenario is the scenario that we recommend using for the analysis of long-term effects, for planning future demand and top make projections. Some of the historic demand numbers as well as the current shortage may be slightly inaccurate e.g. because effects such as COVID-19 were smoothed over. However, these inaccuracies are not material to the overall findings and more 'accurate' models of demand tend of add noise that disguise the insights about the underlying trends.

The key feature of this scenario is:

- Smoothing over all demand-side effects.

Pilots – Model findings – baseline scenario

How is the demand for pilots changing over time?



Based on changes in the fleet size over time, growth in demand for pilots is increasing by about 2-3% per year. This trend is expected to continue.

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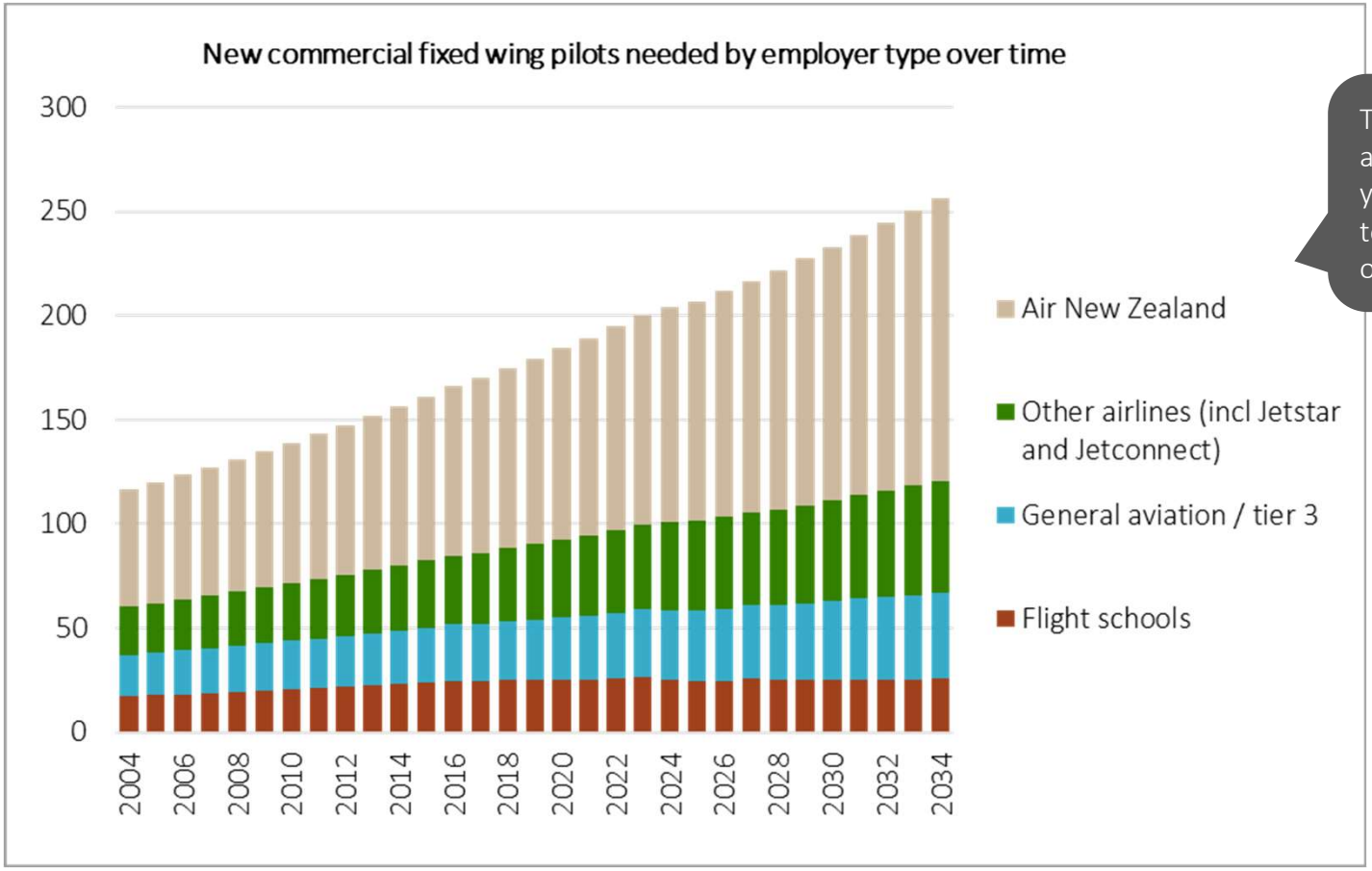
Pilots – Model findings – baseline scenario

How many new pilots are needed each year?



The workforce currently requires approximately 200 new pilots each year. This number is expected to rise to about 250 new pilots each year over the next ten years.

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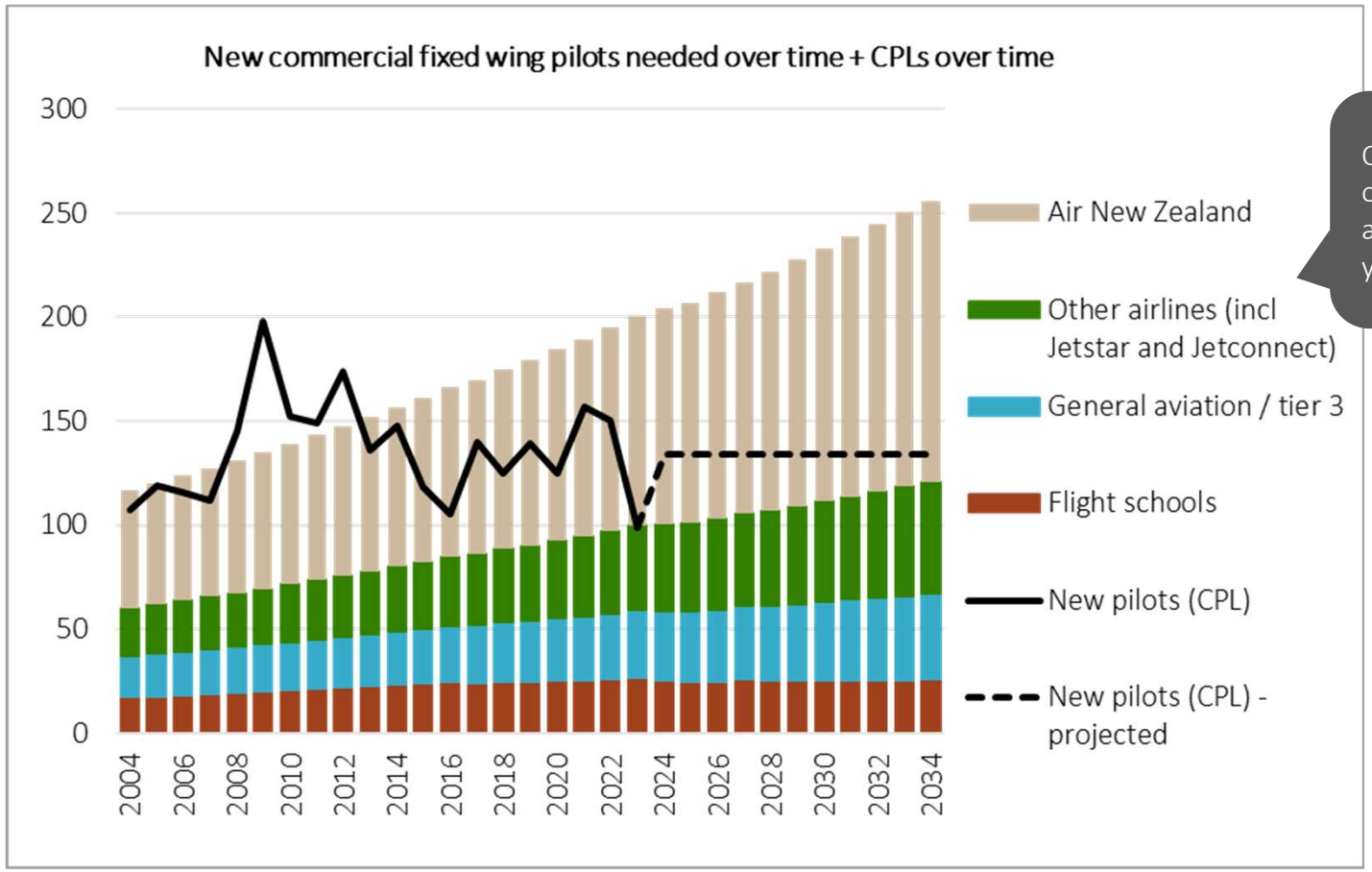
Pilots – Model findings – baseline scenario

How many new pilots are supplied each year?



Over the past ten years the supply of new pilots has been flat at approximately 150 new pilots per year.

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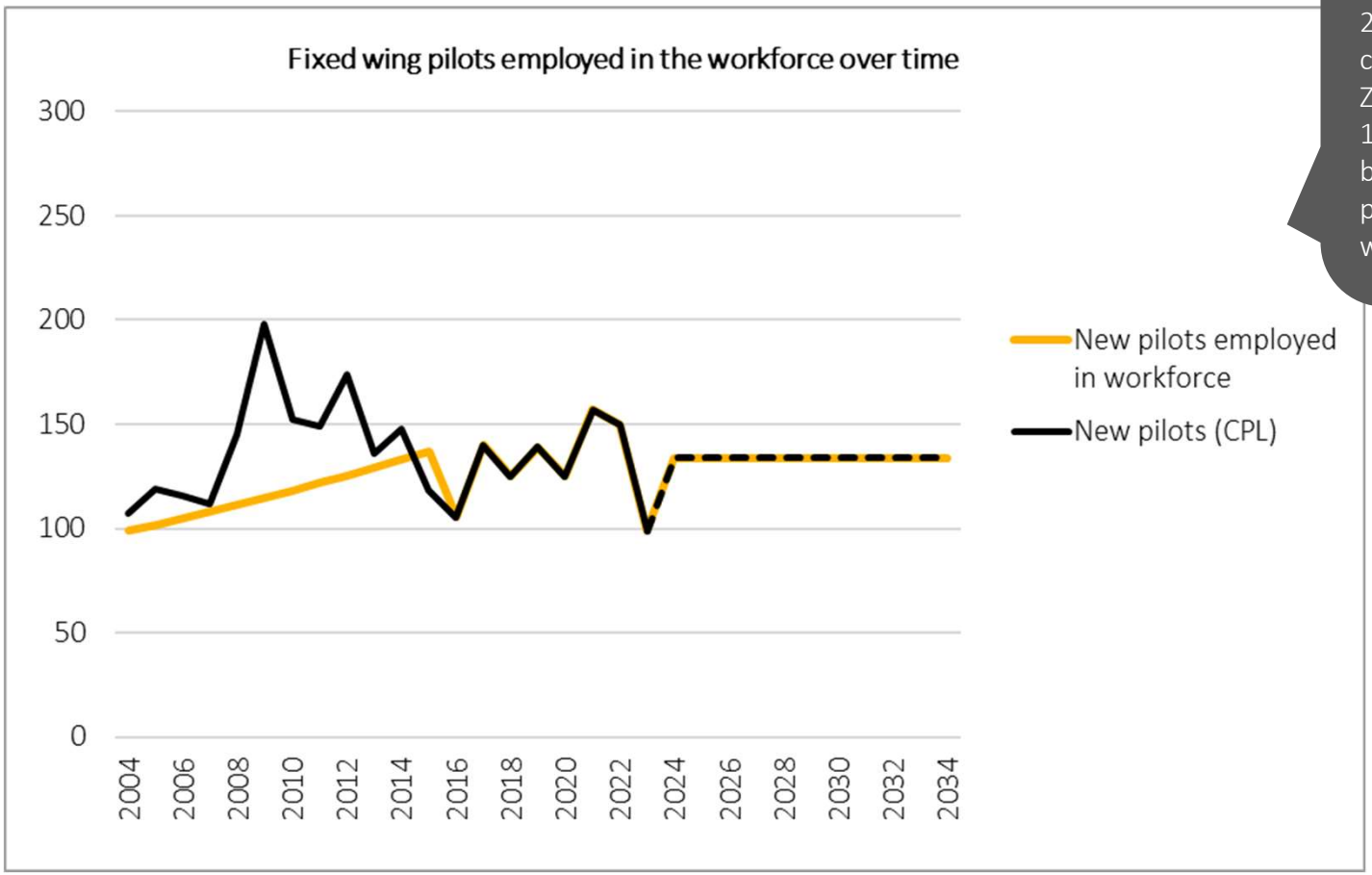
Pilots – Model findings – baseline scenario

How many new pilots are employed in the workforce over time?



In a period from about 2007 to 2015 more pilots were trained than could be placed into the New Zealand workforce. Over the past 10 years though, the workforce has been able to absorb all the new pilots available to enter the workforce.

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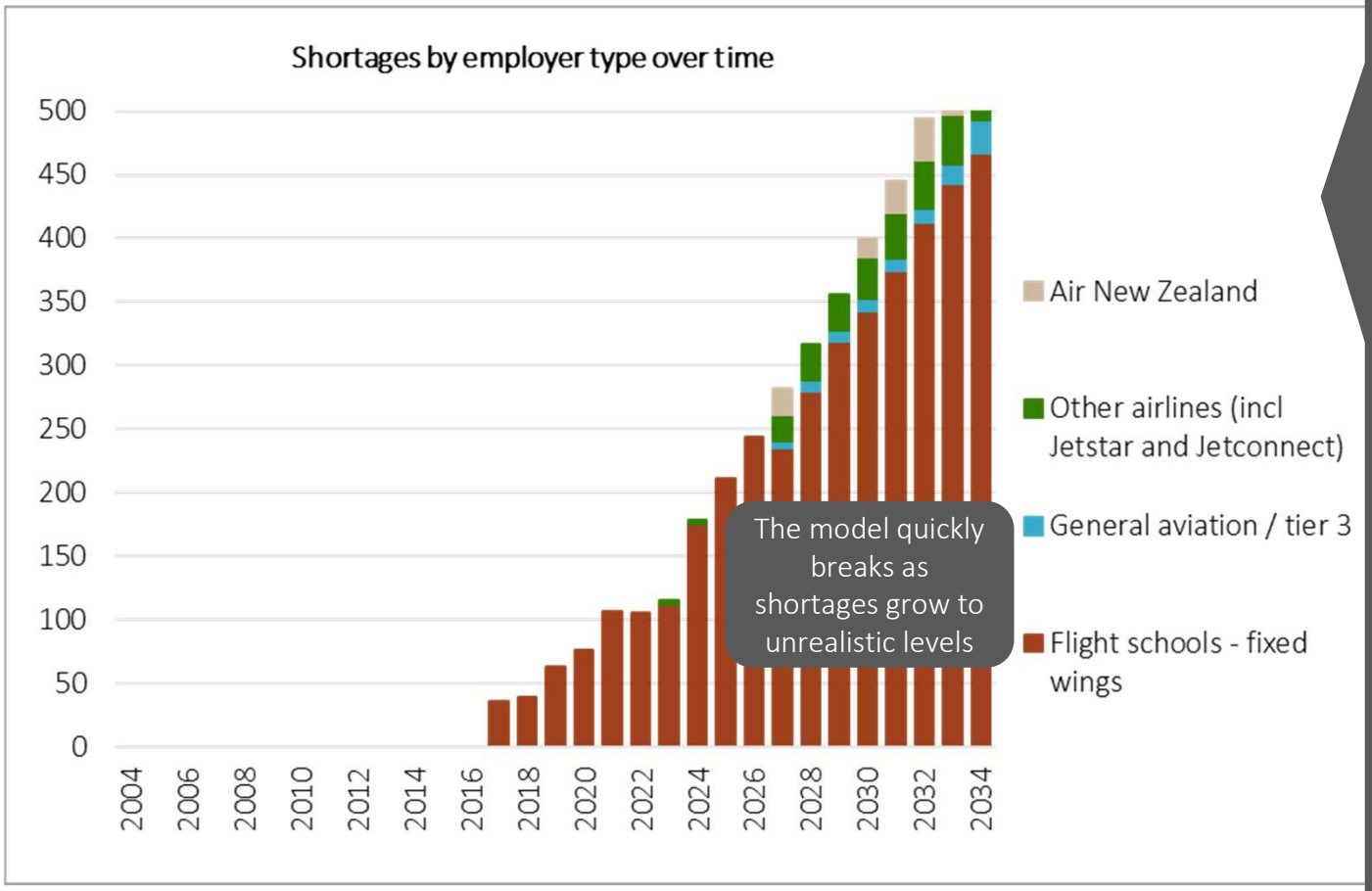
Pilots – Model findings – baseline scenario

How will workforce shortage change over time?



INDICATIVE ONLY

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An underlying workforce shortage probably began to form 8-10 years ago and may have built to approximately 100-150 pilots today.

The way that typical pilot career pathways progress – with a net flow from roles as flying instructors, to general aviation, to Air New Zealand and other airlines – means that shortages 'flow down' and fall mainly on flight schools / aero clubs in the first instance.

If current trends continue, flying schools will quickly become unsustainable due to lack of pilots (that is, the model quickly breaks as it projects ever growing shortages which will not be sustainable in practice).

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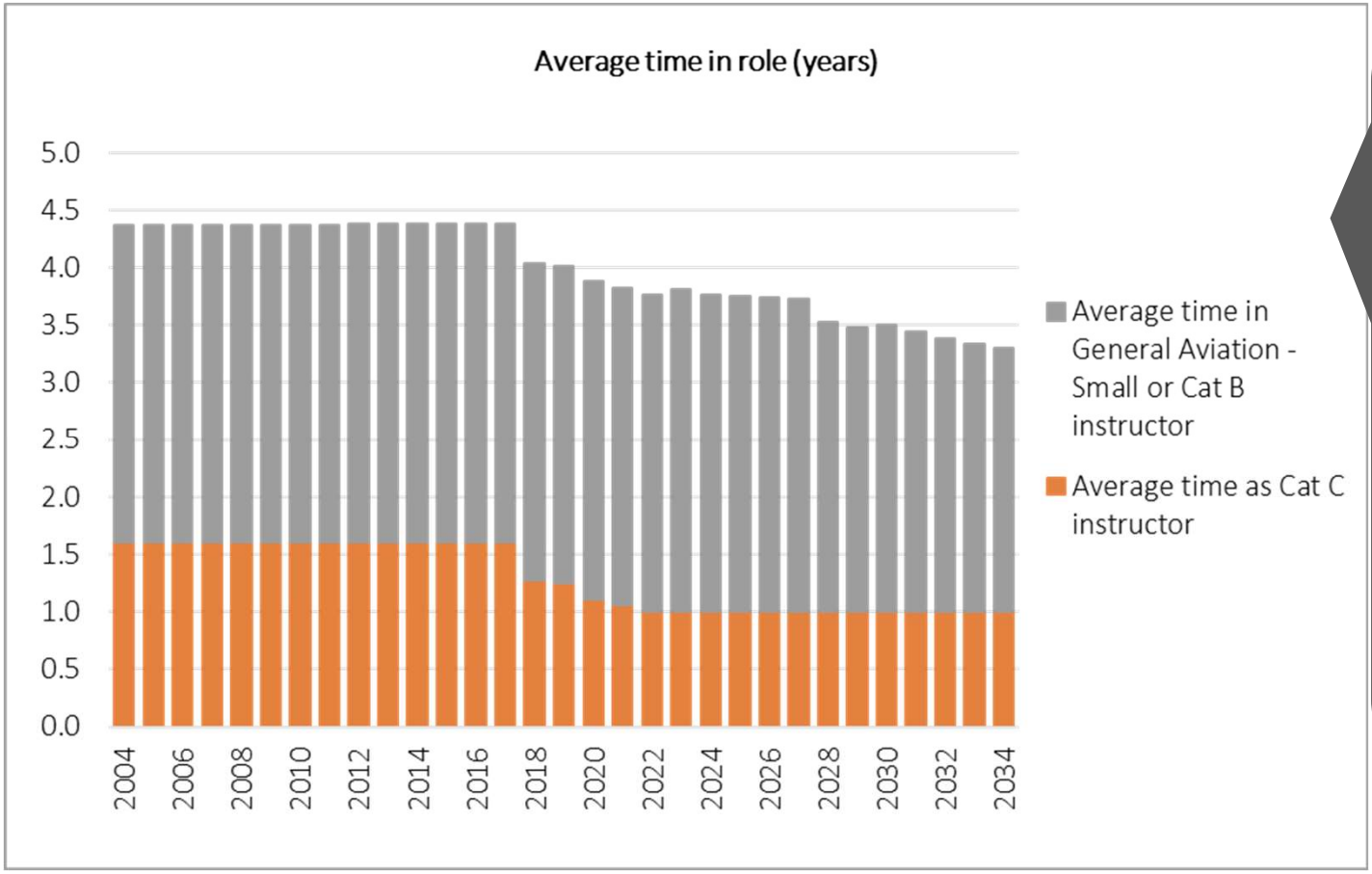
Pilots – Model findings – baseline scenario

How long do pilots stay in flight instructor roles?



INDICATIVE ONLY

As with the previous chart this analysis should be treated as indicative and considered for the general pattern rather than the numeric values.

To this point the underlying shortage has been partly managed by 'drawing down' on the pool of experience within the flight instructor and general aviation workforce.

A related observation that Air New Zealand's hiring requirements have changed over the past 20 years from expecting ~2,500 hours prior to entering Air New Zealand in 2004, to expecting ~500 hours today.

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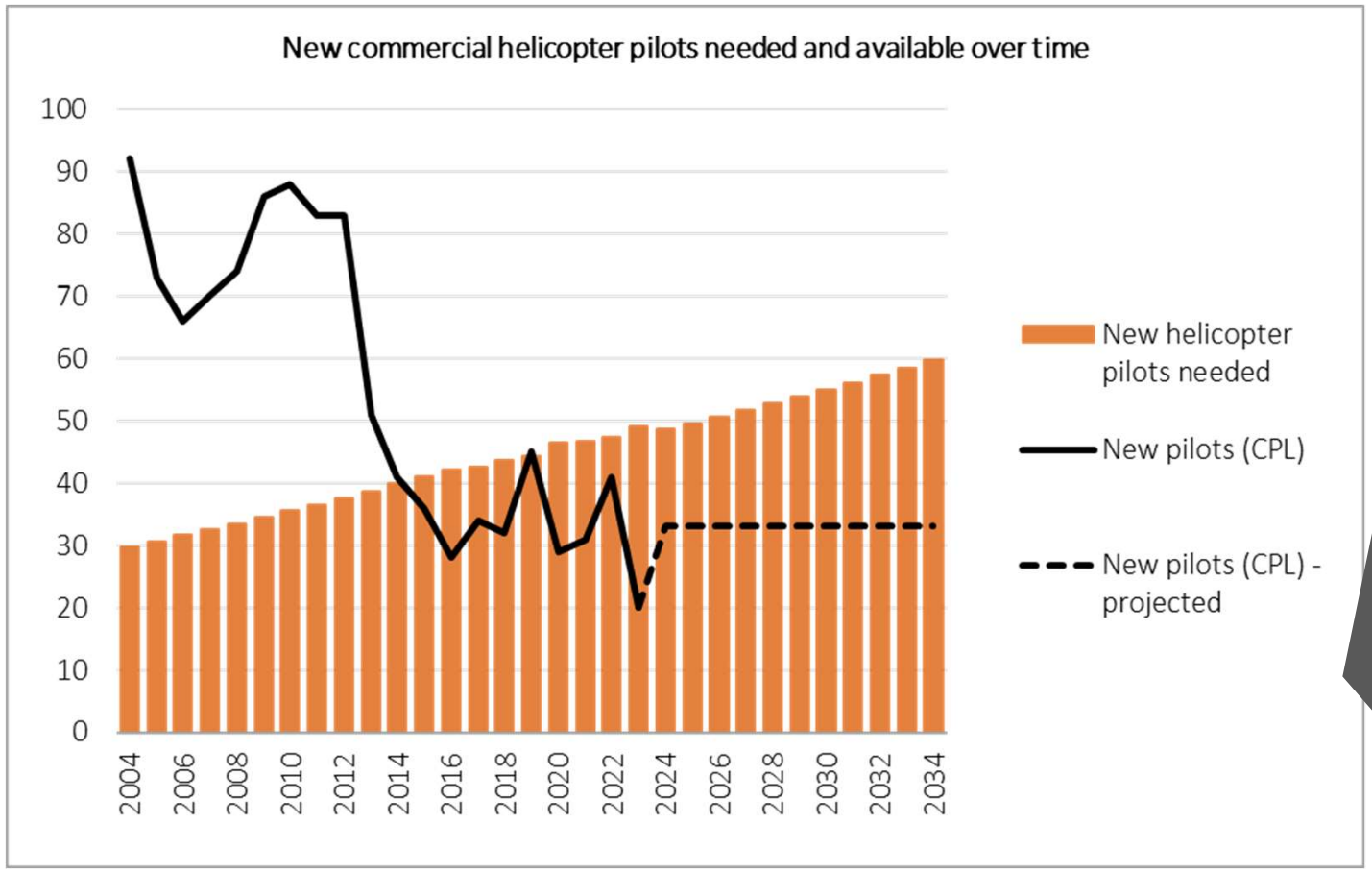
Pilots – Model findings – baseline scenario

What is the situation for helicopter pilots?



The pattern of demand and supply of new helicopter is similar that for fixed-wing pilots, just more extreme. Historically, there appears to have been a large over-supply of new helicopter students compared to the demand, although it is difficult to estimate how many of these intended to use their licence for private vs commercial activities.

About 10 years ago the situation flipped, and now demand outweighs supply.
Currently, there is a need for about 50 new helicopter pilots a year.

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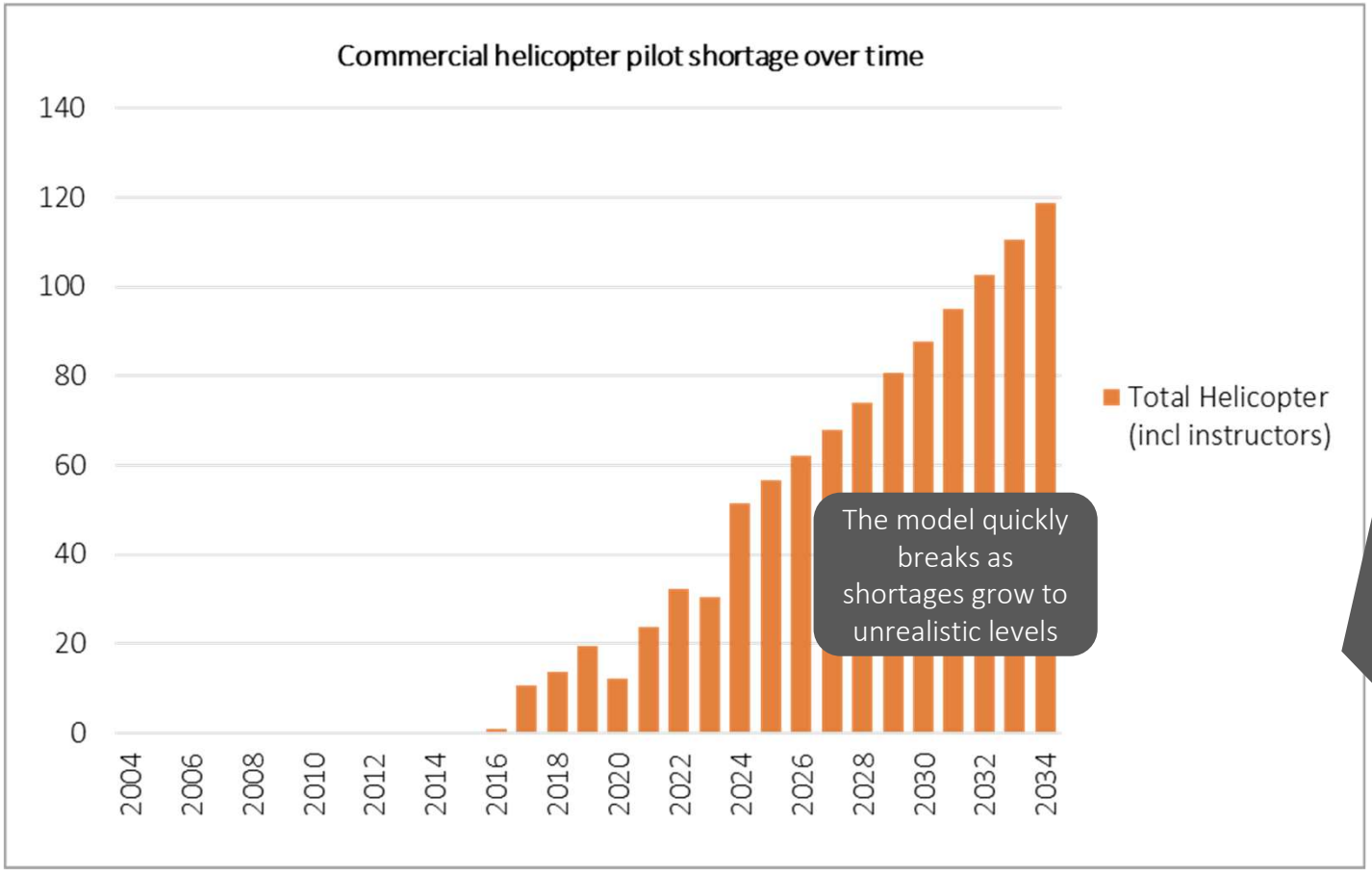
Pilots – Model findings – baseline scenario

How will the helicopter workforce shortage change over time?



As expected, based on the previous chart showing the growing substantial gap between the demand for and supply of new helicopter pilots, there is a growing shortage.
Currently, this shortage is estimated to be around 50 helicopter pilots.
Like fixed-wing pilots, this growing shortage poses a risk for the sustainability of the sector, because a shortage of helicopter pilots means there are fewer experienced pilots that are available to become instructors to train new pilots.

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Key aspects of the COVID-19 scenario

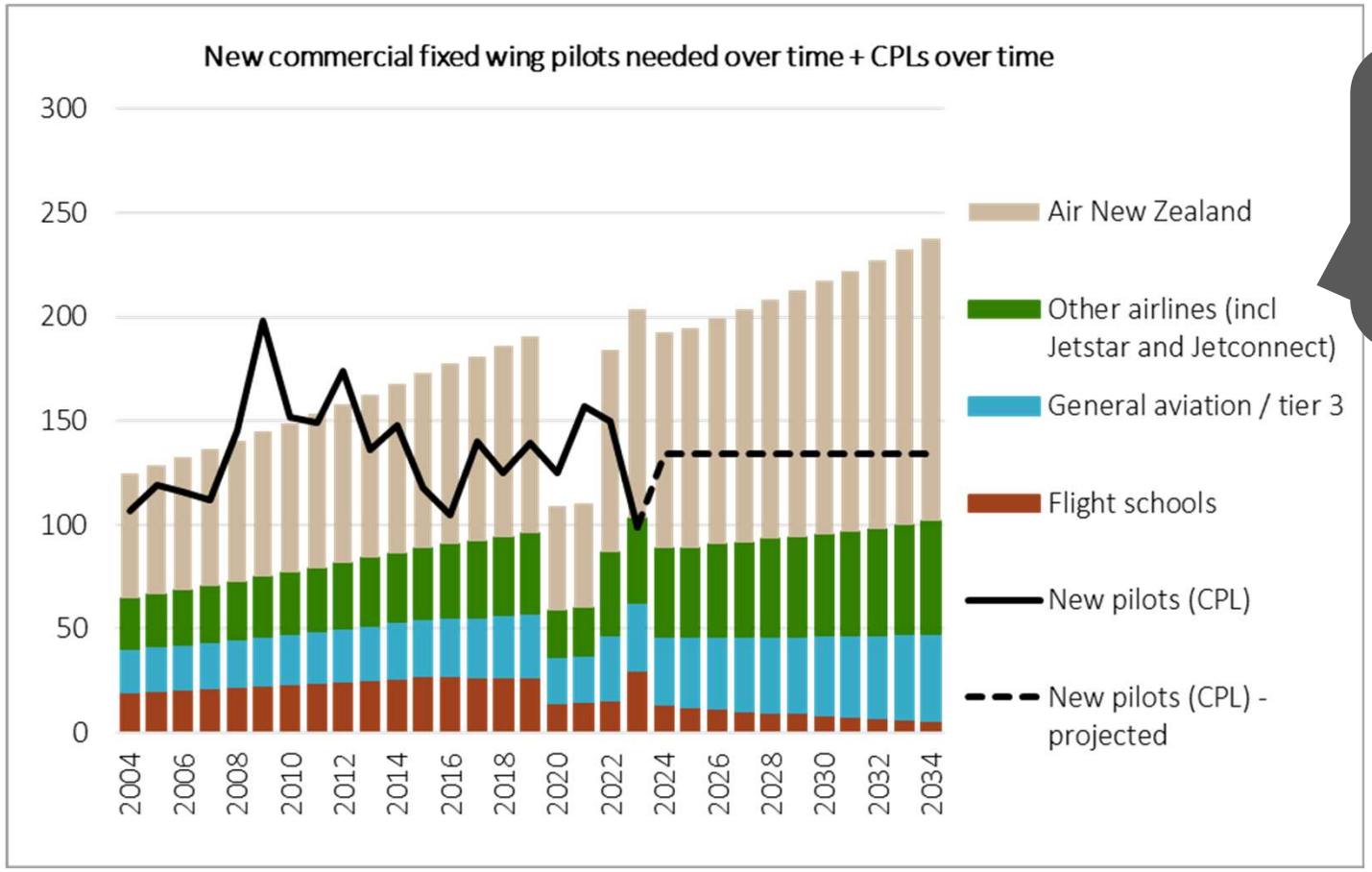
The COVID-19 scenario is the version that we recommend using to estimate the actual number for the current shortage and to estimate the timing of when the shortage is likely to affect the different operator types without interventions. It is based on the baseline scenario, but shows more variability.

The key feature of this scenario is:

- Modelling the effect of COVID-19. As discussed before, many pilots were furloughed in 2020 and 2021, but of these most have already returned or are expected to return soon. Therefore, the key effect of COVID-19 was that pilots at retirement age retired slightly earlier, and that the demand for pilots did not increase in 2020 and 2021.
- It assumes, in line with the number of students not increasing, that the demand for flight instructors stays constant from 2019
- This model aligns most closely with current and past census data for the number of pilots and instructors.

Pilots – Model findings – COVID-19 scenario

How many new pilots are supplied each year?



Due to COVID-19, there was no increase in demand for pilots in 2020 and 2021. This did, however, lead to a slightly increased one-off demand for replacement flight instructors in 2023 as larger numbers than normal got hired into airlines.

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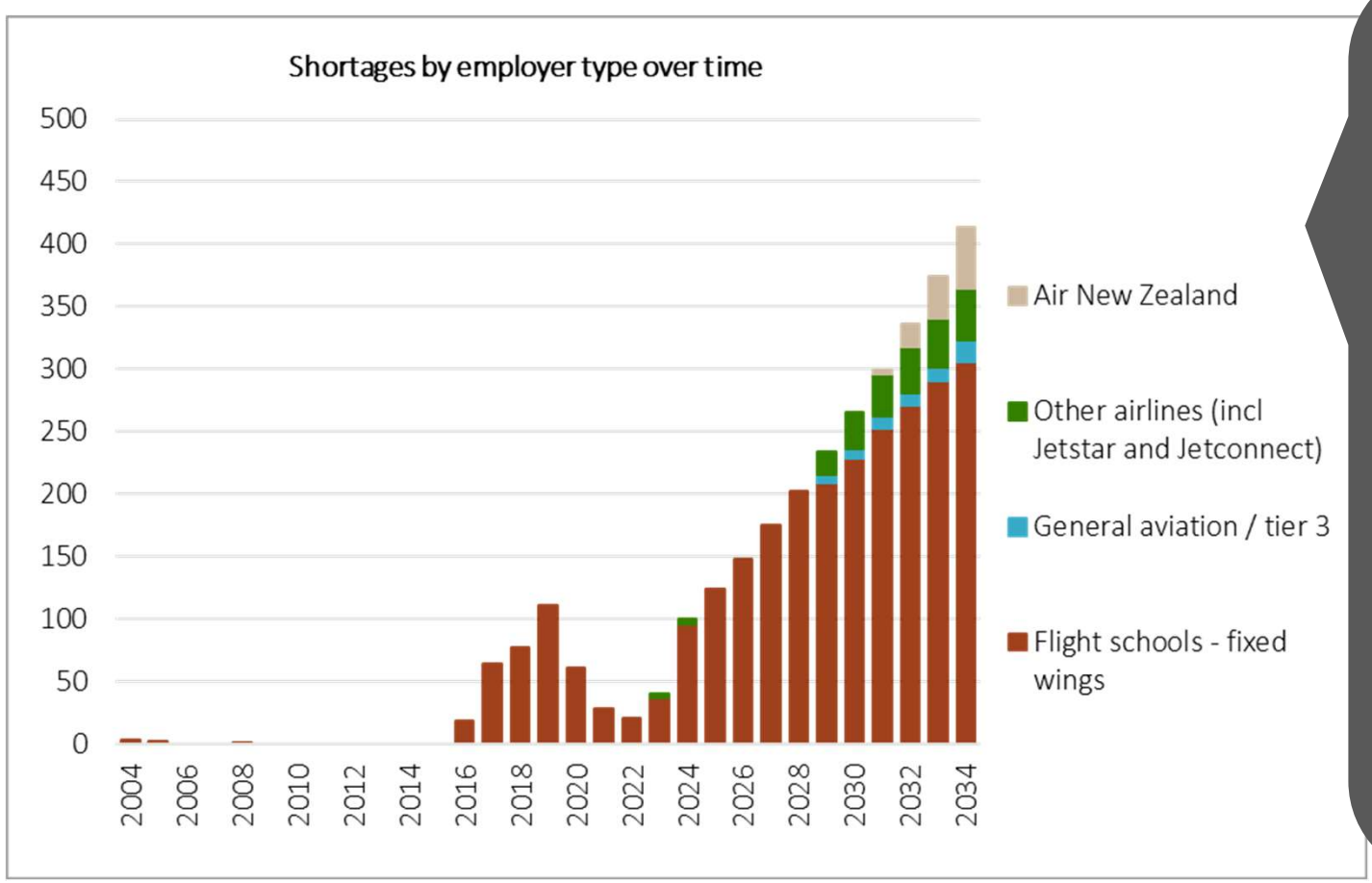
Pilots – Model findings – COVID-19 scenario

How will workforce shortage change over time?



The story that can be seen here the same as for the baseline scenario, but with slightly lower numbers.

Effectively, due to the reduced demand and it not increasing between 2019 and 2022 due to COVID-19 while there were still students who gained their CPLs, this delayed the severity of the shortage by about four years.
Based on this scenario, the current shortage is estimated to be around 100 pilots, almost exclusively at flight schools.

Because the more realistic COVID scenario does not show different trends and highlighting these as clearly as possible is seen as most important, we use the indicative baseline model going forwards to estimate the effect of interventions.

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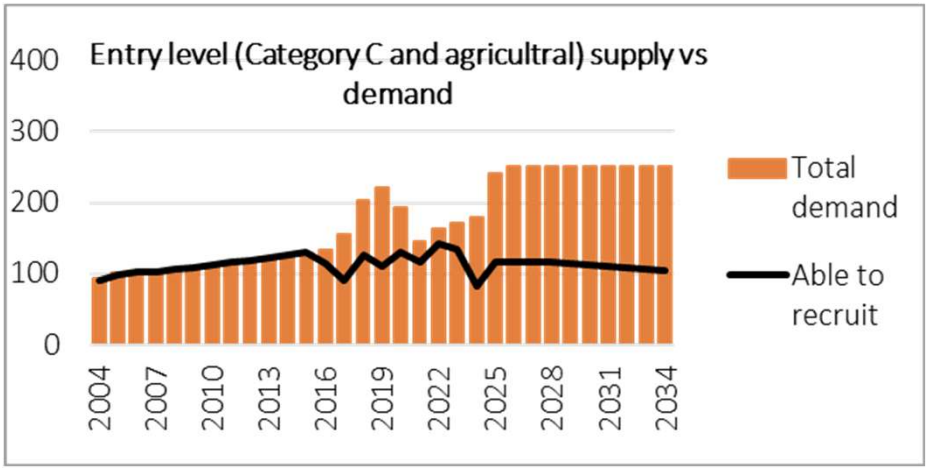
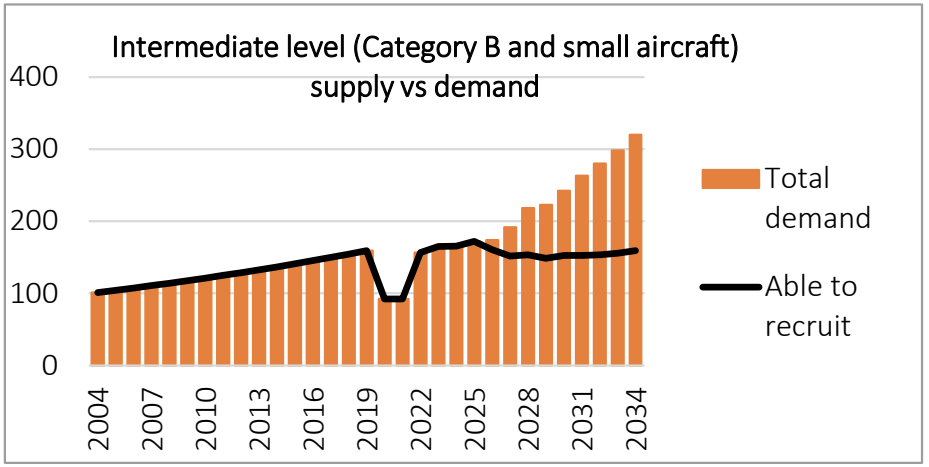
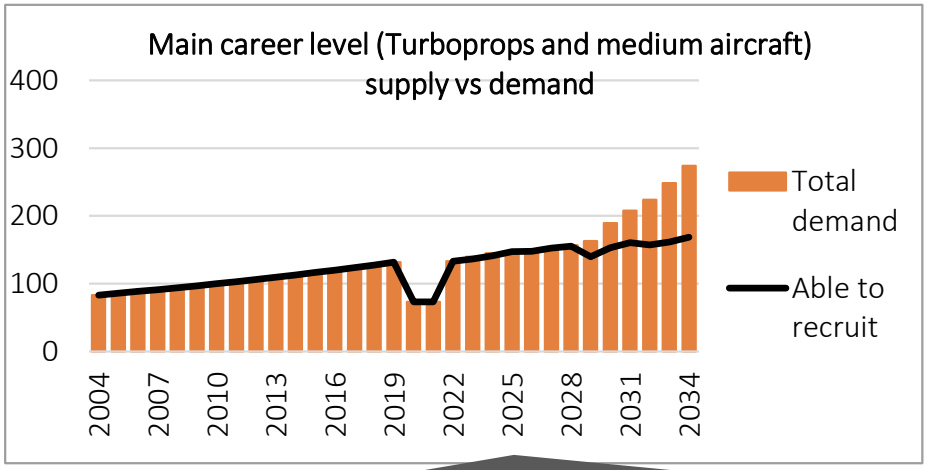
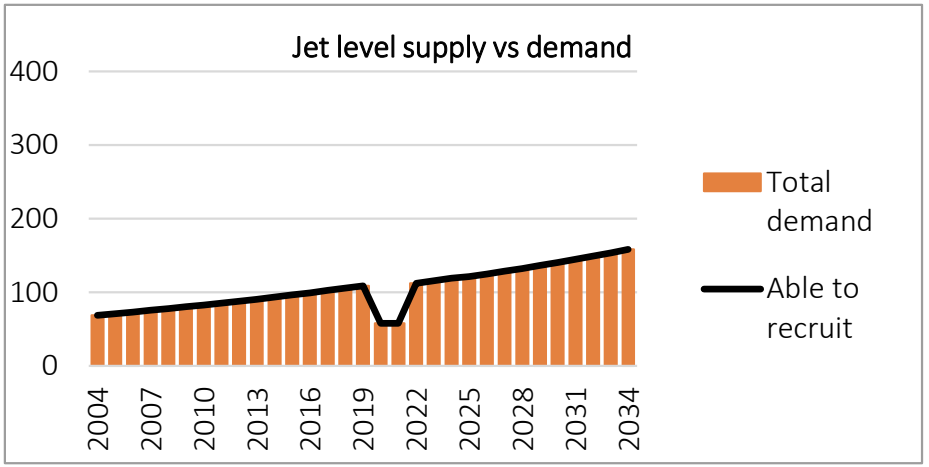
Pilots – Model findings – COVID-19 scenario

When do we expect the shortage to impact each operator level?









These plots show the total demand for pilots by operator type, and the number of pilots that are available for recruitment at the respective levels. The key messages are that entry-level positions have already been affected and have not been able to fill all vacancies with skilled staff. From roughly 2026 on this will likely reach a steady state, where pilots cannot be retained and need to be recruited by others as soon as they meet the minimal requirements. The effect on the other levels is delayed, with Category B instructors and general aviation likely being affected substantially from 2028 on, and Turboprops from ~2030. The delay comes from the higher levels being able to drain the stocks of the previous levels before a shortage manifests.

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Key aspects of the international pull scenario

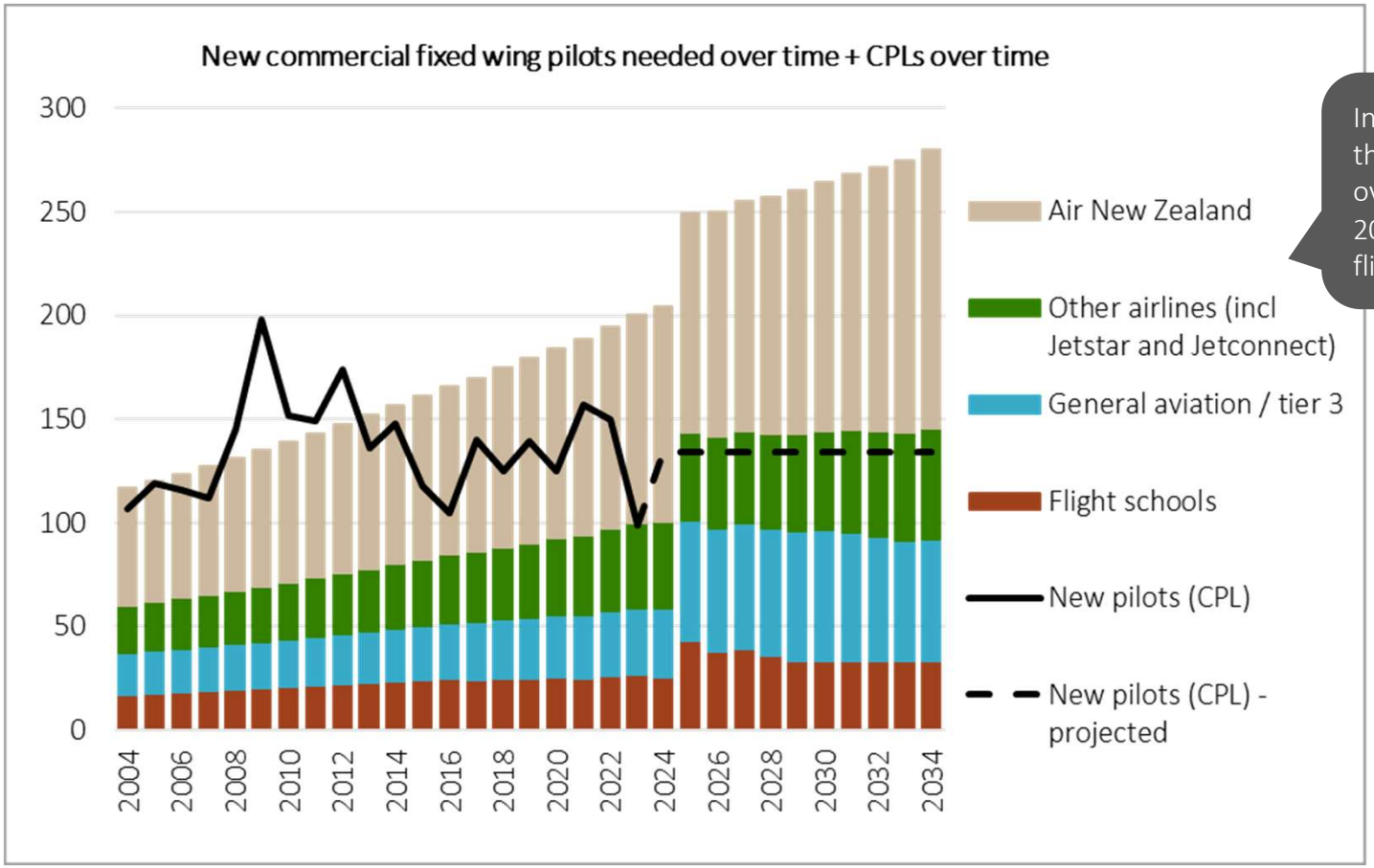
The baseline scenario is conservative in estimating the number of pilots going overseas over the next 10 years. Due to increasing demand for pilots internationally, it is likely that other airlines will increase the attractiveness for New Zealand trained pilots to leave New Zealand; partly, this is already evident. Moderately representing the effect of this is attempted in this international pull scenario.

The key feature of this scenario is:

- The rate of trained pilots permanently leaving the New Zealand workforce to move overseas is doubled. The rate in this scenario is still moderate and under 10% for most operator types.

Pilots – Model findings – international pull scenario

How many new pilots are supplied each year?



In this scenario it is assumed that the attrition due to pilots moving overseas increases drastically in 2025, particularly at the level of flight schools and general aviation.

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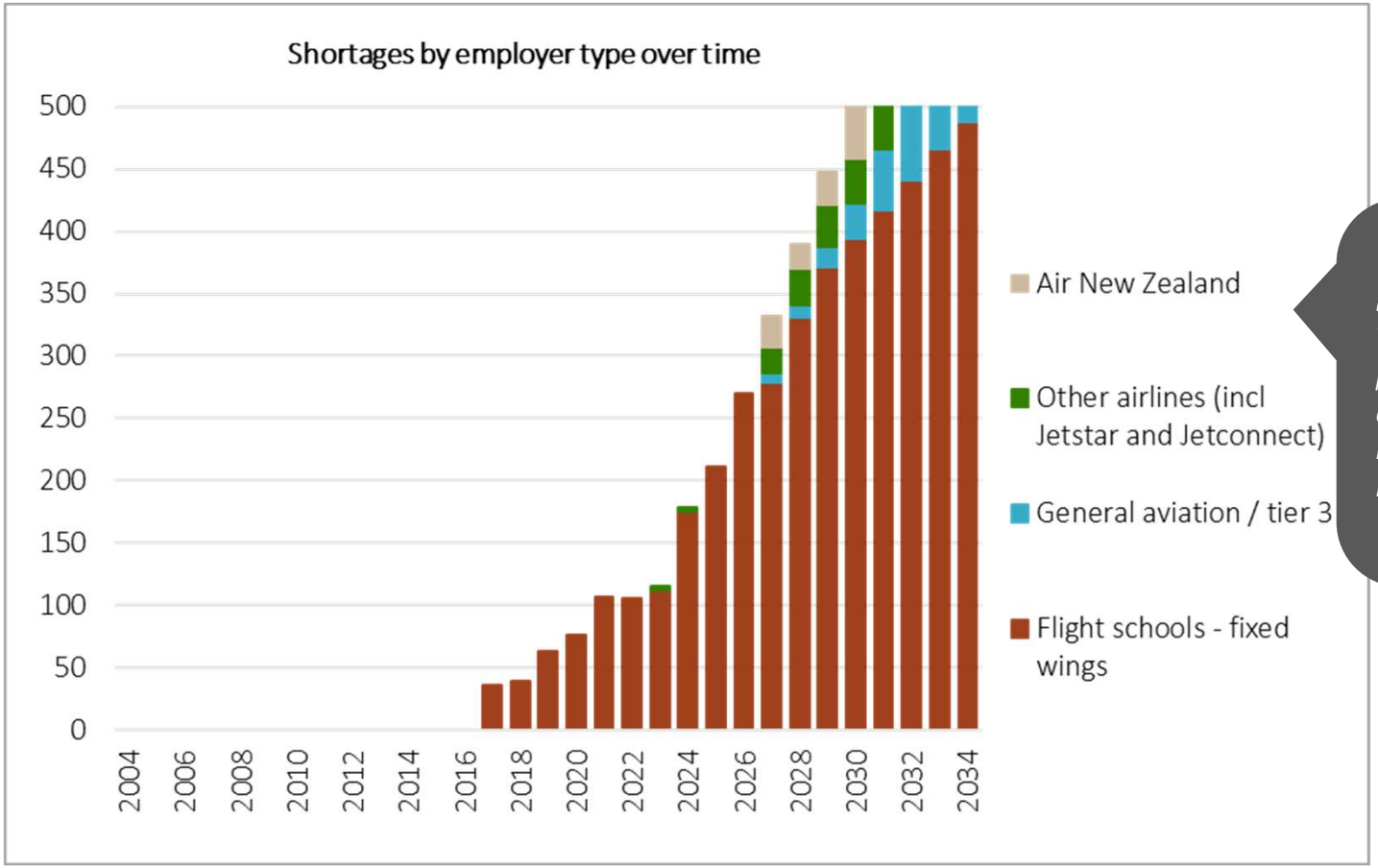
Pilots – Model findings – international pull scenario

How will workforce shortage change over time?



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The increased demand due to more pilots leaving overseas drastically accelerates the build-up of the shortage, leading to it becoming unsustainable much sooner.

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Key aspects of the interventions

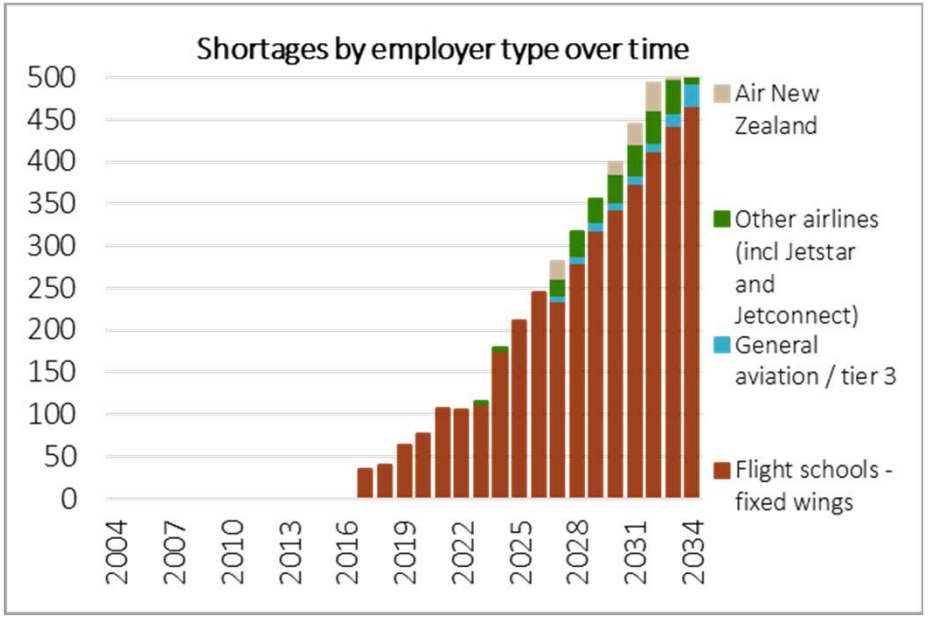
For this work, the effect of a variety of interventions were modelled. They were all based on the baseline scenario: The interventions are as follows and are presented in the report in the following order:

- Air New Zealand Cadet scheme – 30 more recruits for Air New Zealand turboprops from 2026 onwards.
- 50% increase of new pilot students – an increase of 50% more new graduates over the next five years, followed by a yearly 3% increase to match the increase in demand.
- Increase of new pilot students required to fully counter the shortage by 2034 – the required increase in new graduates over the next five years (60%), followed by a yearly 3% increase to match the increase in demand.
- Air New Zealand Cadet scheme and increase of new pilot students – an increase of 50% more new graduates over the next five years, followed by a yearly 3% increase to match the increase in demand.
- Allowing international pilot students to work as instructors in New Zealand - assuming up to 50% of non-citizens stay after completing their CPL, with the standard pathway to residency after working for at least 2 years, which would enable them to continue working as pilots in New Zealand.

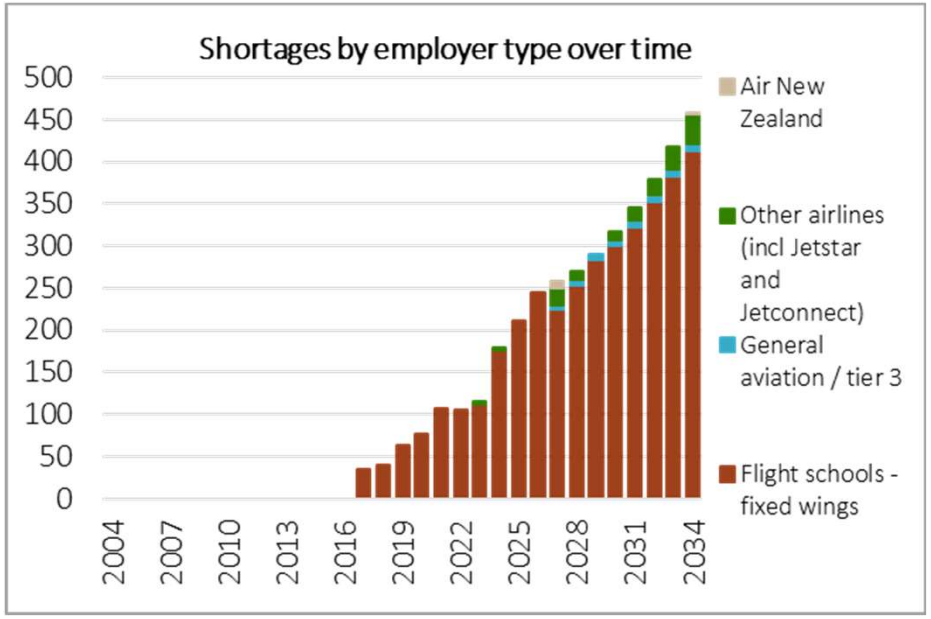
Pilots – Model findings – intervention: Air New Zealand cadet scheme

What impact will the Air New Zealand cadet scheme have?

Baseline scenario



Baseline scenario + cadet scheme



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The left shows the shortage without any intervention, the right shows if, in addition to normal hiring processes*, the Air New Zealand Cadet scheme came into action and added pilots from 2026 onwards. These additional pilots do have impact on the shortage, because adding them directly to Air New Zealand eases the pressure on the entire system, particularly on flight schools. It also reduces the shortage for other airlines. However, it is not nearly sufficient to alleviate the shortage.*

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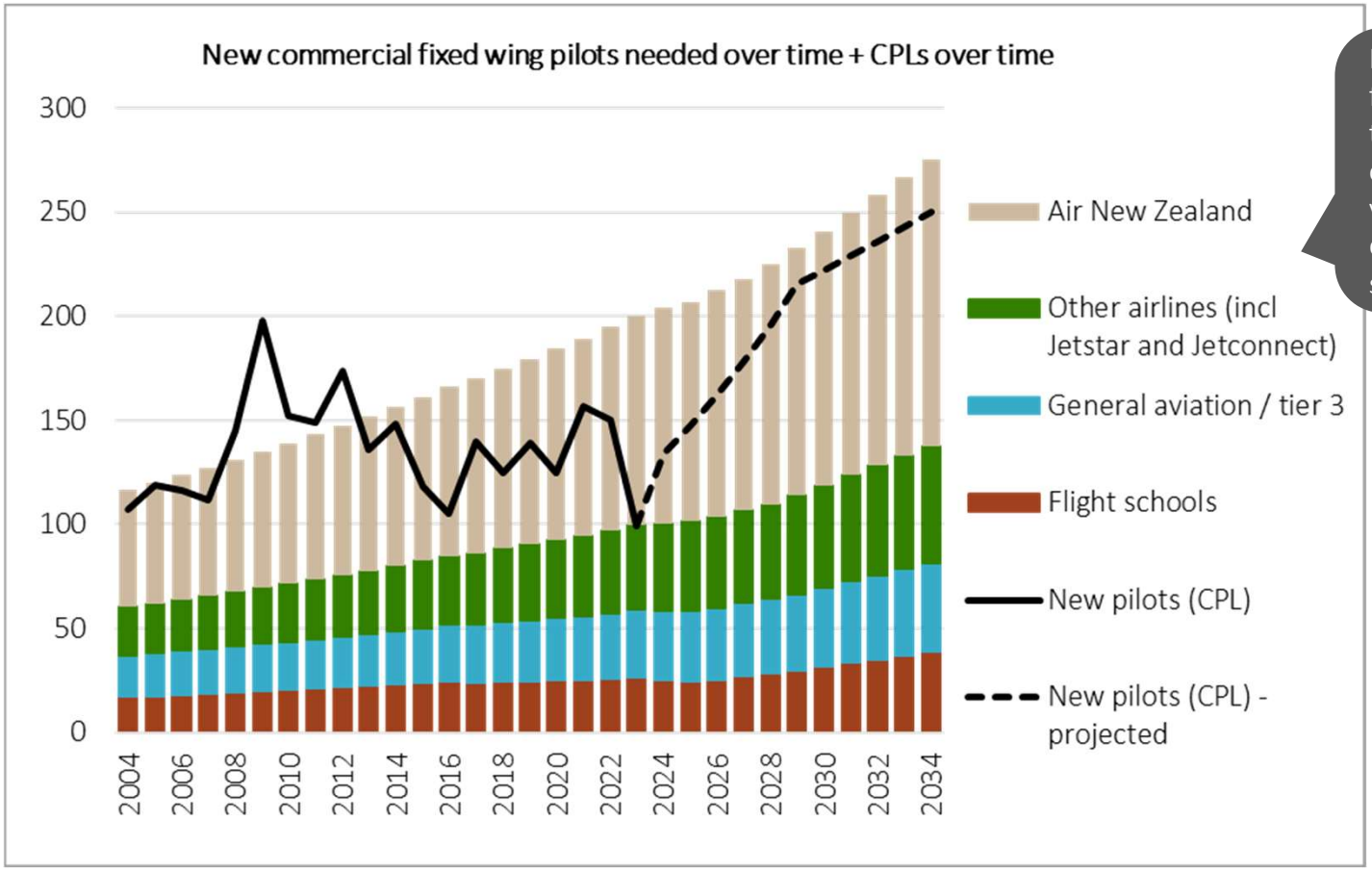
Pilots – Model findings – intervention: 50% increased number of students until 2029

What is the impact of increasing the number of students by 50% over the next 5 years?



If the pilot supply going forwards from 2024 is increased by 50% over the next five years, and then continues to increase by 3% each year, the gap between supply and demand would be substantially smaller, but not eliminated

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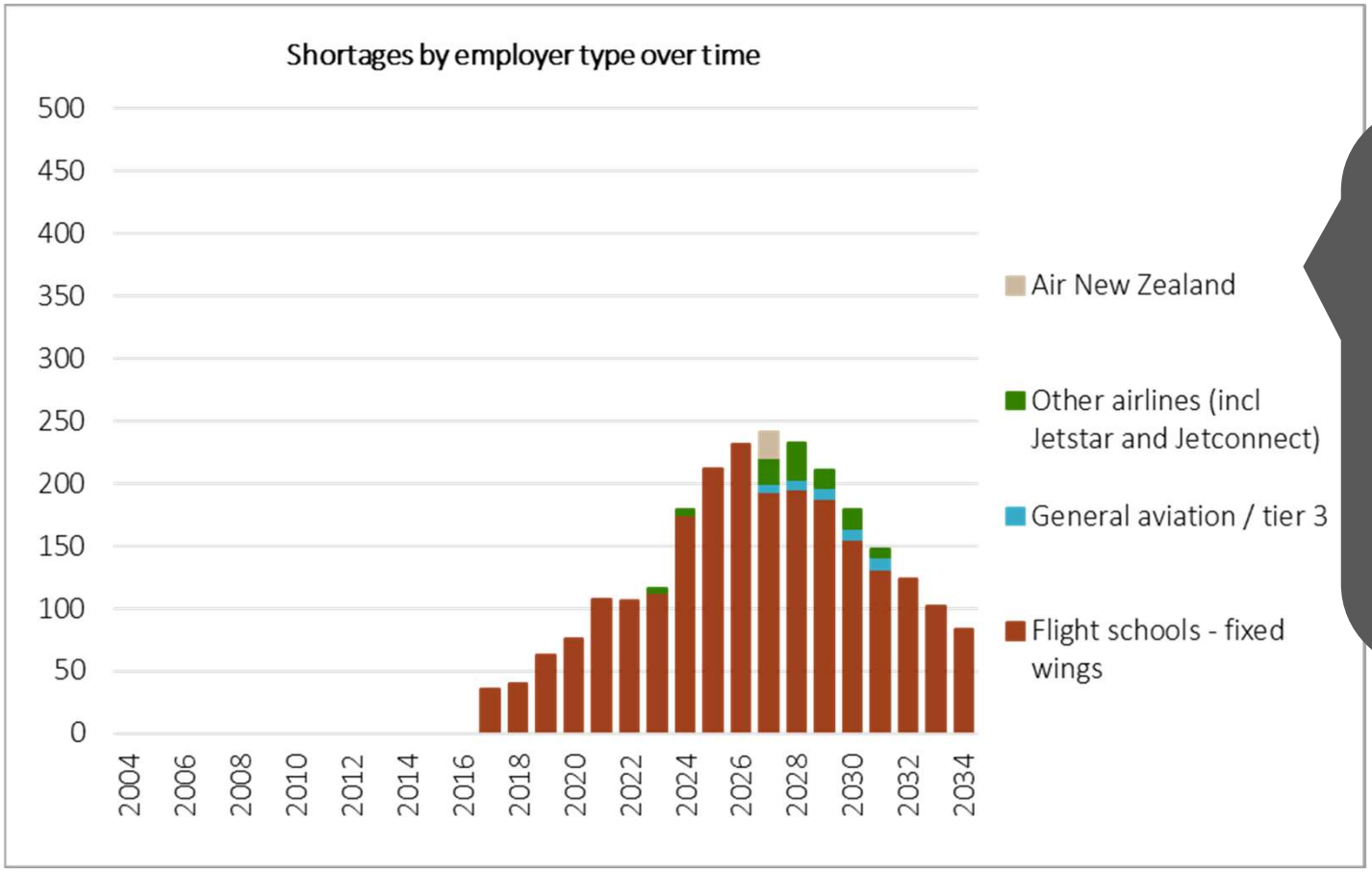
Pilots – Model findings – intervention: 50% increased number of students until 2029

What is the impact of increasing the number of students by 50% over the next 5 years?



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Increasing the supply of new pilots by 50% over the next five years and then by 3% each year would substantially reduce the growth of the shortage and would even slowly reduce the shortage to a point from where it will stay constant, but would not be able to fully eliminate it.

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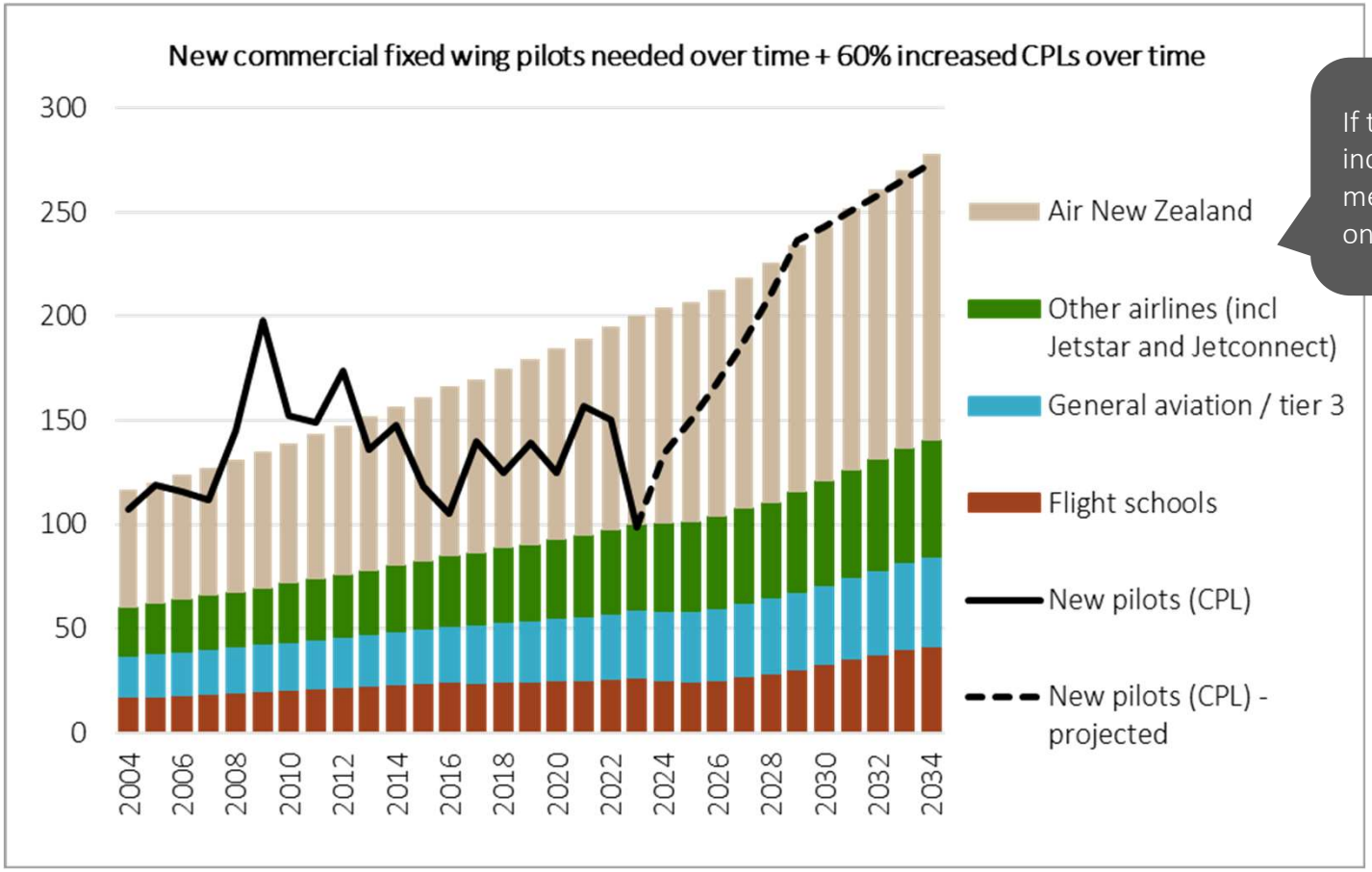
What increase of student numbers is required to counter the shortage by 2034?



If the pilot supply from 2024 was increased by 60% the supply would meet demand from about 2029 onwards.

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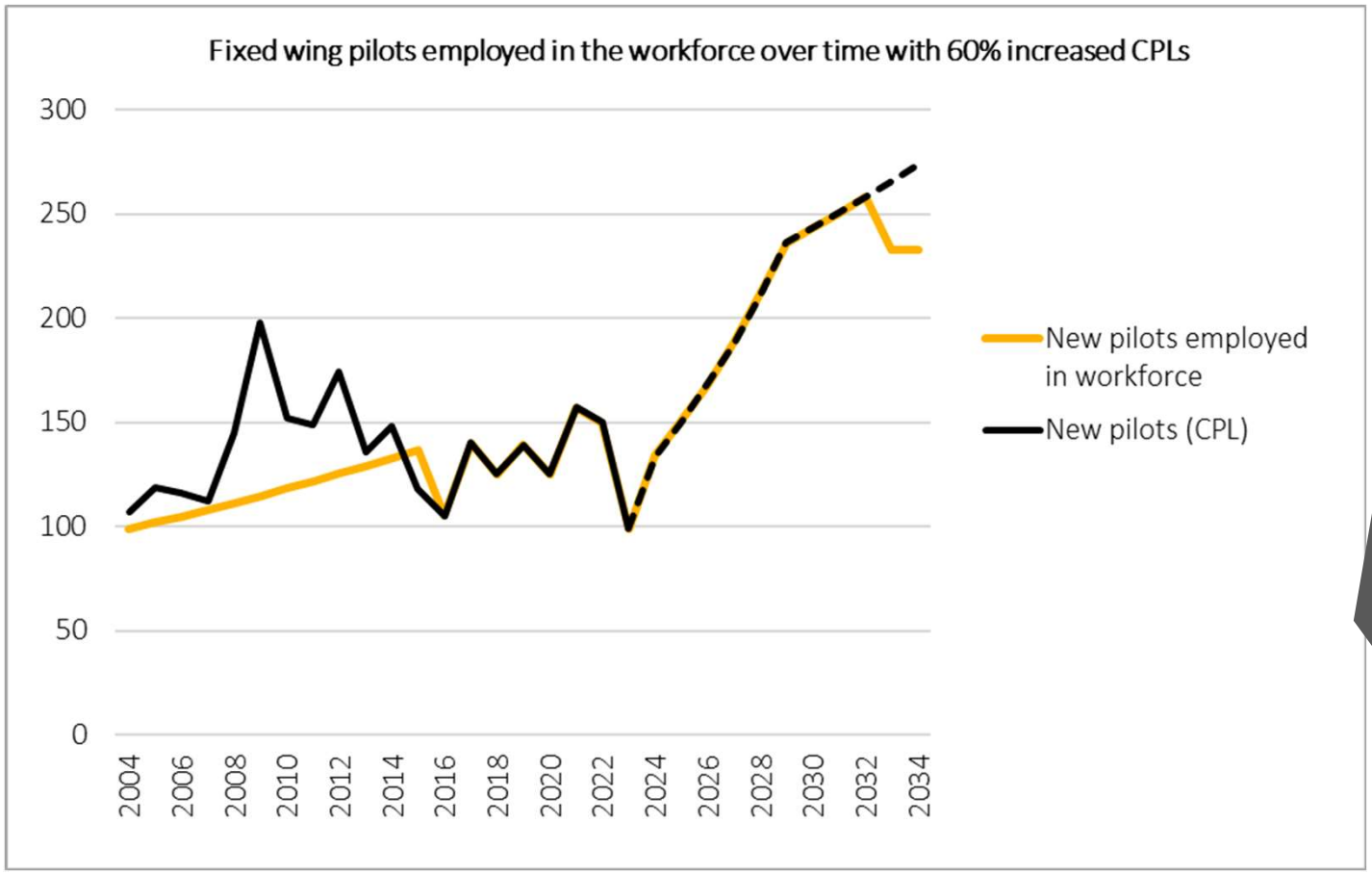
What increase of student numbers is required to counter the shortage by 2034?



At an increase of 60% or above a different bottle-neck starts appearing:
Despite there still being a shortage of pilots in 2032 and the supply being equal to the demand (previous graph), some of the new pilots could not be employed in the workforce.
This is because there is only a limited number of entry level positions available, and the leftover shortage in the model is at the level of Category B instructors. Increasing the number of students beyond the number of entry level positions (Category C instructors) does not reduce the shortage any further.
This effect becomes particularly noticeable when modelling further than 2034, where the total annual demand exceeds the number of Category C instructor positions.

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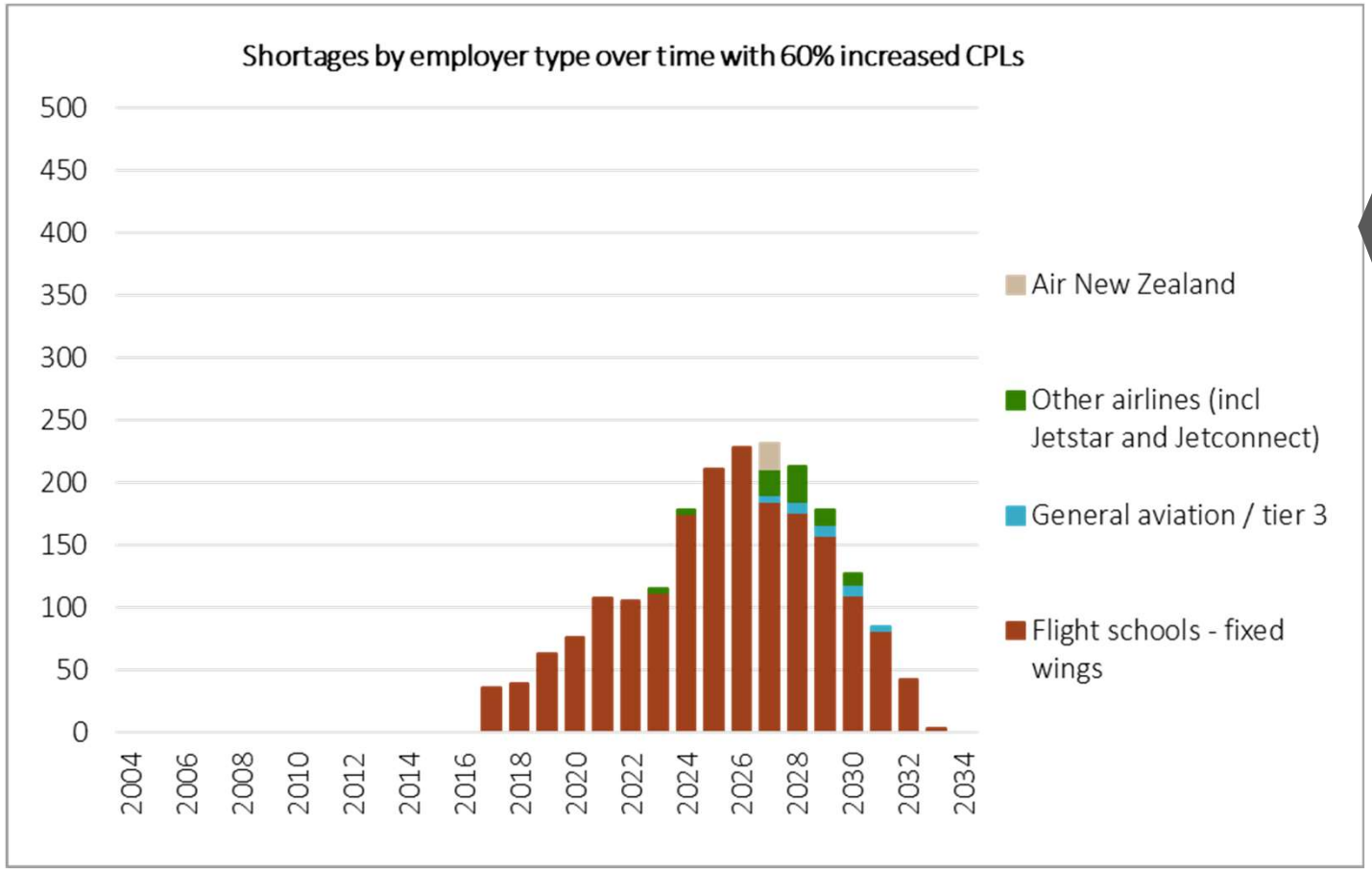
Pilots – Model findings – intervention: Increase of pilot students required to counter the shortage by 2034

What increase of student numbers is required to counter the shortage by 2034?



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Increasing the supply of new pilots going forwards by 60% over the next five years, and then continuing to increase it by 3% each year, *would be required to fully counteract increasing demand and avoid any shortage.*

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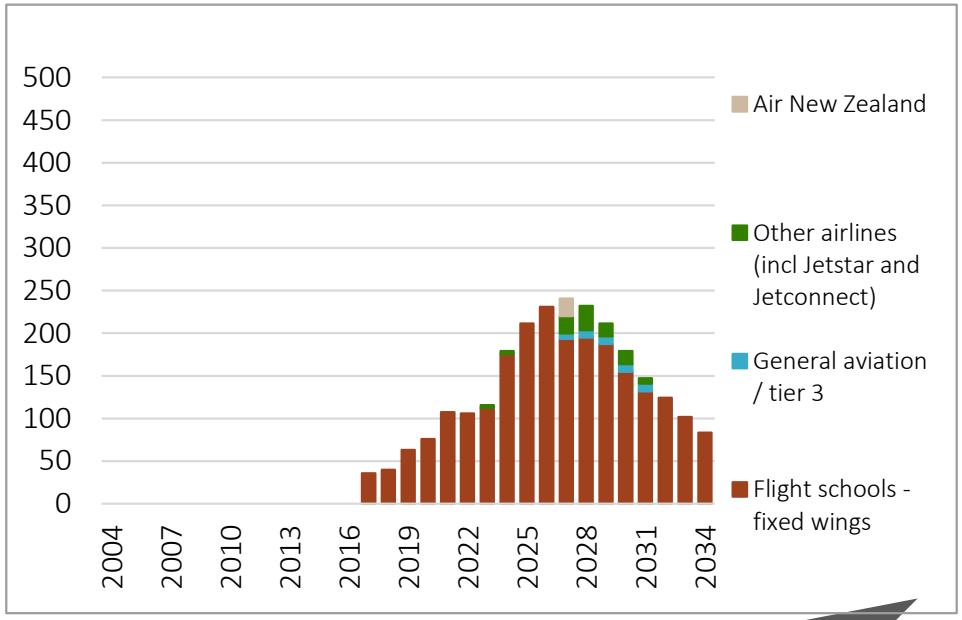
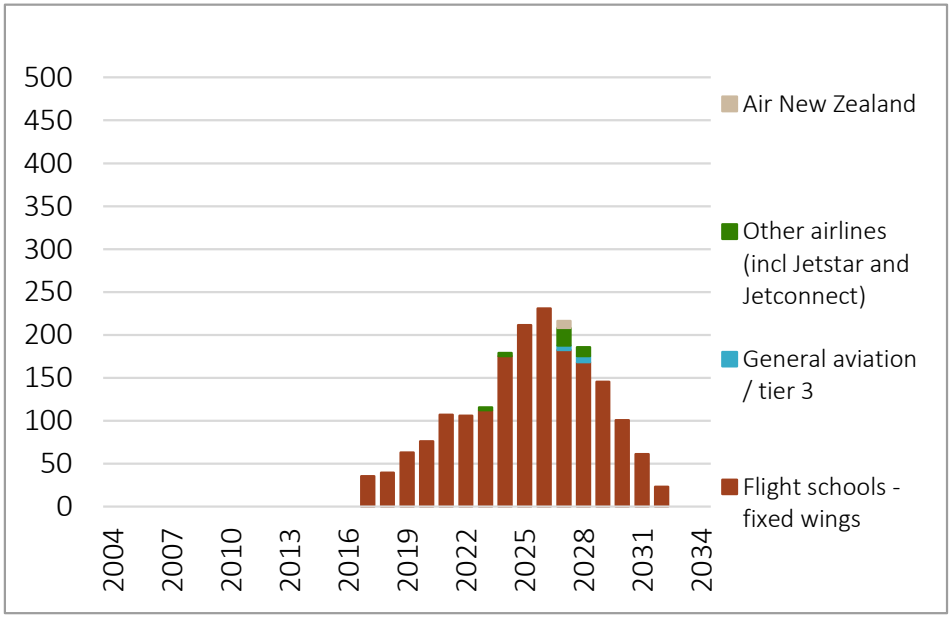
What impact will the Air New Zealand cadet scheme + a 50% increase in CPLs have?

Baseline scenario + 50% increase in CPL



Baseline scenario + cadet scheme + 50% increase in CPLs



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The left shows the shortage with an increase of 50% new pilots over the next five years and then a continuing increase of 3% each year, the right shows if, in addition to 50% more new pilots, the Air New Zealand Cadet scheme came into action and added pilots from 2026 onwards. This combination would be expected fully alleviate the shortage until by 2034.

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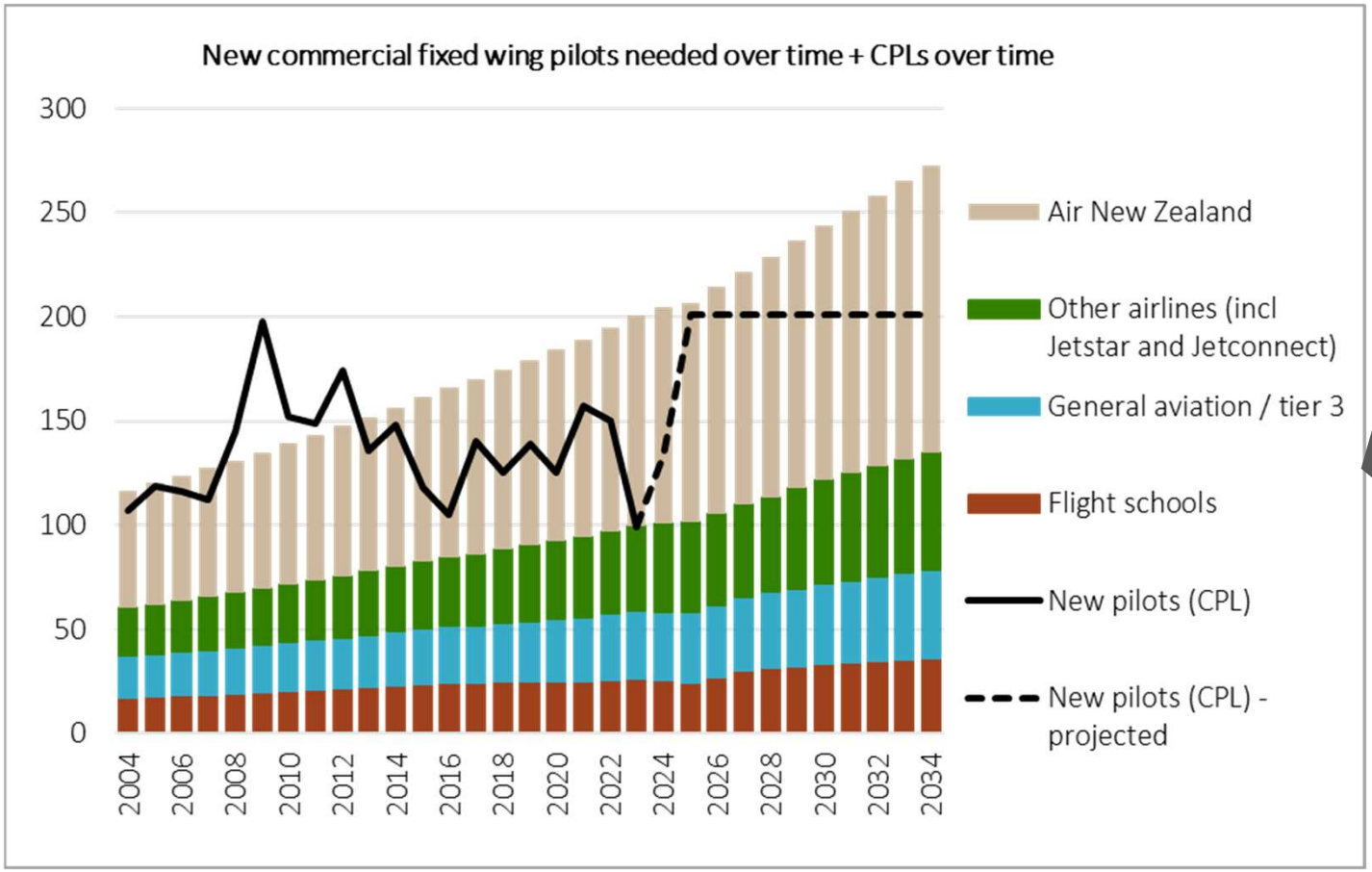
What is the impact of allowing international students to stay on as flight instructors?



Given that currently half of all people gaining CPLs in New Zealand are non-citizens, allowing these to become instructors, and assuming around 50% would accept that offer, would be equivalent to immediately increasing the number of new pilots available to the workforce by 50%.
This would meet the current demand, but not going forwards.

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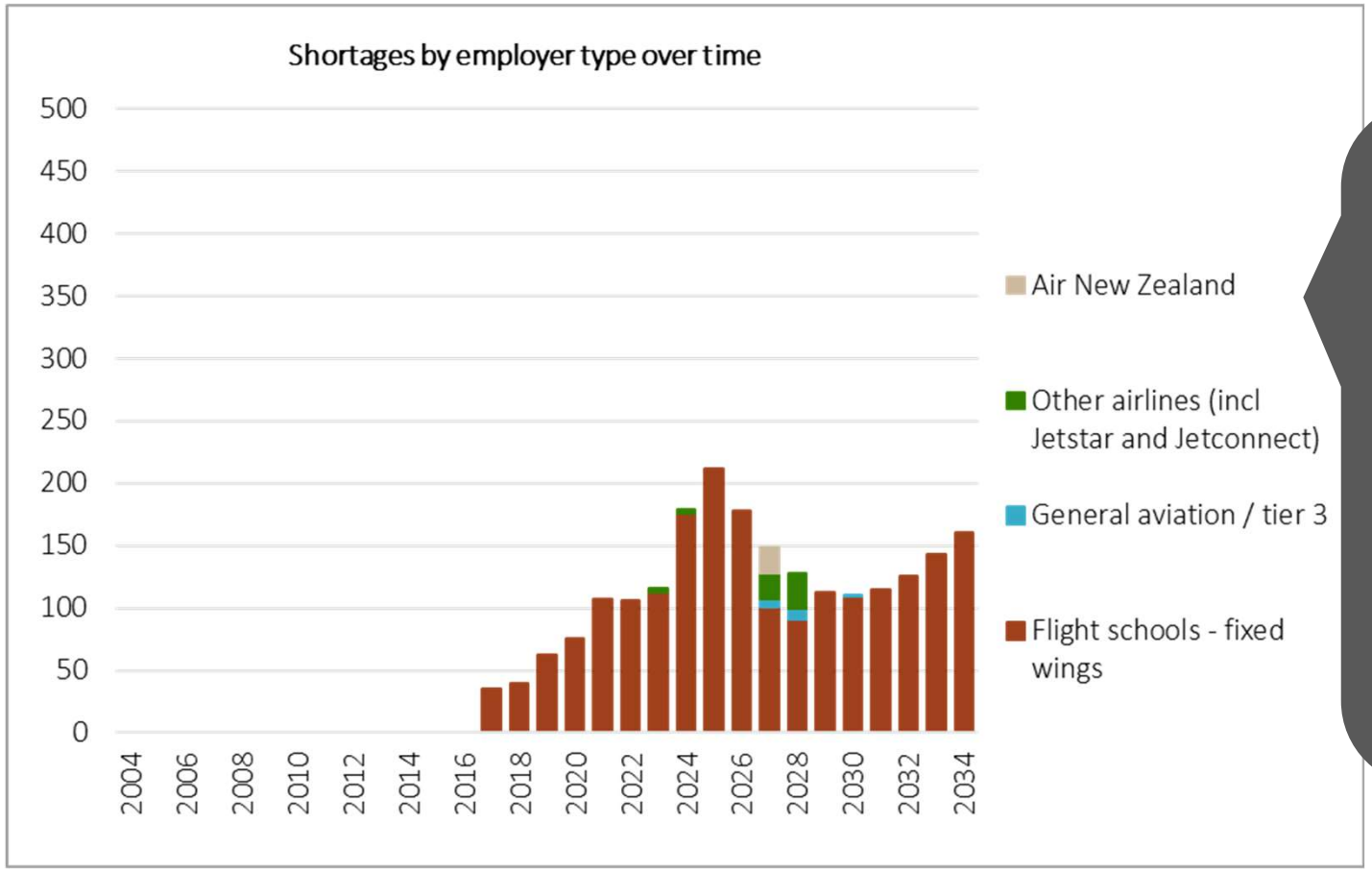
Pilots – Model findings – intervention: Allowing international students to stay on as flight instructors

What is impact of allowing international students to stay on as flight instructors?



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Increasing the number of new pilots available by 50% from 2025 on by allowing international students to become instructors would be easier and cheaper and have a substantially faster effect than gradually increasing the CPLs by 50% over the next five years, and would stop the growth of the shortage. In particular, it might prevent some flight schools from having to shut down. However, it would not be sufficient to fully counter the shortage without a subsequent continuing increase of 3% to match the increasing demand.

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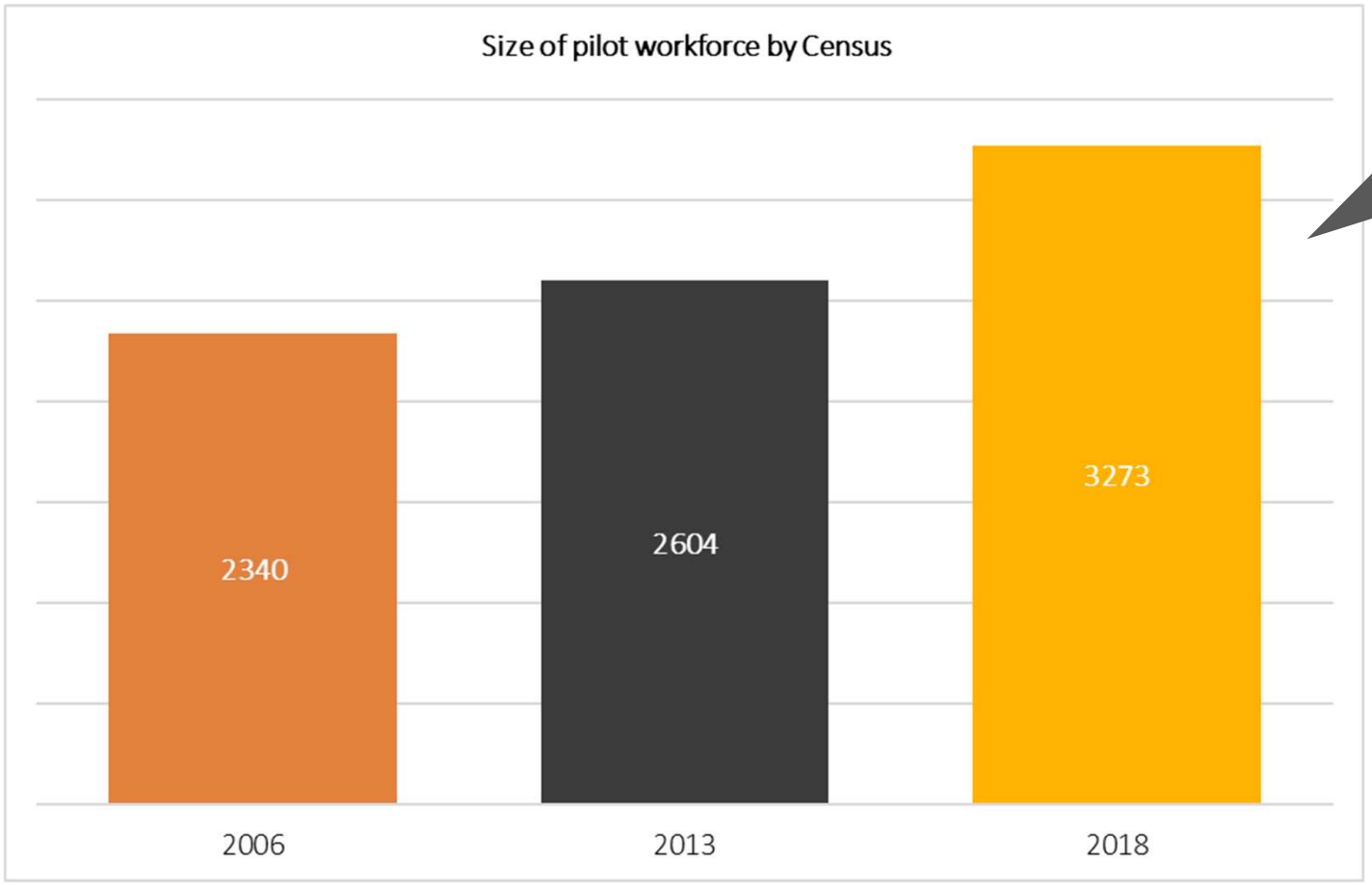
What is the size of the pilot workforce? How has this changed over time?



Pilot numbers have grown by 2-3% per year over the past two decades.

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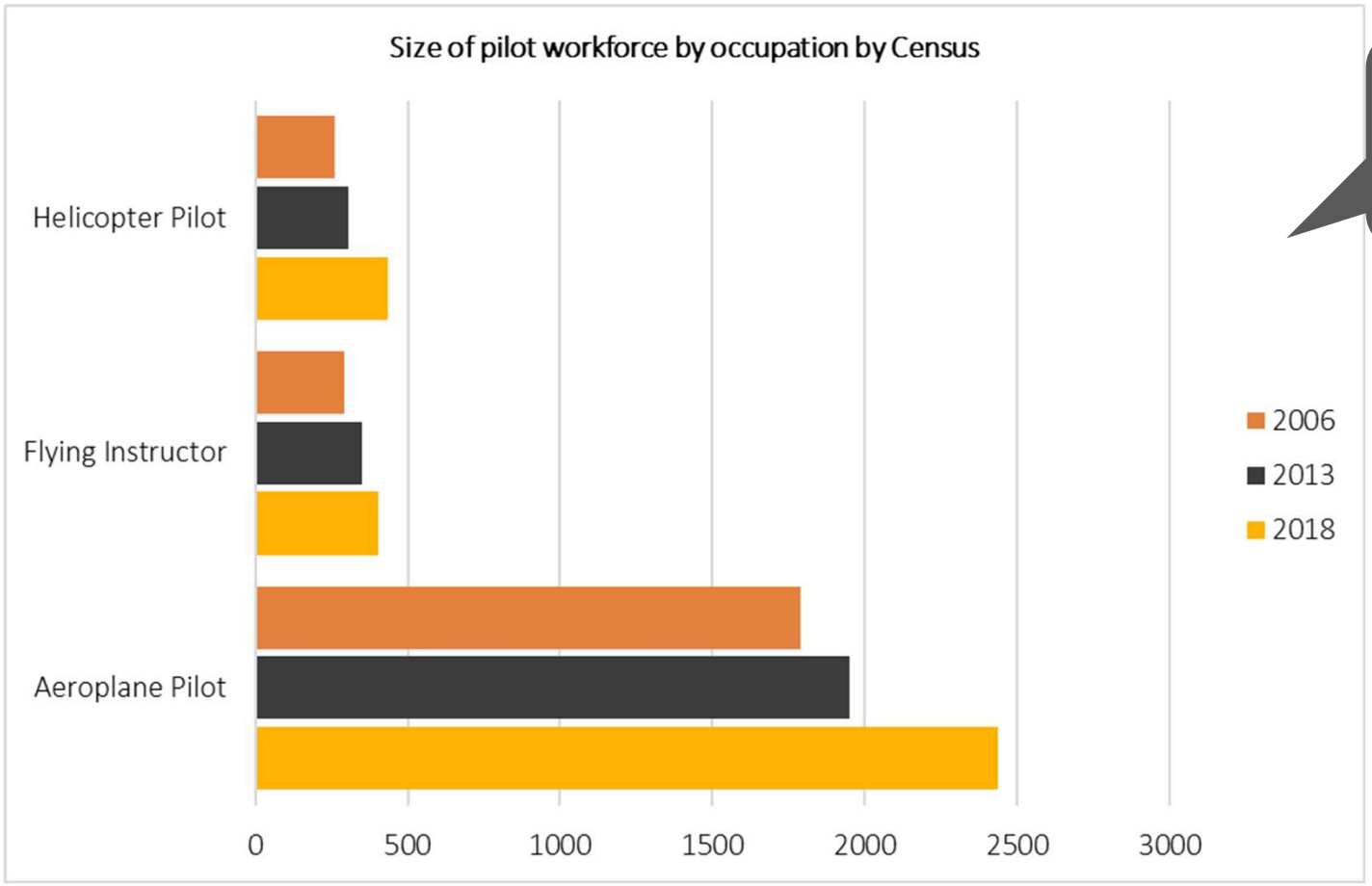
What is the size of the pilot workforce? How has this changed over time?



Pilot numbers have grown at about the same rate in each of the three categories included in the census.

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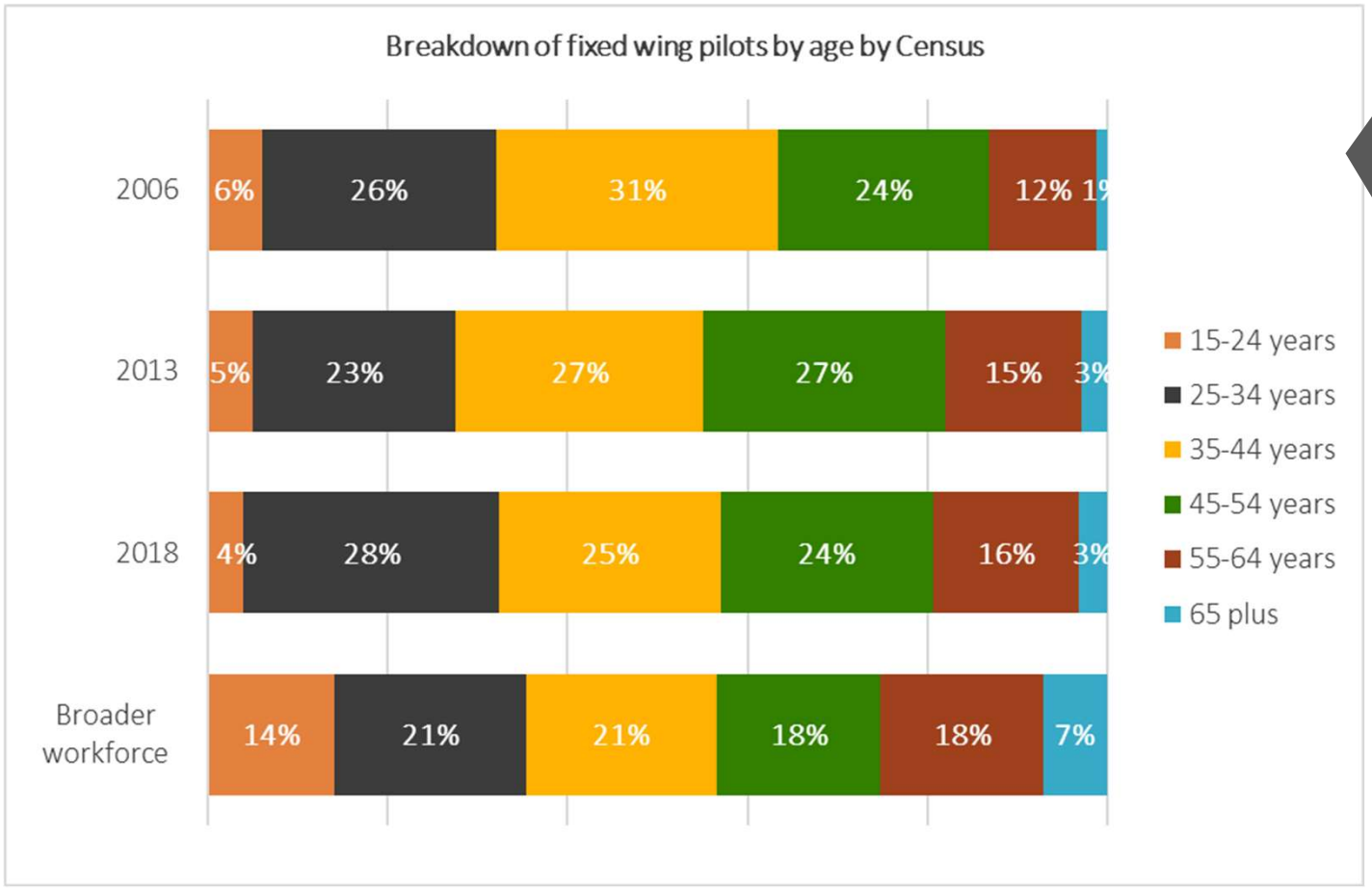
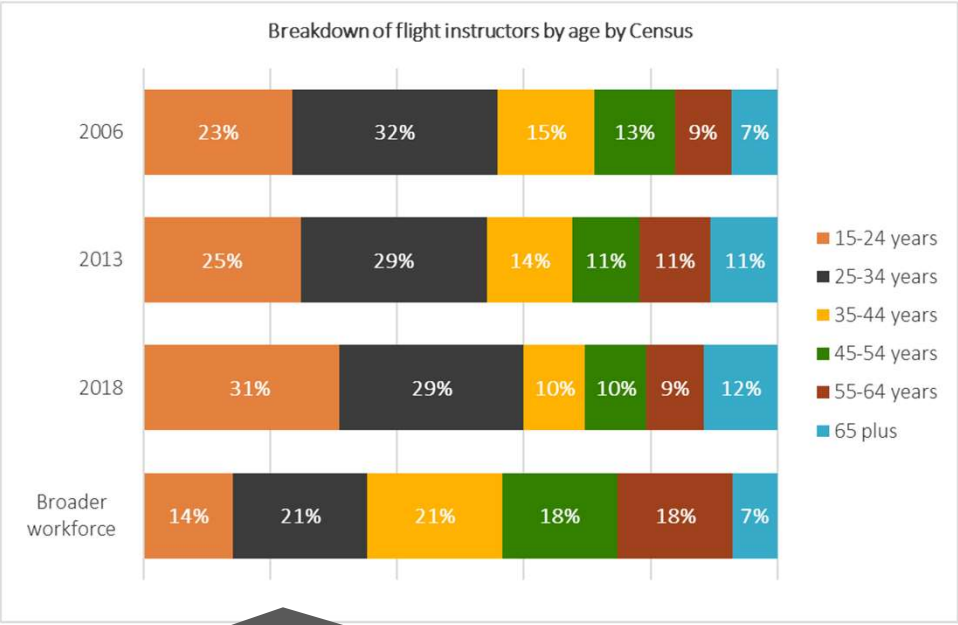
What is the composition of pilots by age? How has this changed over time?



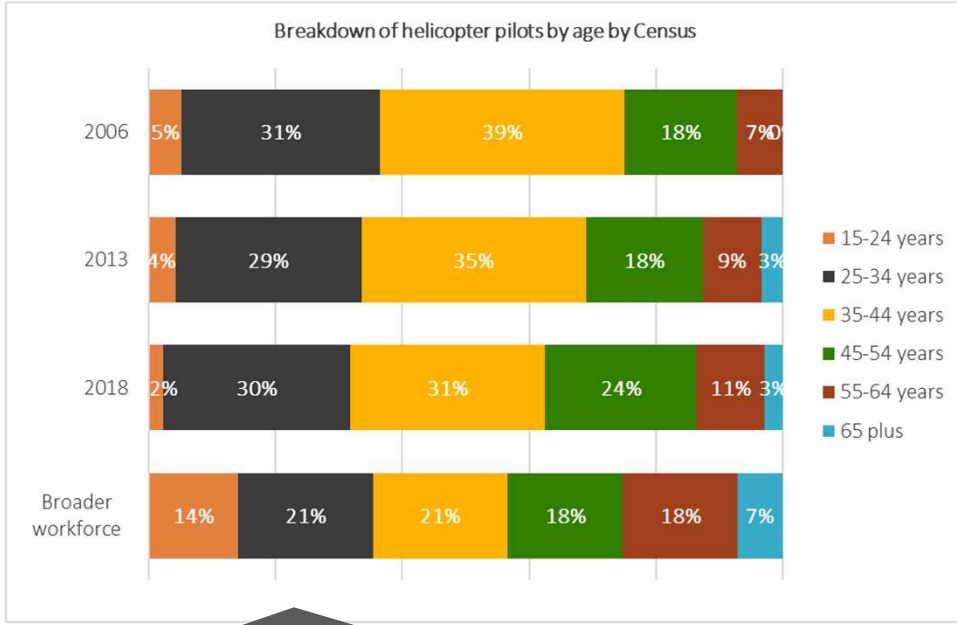
The age profile of the fixed wing pilot workforce has stayed broadly similar over time.

For those over 25, the age distribution of the pilot workforce is similar to that of the wider workforce.

What is the composition of pilots by age? How has this changed over time?



The age profile of the flight instructor workforce is young reflecting the high proportion of newly qualified pilots in this occupation.



The age profile of the helicopter workforce is aging over time but is still skewed younger than that for fixed wing pilots.

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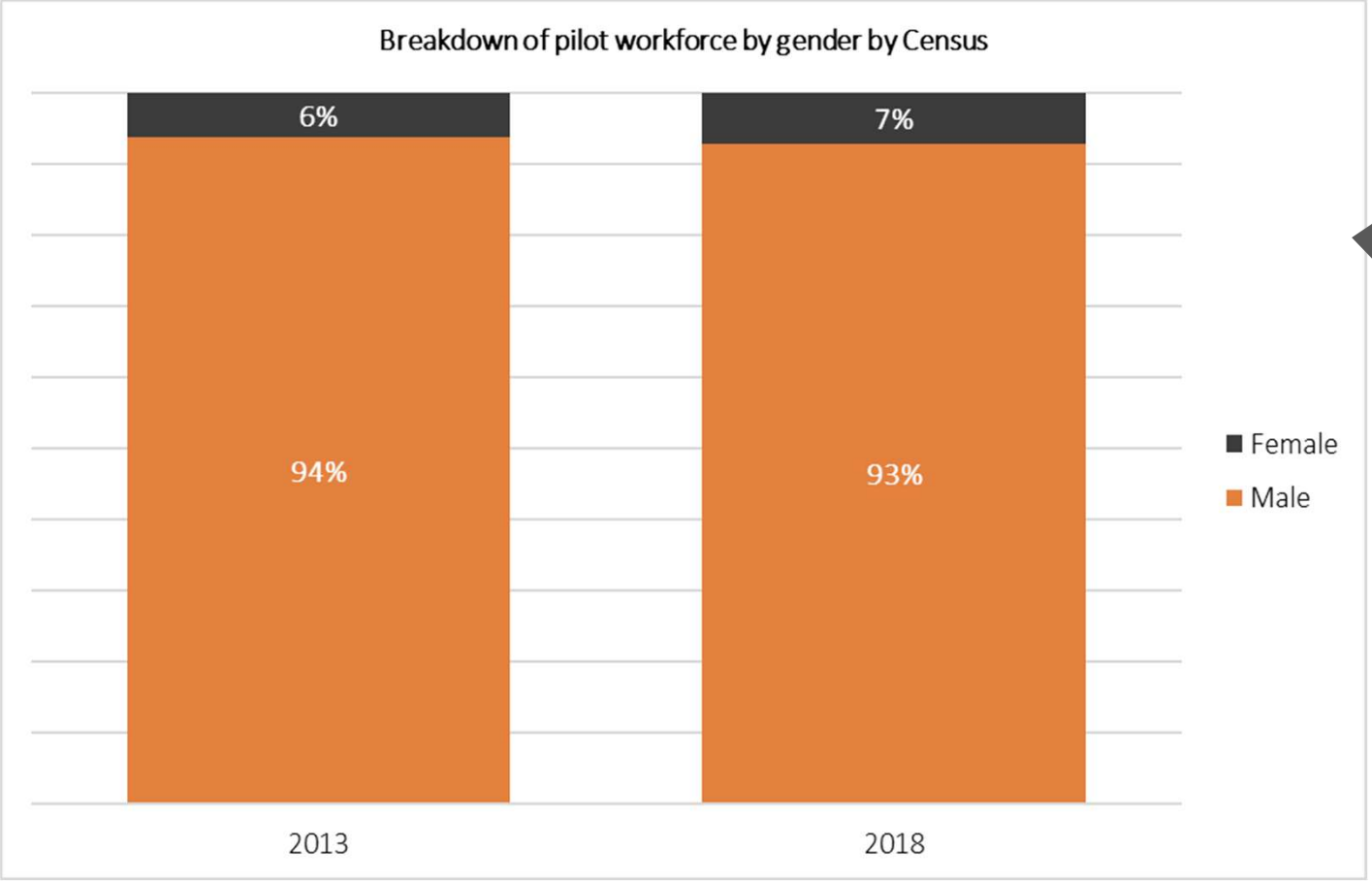
Pilots – Features of the pilot workforce

What is the composition of pilots by gender? How has this changed over time?



There is a long-way to go to address gender disparity in the pilot workforce.

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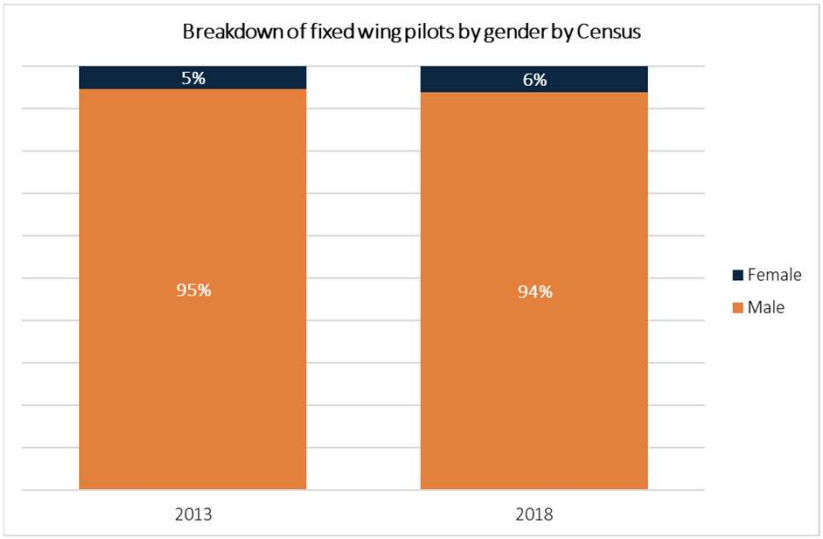
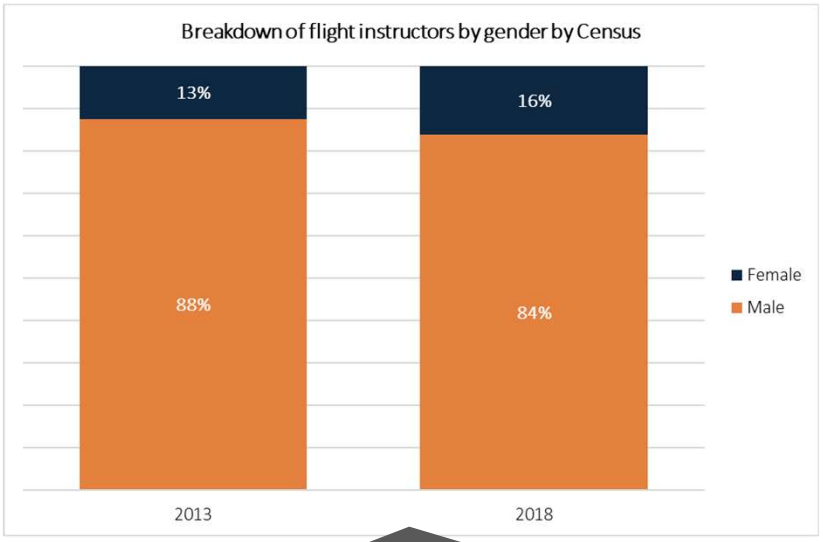
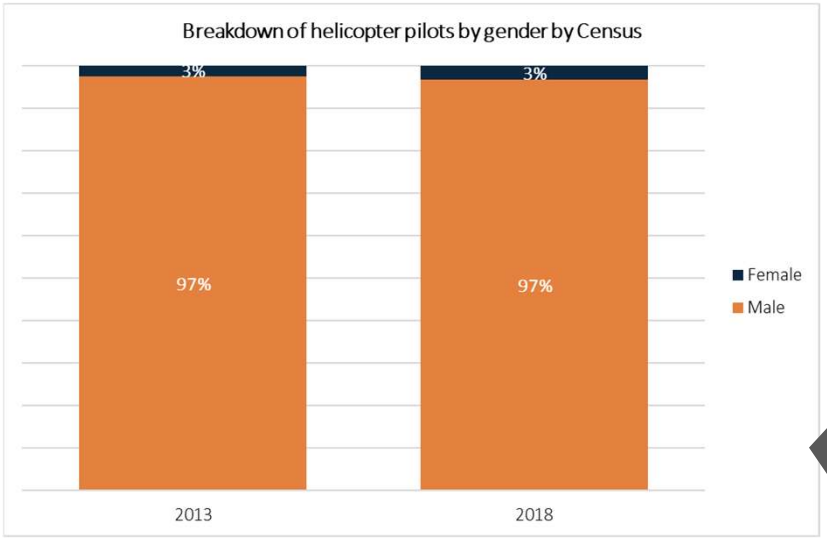
Pilots – Features of the pilot workforce

What is the composition of pilots by gender? How has this changed over time?





The higher-than-average proportion of women in flying instructor roles hints that gender imbalances may at least be moving in the right direction.



Helicopter pilots are even more skewed male than their fixed wing peers.

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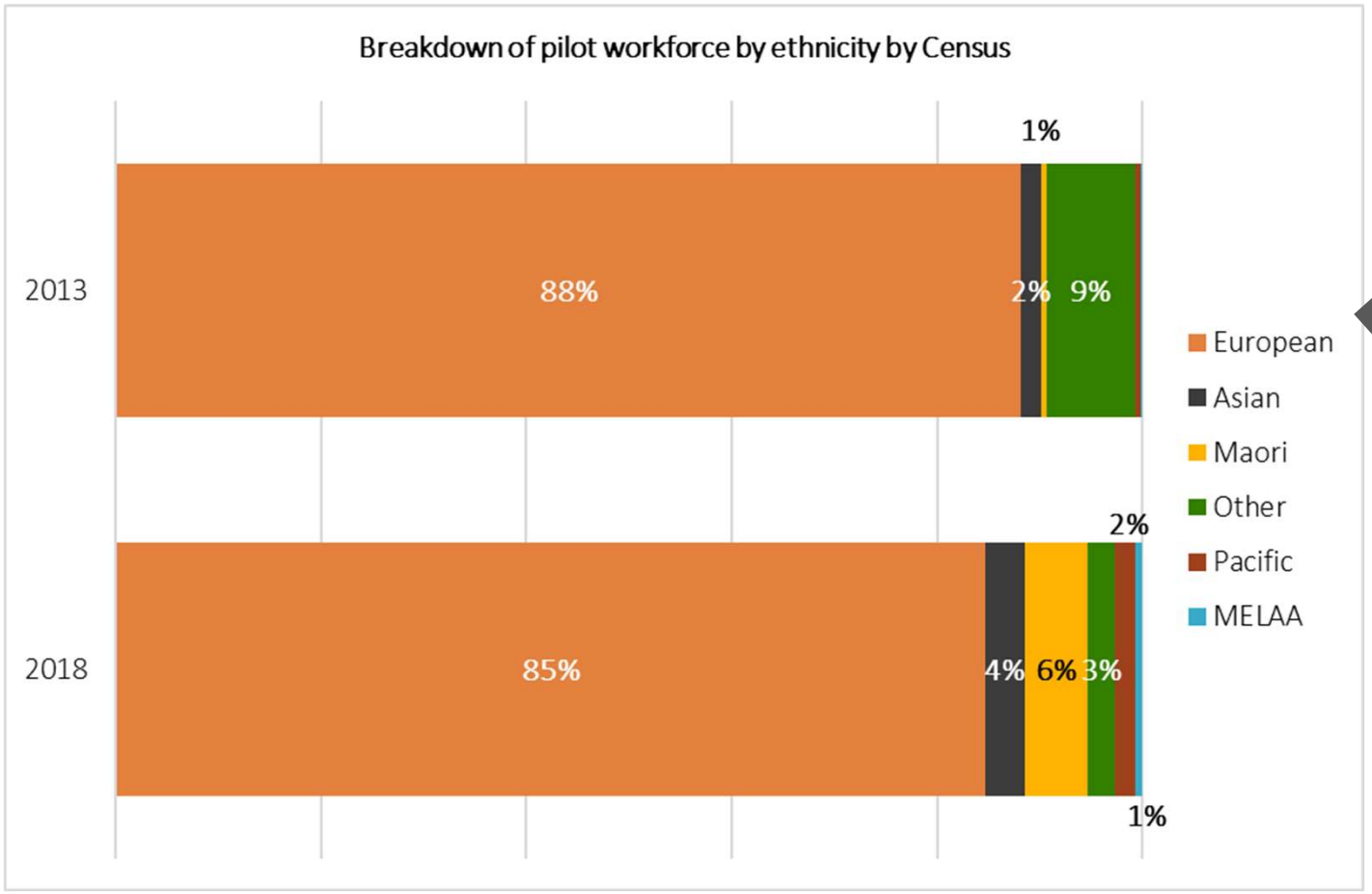
Pilots – Features of the pilot workforce

What is the composition of pilots by ethnicity? How has this changed over time?



There are hints that the workforce is becoming more ethnically diverse.

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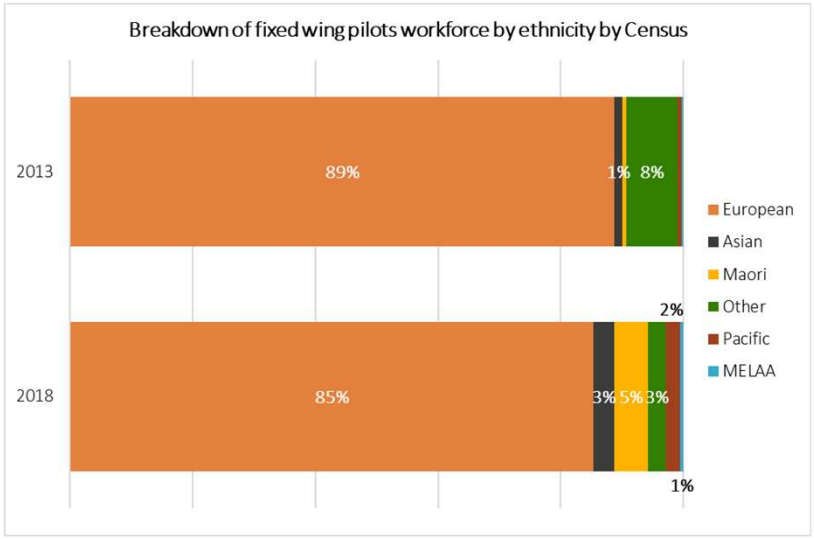
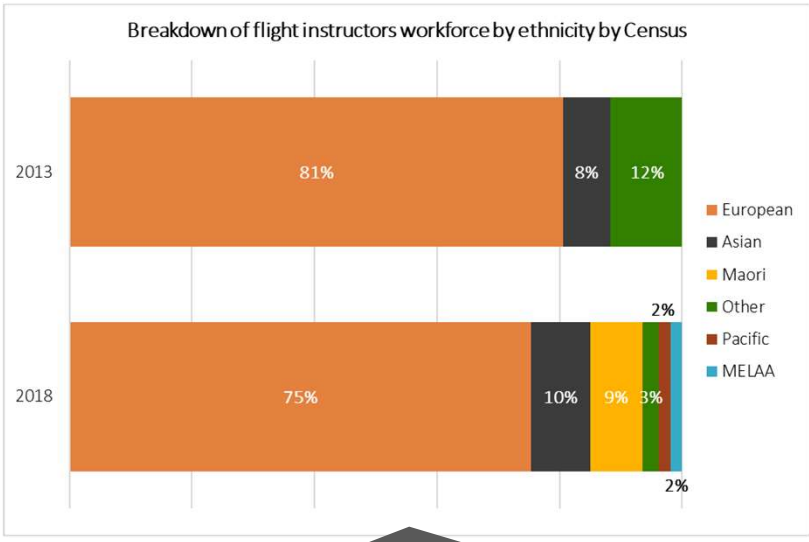
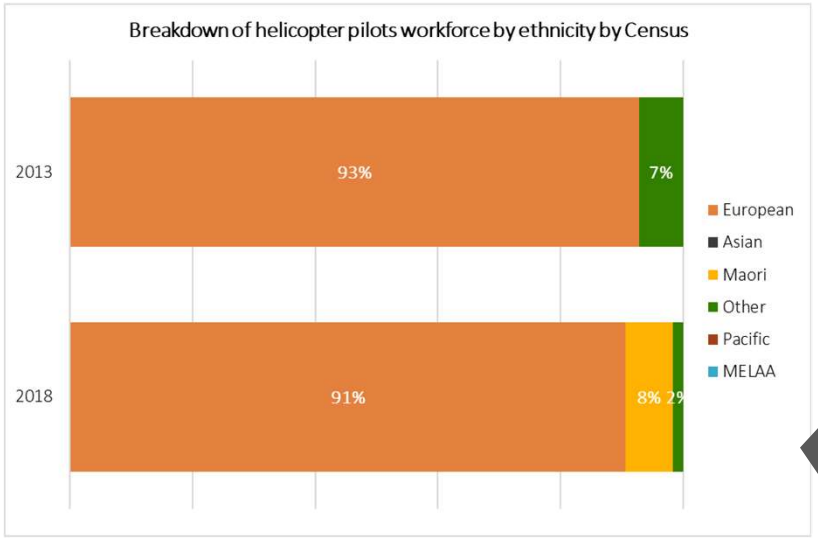
What is the composition of pilots by ethnicity? How has this changed over time?







Again, the higher than average proportion of ethnic minorities in (typically younger) flying instructor roles hints that the workforce may be becoming more diverse.

And again, helicopter pilots are less diverse than fixed wing pilots.

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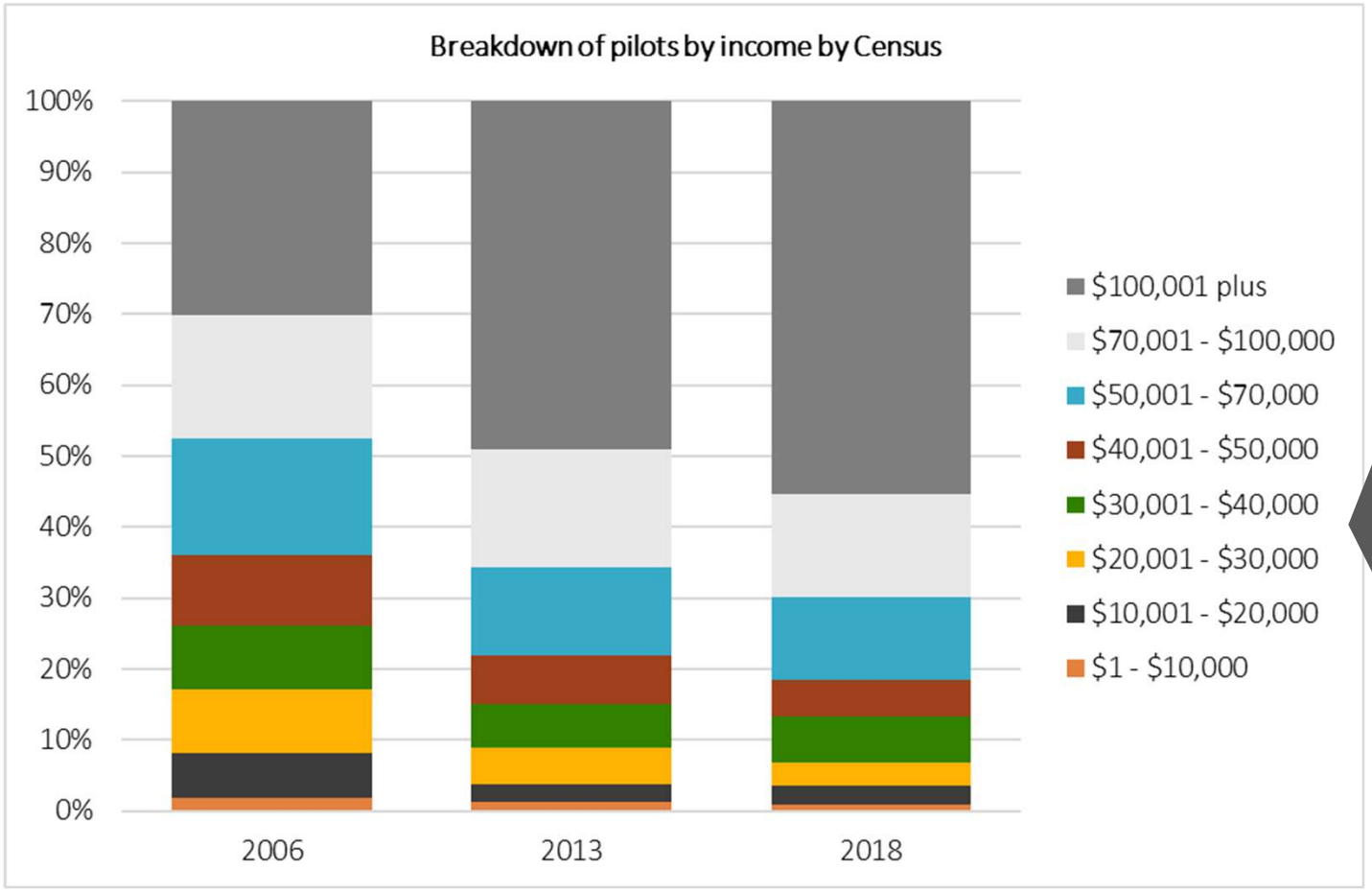
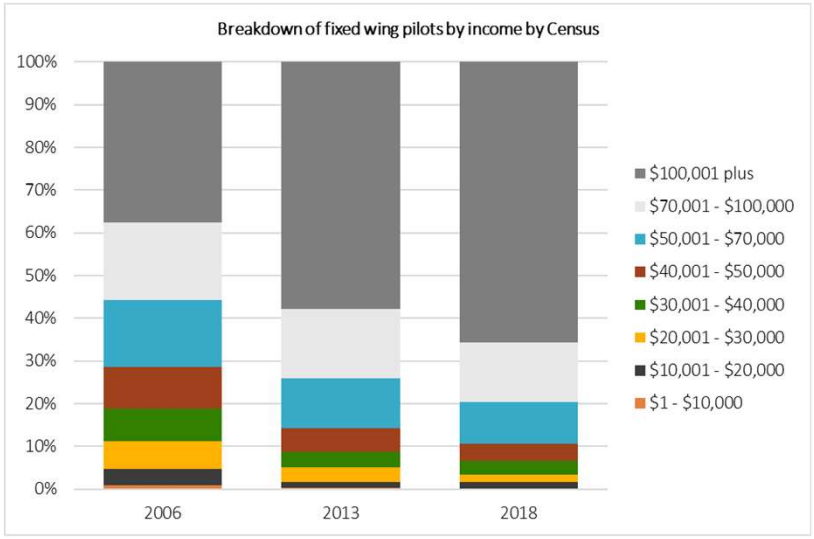
What is the composition of pilots by income? How has this changed over time?

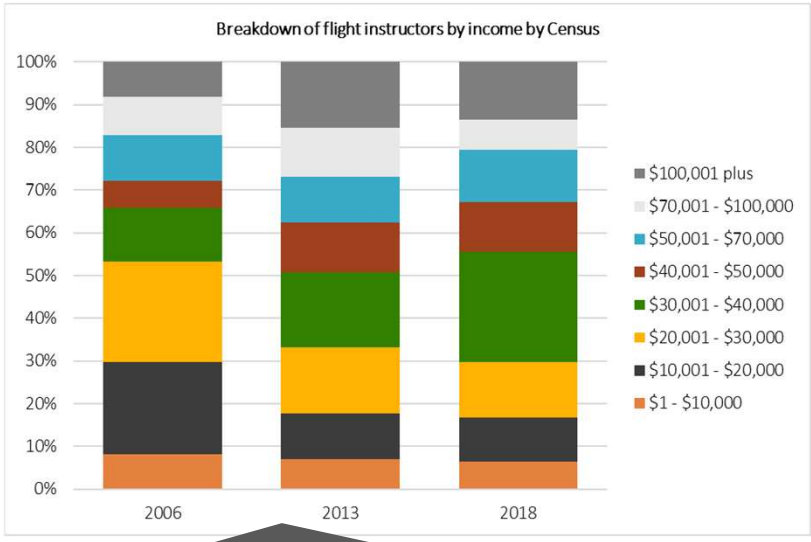


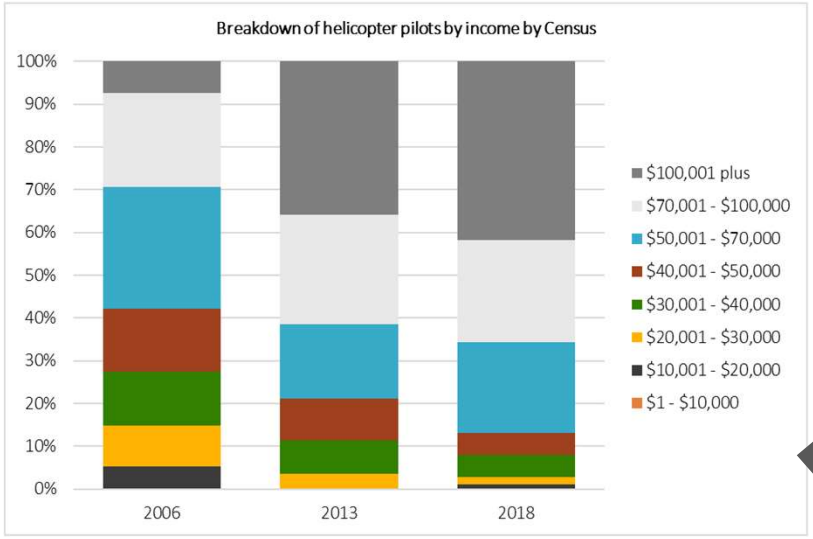
In 2018, 70% of pilots earned over $70k per year. As well as reflecting wage/salary inflation, this may reflect the increase in the number of airline pilots between 2006 and 2018, who tend to fall into higher salary categories, relative to flight instructors, who may be at the early stages of their careers (i.e., Category C flight instructors).

Pilots – Features of the pilot workforce

What is the composition of pilots by income? How has this changed over time?







As noted, the income of flight instructors is spread across the income categories, reflecting the range of career stages, with the income of Category C flight instructors being impacted by the consistency and quantity of work hours. However, there has been upward movement in their income distribution over time, with 70% earning over $30k, compared to 48% in 2006.

Fixed wing and helicopter pilots have seen similar changes in their income distributions, partly reflected by career stage.

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Opportunities for future refinement

There are several areas that the modelling could be incorporated into any future project to update this work. We do not think that they will change the conclusions of the current work, however. Refinements include:

Demand side

- Get CAA data on fleet size by time x operator type to improve the historic demand model

Supply side

- Adjust replacement rates and the number of instructors not moving to airlines despite being able to, to generate more informative time-in-role estimates

Workforce demographics

- Update data to include 2023 census data when this becomes available.

Report contents

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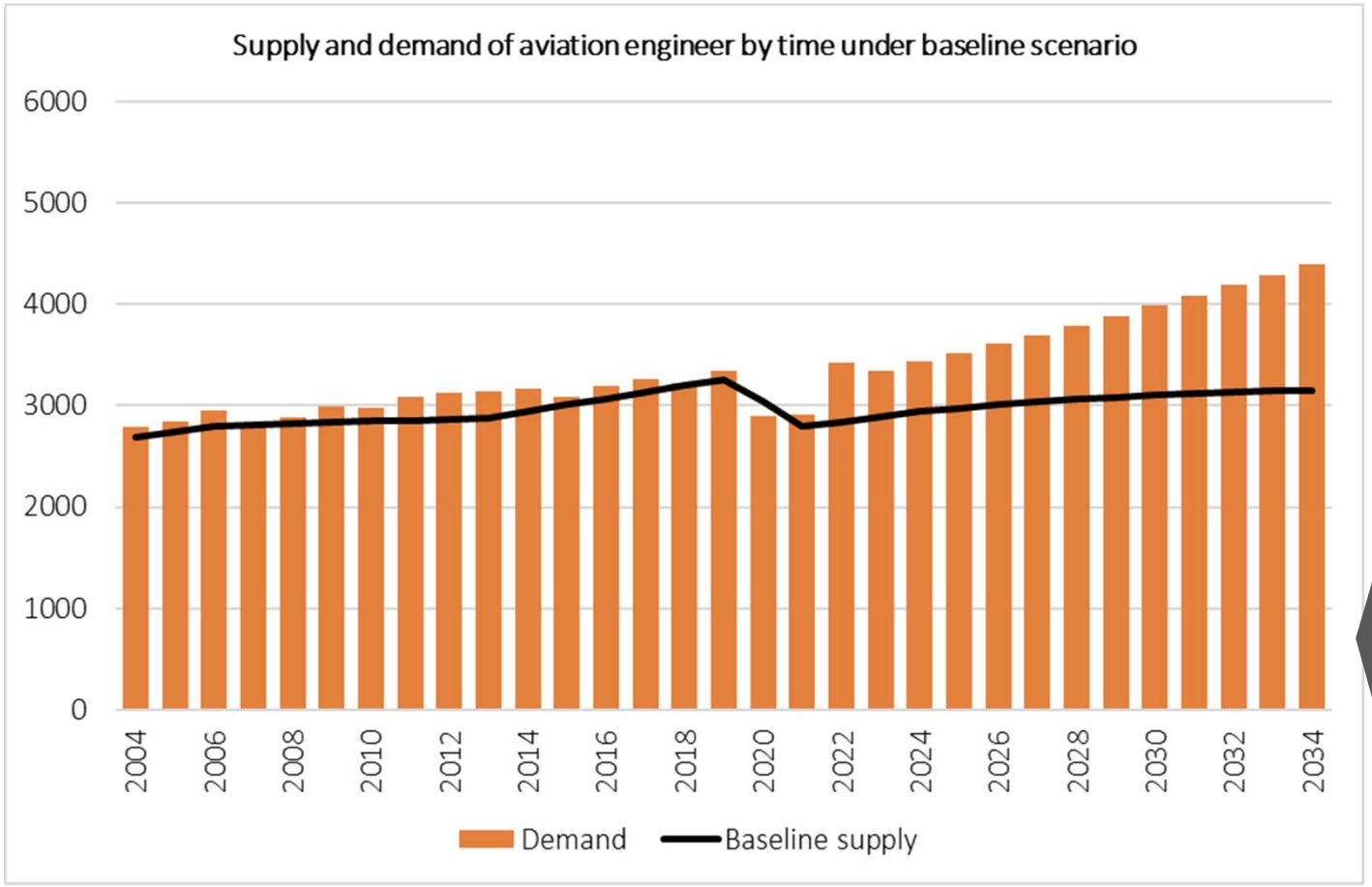
Aviation engineers – Summary of findings

How does the supply of aviation engineers compare to demand?



Demand for aviation engineers, has increased steadily since 2000, with a significant dip during COVID-19 – due to the drop in aircraft utilisation and thus lower maintenance requirements.

The COVID-19 period is also where our model simulates the emergence of the current shortage, which remains across the projection window, due to a slight decrease in the growth rate of aviation engineer supply, in contrast to a consistent increase in demand.

Currently, the model estimates a shortage of around 500 aviation engineers, with the gap between supply and demand growing by 7% on average each year.

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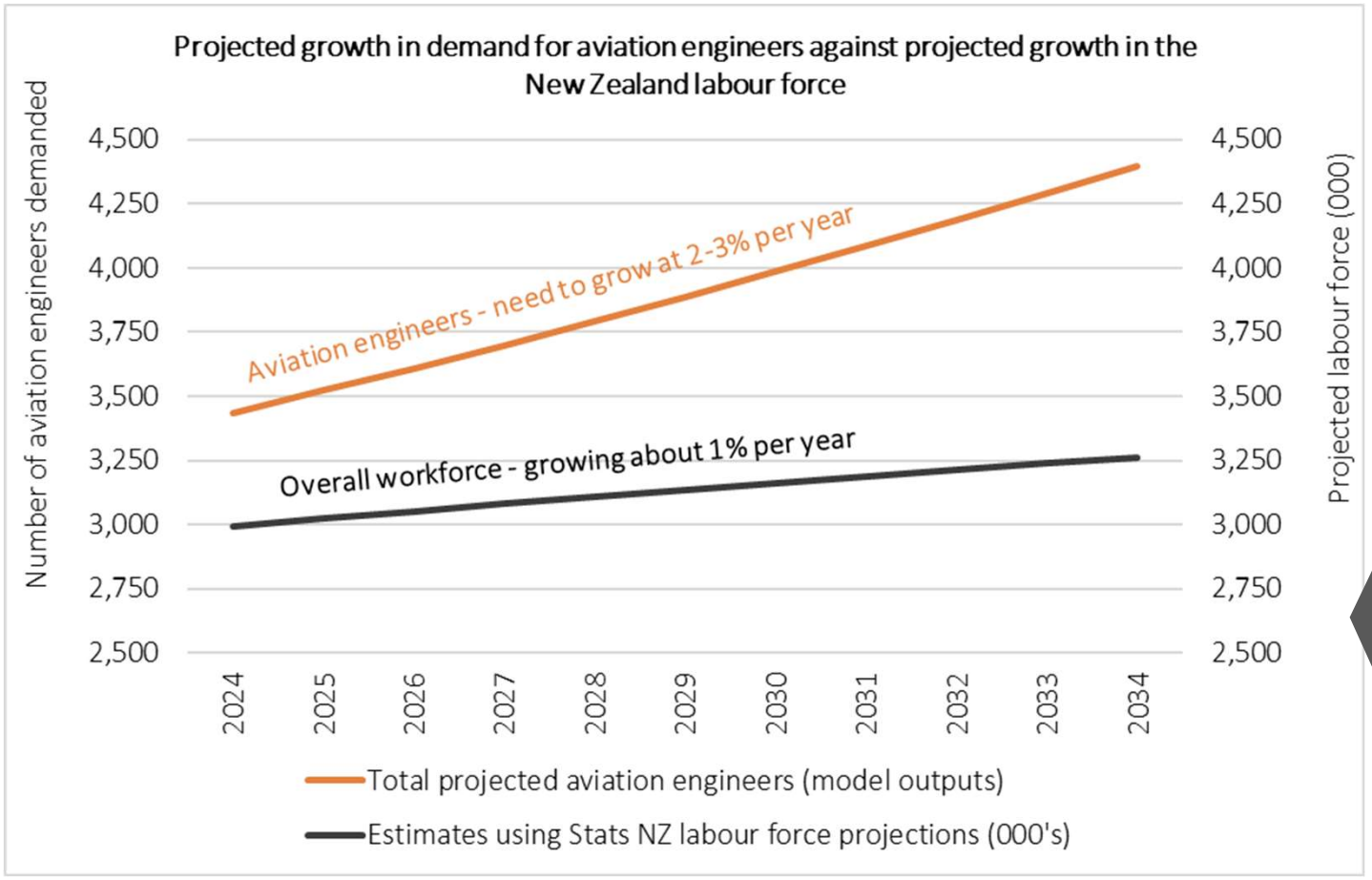
How will the demand for the aviation engineering workforce grow over time?



Demand projections indicate that, from 2024, the demand for aviation engineers will grow faster (~2-3% per year) when compared to the New Zealand labour force (~1% per year).

This suggests that it will become increasingly difficult over time to compete for new talent.

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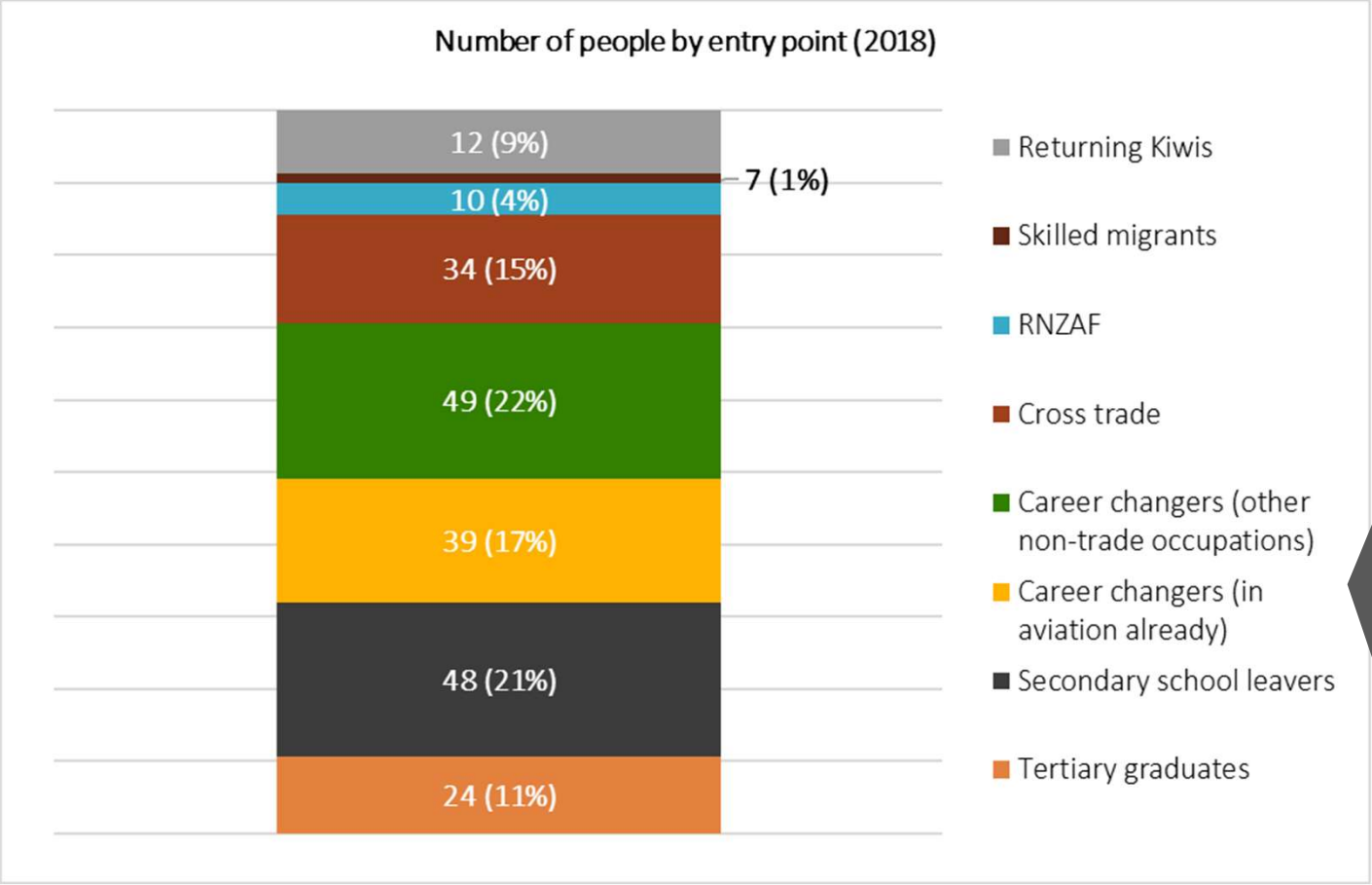
Aviation engineers – Summary of findings

Where are people entering aviation engineering from?



The workforce draws its new entrants from a diverse range of sources. This is a strength but means that an equally diverse range of approaches are likely to be needed to grow the talent supply.

Career changers are notably significant, with nearly 40% entering the field without a prior trade and an additional 15% transitioning from different trades. The education sector remains to be a key source of talent, supplying about one-third of new entrants.

There are opportunities to leverage established talent pools, while expanding others, such as skilled migrants, supported by aviation engineers being places on the Green List.

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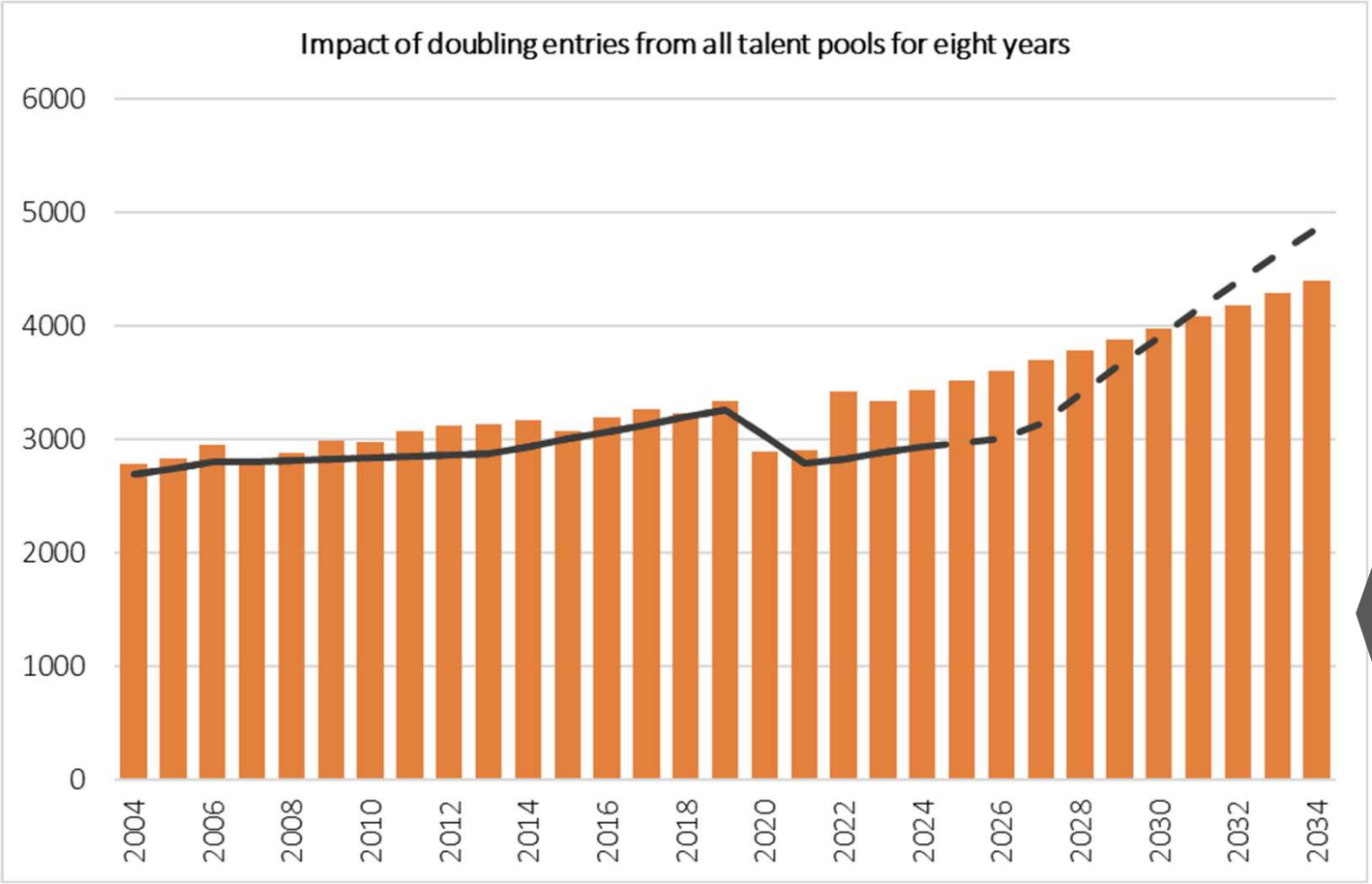
Aviation engineers – Summary of findings

What if we doubled the number of entrants from all talent pools?



This scenario simulates the impact of doubling the number of entrants from each talent pool for eight years. This equates to an additional **112** above the projected **224** entering the pipeline in 2026, and an additional **224** for the seven years following.

This may be a more relatable intervention given its dependency specific entry point(s).

Here, workforce surpluses are estimated from 2031 and continues throughout the projection window.

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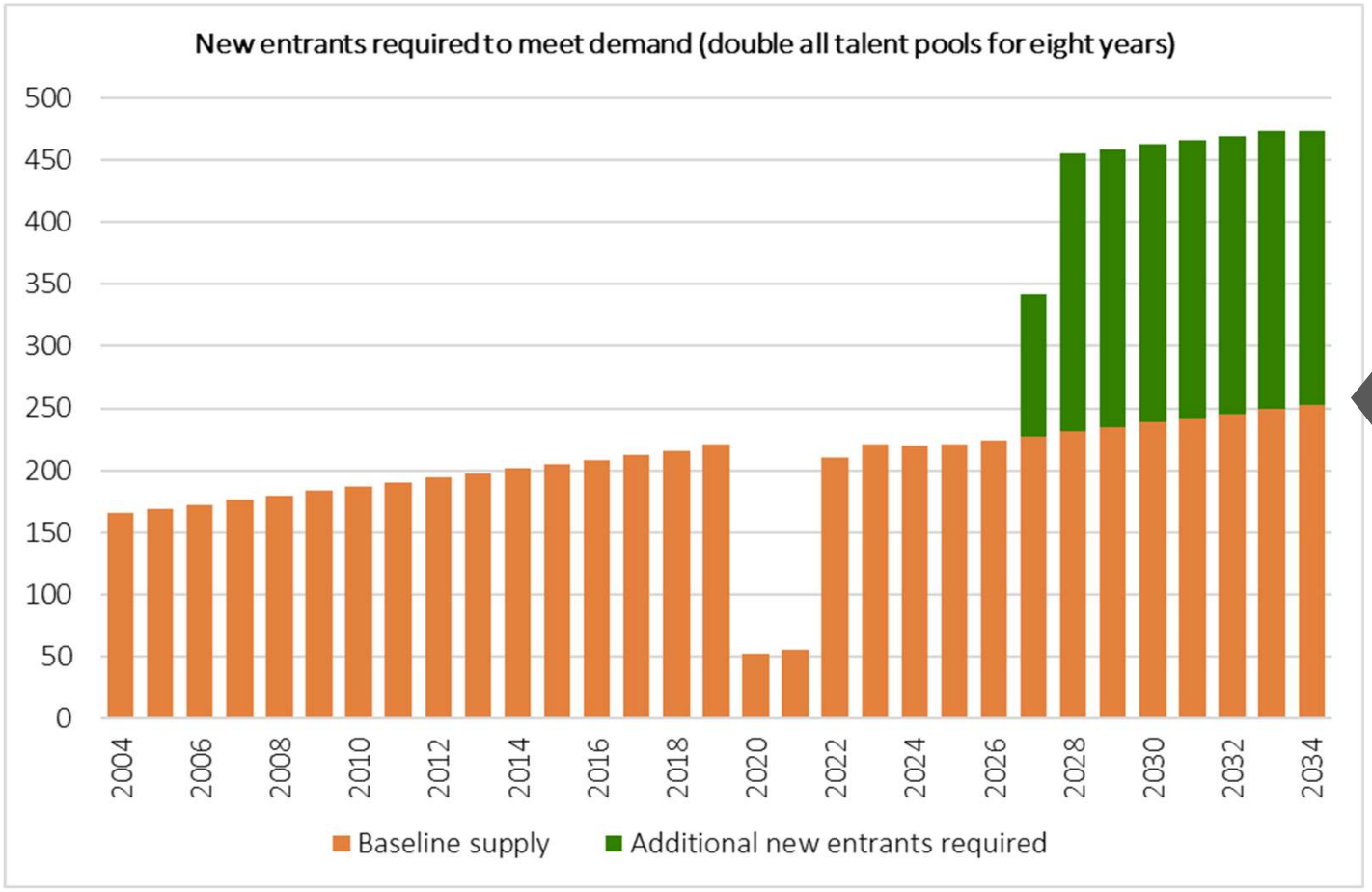
Aviation engineers – Summary of findings

New entrants required by year if we doubled the number from each talent pool



Doubling the number of entries from each talent pool would require **an additional ~110 in 2027, and ~225 from 2028, over and above baseline changes in supply.**

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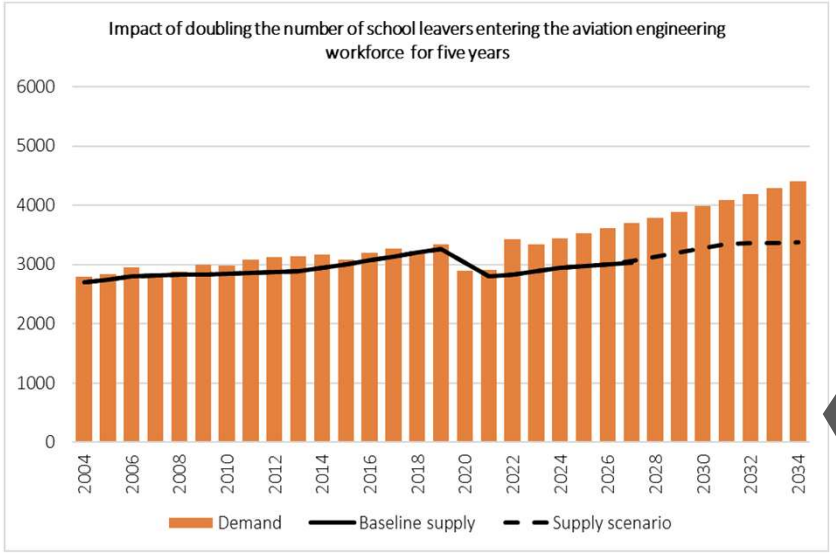
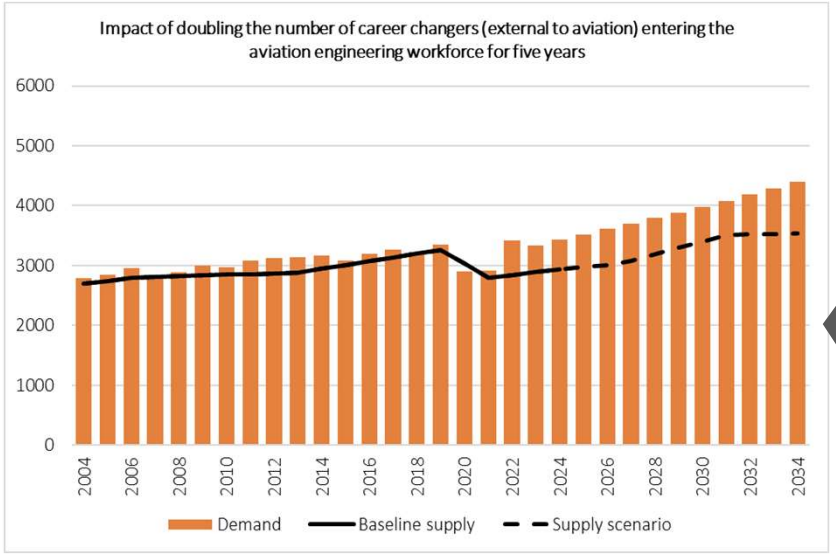
What if we doubled the number of new entrants from specific talent pools?



Doubling the number of school leavers alone will not resolve the workforce shortage. Over a five-year period, there will be a consistent reduction in the shortage, dropping just below 350 in 2031.

To resolve the shortage, approximately 200 additional leavers would be needed each year, above the projected 51 entering the pipeline in 2026, for a period of at least 7 years.



Doubling the number of career changers (external to aviation) will also not resolve the workforce shortage as a single point of intervention, unless the intervention is sustained for a minimum of 8 years.

Alternatively, an additional 260 career changers would be needed each year, above the projected 87 entering the pipeline in 2026, for a period of at least 7 years.

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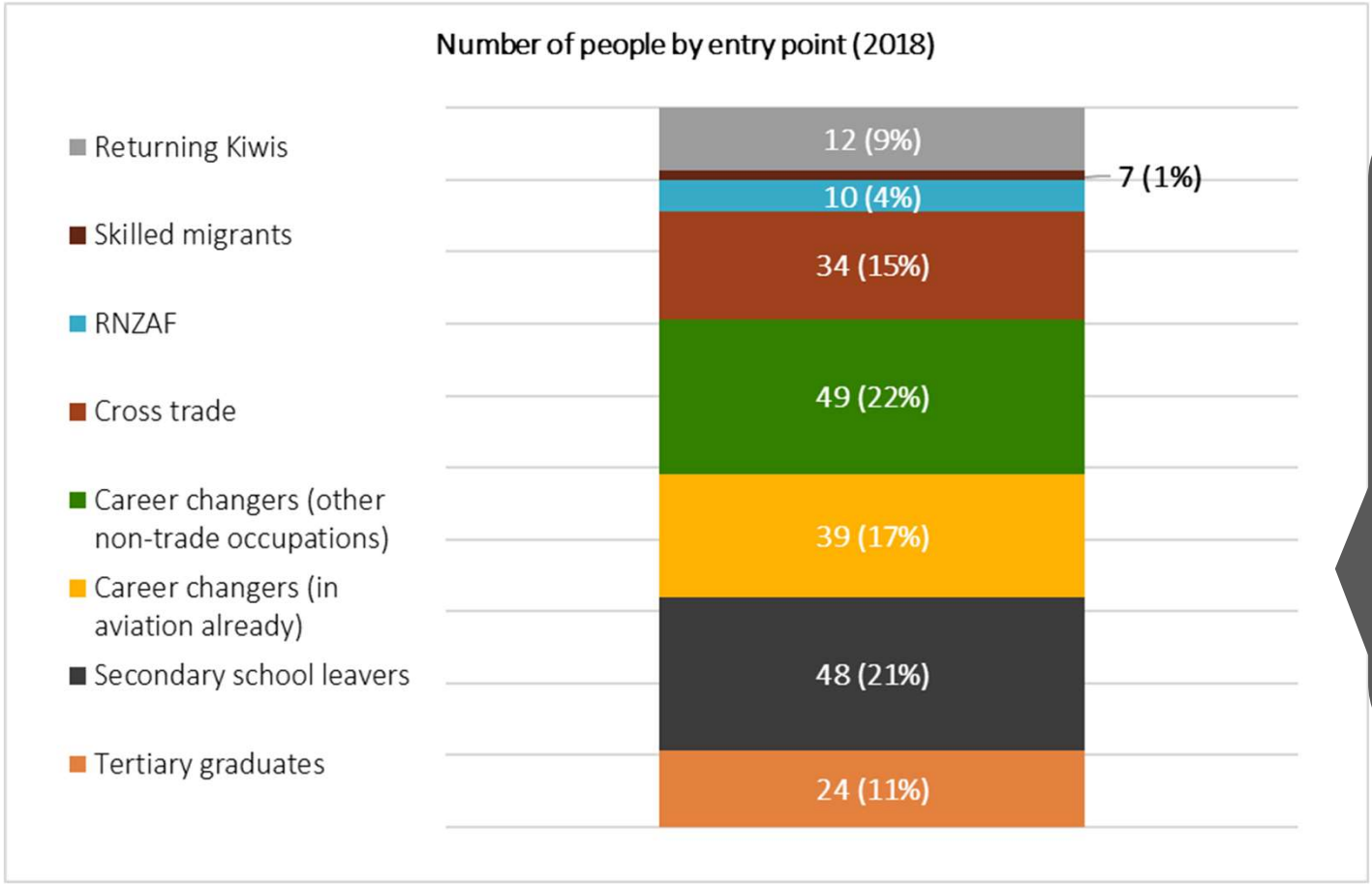
What is needed to remove the training bottlenecks?



We estimate the *current training capacity* to be in the order of 80 per year for pre-employment training, and around 100 per year for workplace-based training. This breaks down to:

- Air New Zealand – 48 places at level 3
- Nelson-Marlborough Institute of Technology – 32 places at level 3 with a *possible* expansion to 40
- ServiceIQ – Roughly 100 per year.

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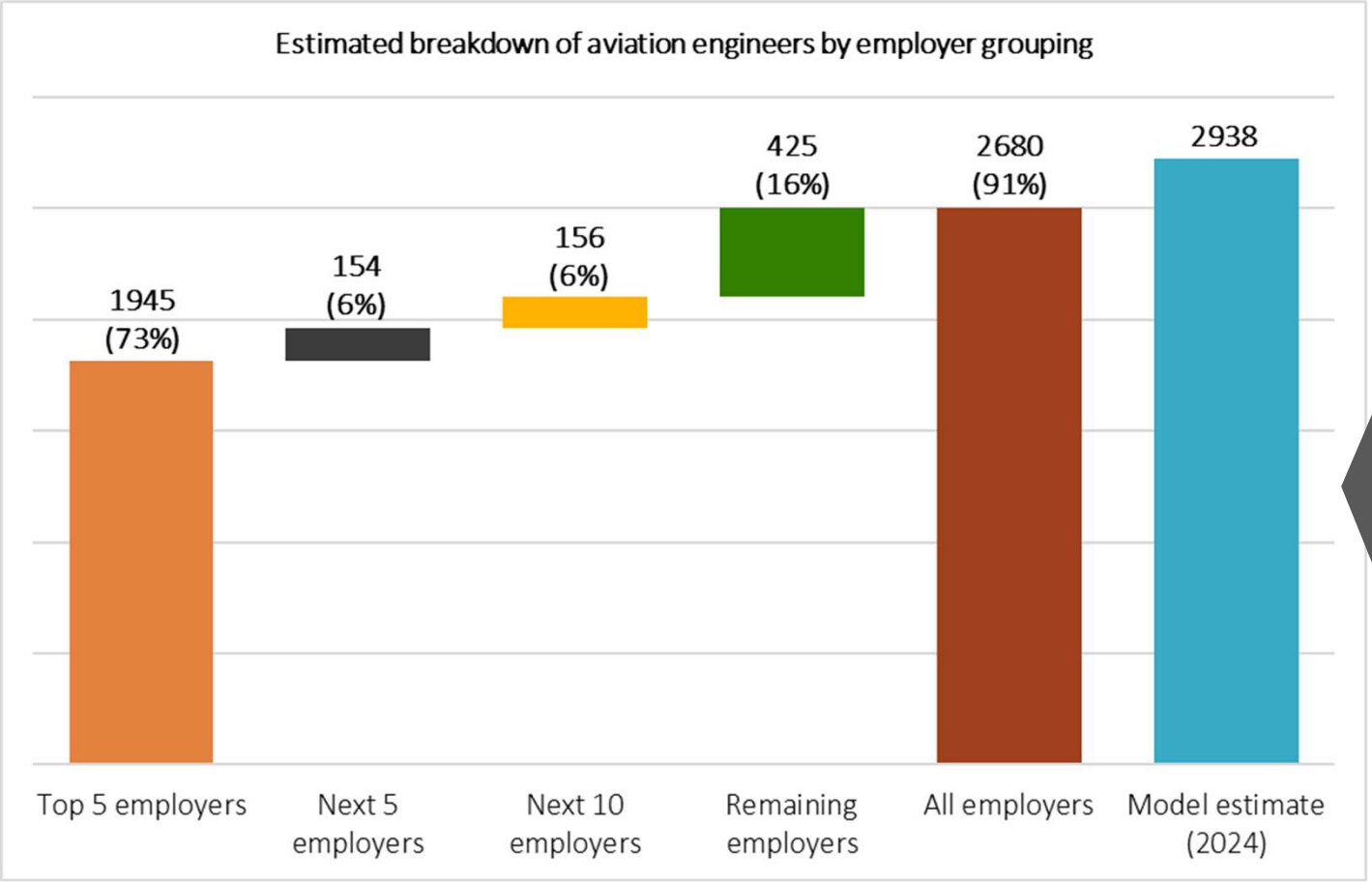
Where do aviation engineers work?



We **tentatively estimate** that approximately just over 60% of aviation engineers are employment by the top 5 employers.

This concentration of employment among a few industry leaders suggest that these firms should take a lead position to attract new entrants into aviation engineering, and advocate and invest in pathways to facilitate career progression.

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Portfolio of interventions

- **Interventions to attract a high proportion of new entrants from a specific talent pool.** To address workforce shortages, targeted interventions must attract a significant number of new entrants from specific talent pools and/or draw in larger numbers over an extended period. For example:
  - **Secondary school leavers:** To temporarily address workforce shortages, an annual addition of 100 leavers, above the 51 projected for 2026, is needed for at least 7 years.
  - **Career changers:** To resolve workforce shortages, 170 additional leavers annually, over the 86 projected for 2026, are required for at least 5 years.
- **Interventions to retain the existing workforce:** Reducing exits by 50%, from its projected 2026 level, would resolve workforce shortages by 2036. Additional interventions are required to address shortages more swiftly.
- **Attract a diverse range of new entrants from a mixture of talent pools and retain the existing workforce.** A more realistic opportunity is to attract workers from a diverse range of talent pools while aiming to improve the retention of the existing aviation engineers. The scenario suggests that by…
  - Reducing annual exits by 20%
  - Bringing in an additional 50 aviation engineers from 2025 for 5 years to reduce short term shortages
  - Increase the entry from all talent pools by 50% each year, above their projected 2026 levels

… workforce shortages are resolved over the remaining projection window (up to 2040).

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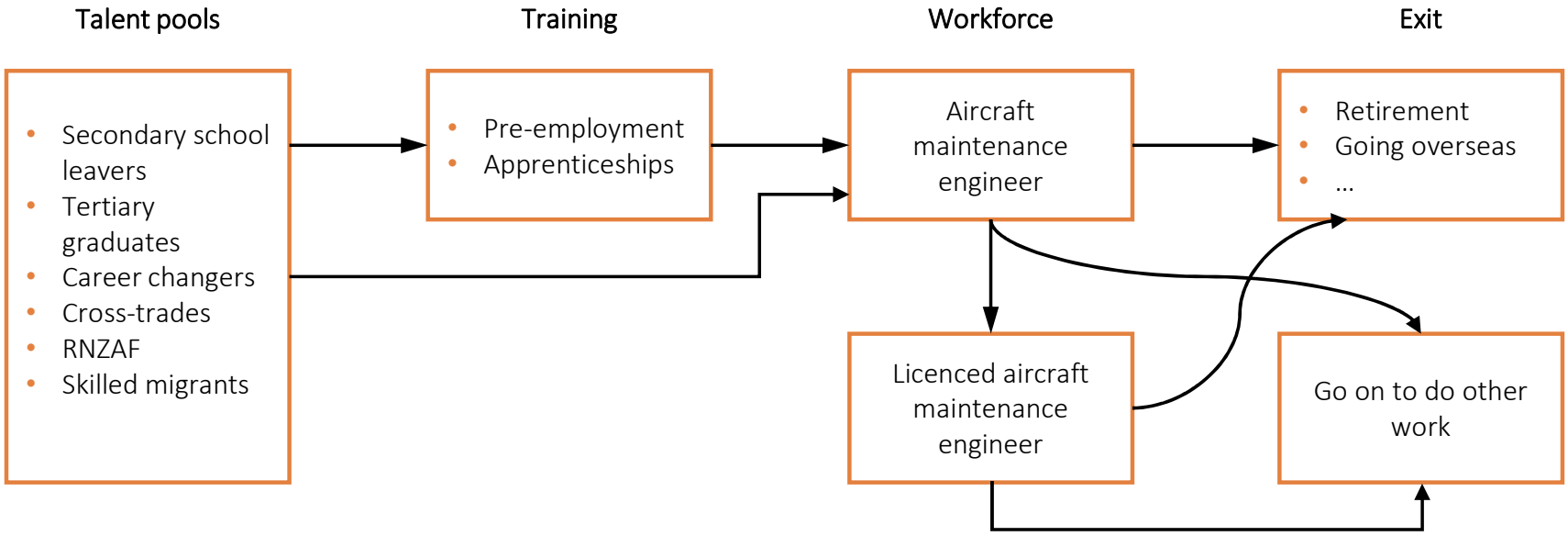
Stocks and flows

This section details the modelling approach used to analyse the dynamics within the aviation engineering workforce. By adopting a **stocks and flows** approach, the model tracks the progression of individuals through various stages of their careers. **"Stocks"** represent the aggregate number of individuals at specific stages (or pools), whereas **"flows"** describe the movement of workers into, through and out of these stages, capturing new entries, career advancements, and exits from the workforce. **See below** for a high-level representation of the stocks and flows model for aviation engineers.



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Model logic

Each year the model updates the workforce by:

Add new entrants as engineers to the AME role from various talent pools based on predefined inflow volumes.

Subtracting exits including AMEs and LAMEs that leave the workforce. These are removed from the stock reflecting workforce attrition.

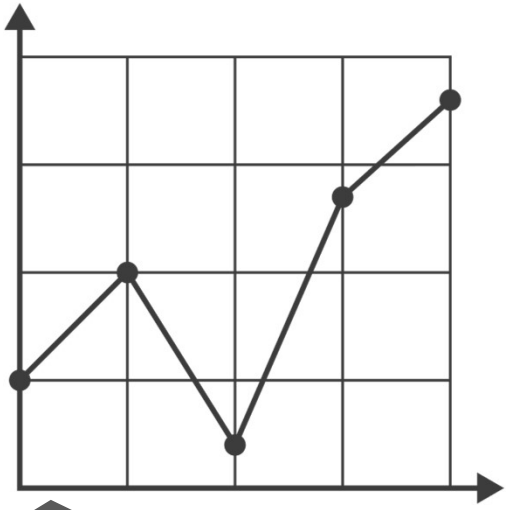
Progress to licensed. A portion of AMEs progress each year to become LAMEs. They are added to the LAME stock and removed from the AME stock.

Engineers returning from overseas are added back in to AMEs/LAMEs to reflect their progression whilst working abroad.

Baseline and scenarios

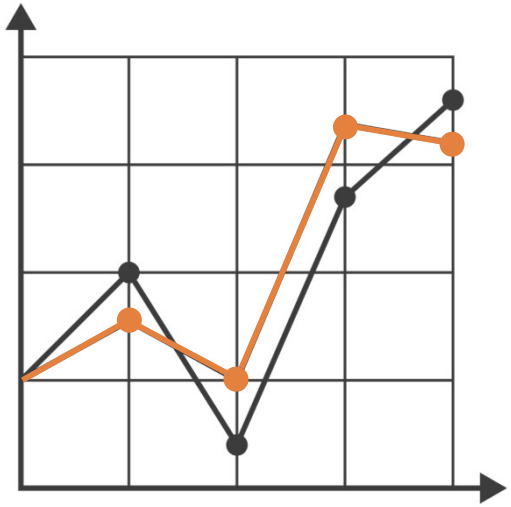
The model estimates the workforce under several scenarios, including:

Baseline



The baseline scenario shows the model's projections under standard conditions, without any other interventions. It reflects expected trends and transitions in the workforce, serving as a reference point for comparing the impact of different interventions.

Interventions



These scenarios allow for the exploration of different interventions and their effects on the workforce. Starting from 2024 users can specify the:

- Start year and duration of the intervention
- Effectiveness by adjusting the size of the impact.

The model will reflect these changes in the workforce composition and help evaluate the impact different intervention strategies will have on the workforce.

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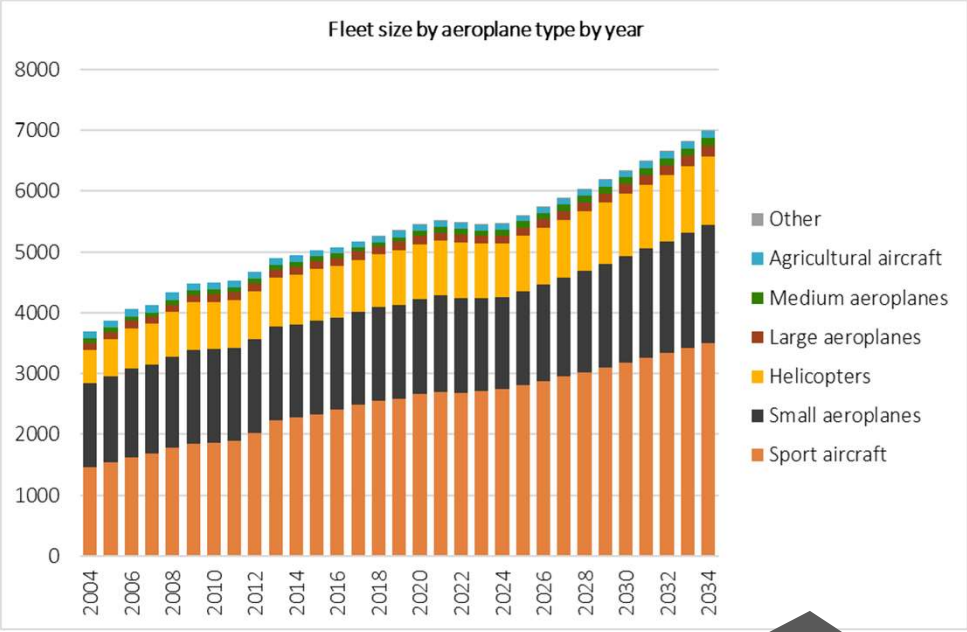
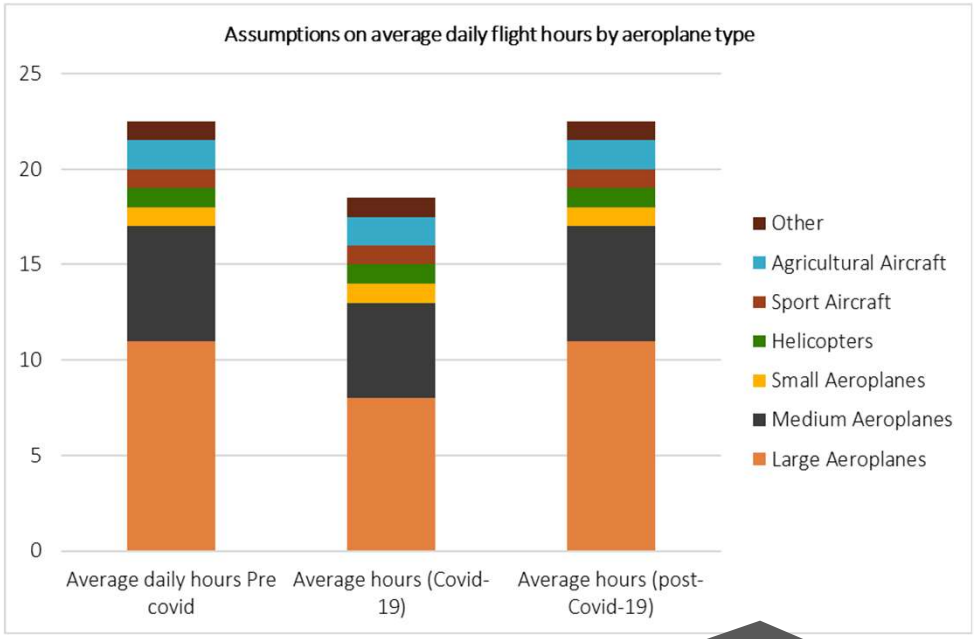
Aviation engineers – Overview of input data

Fleet size by year by aircraft type by year



Fleet size from 2024 are estimates, calculated using an average annual growth rate of 2.5%.



Average daily flight hours were used in combination with fleet size to calculate total engineering hours required.

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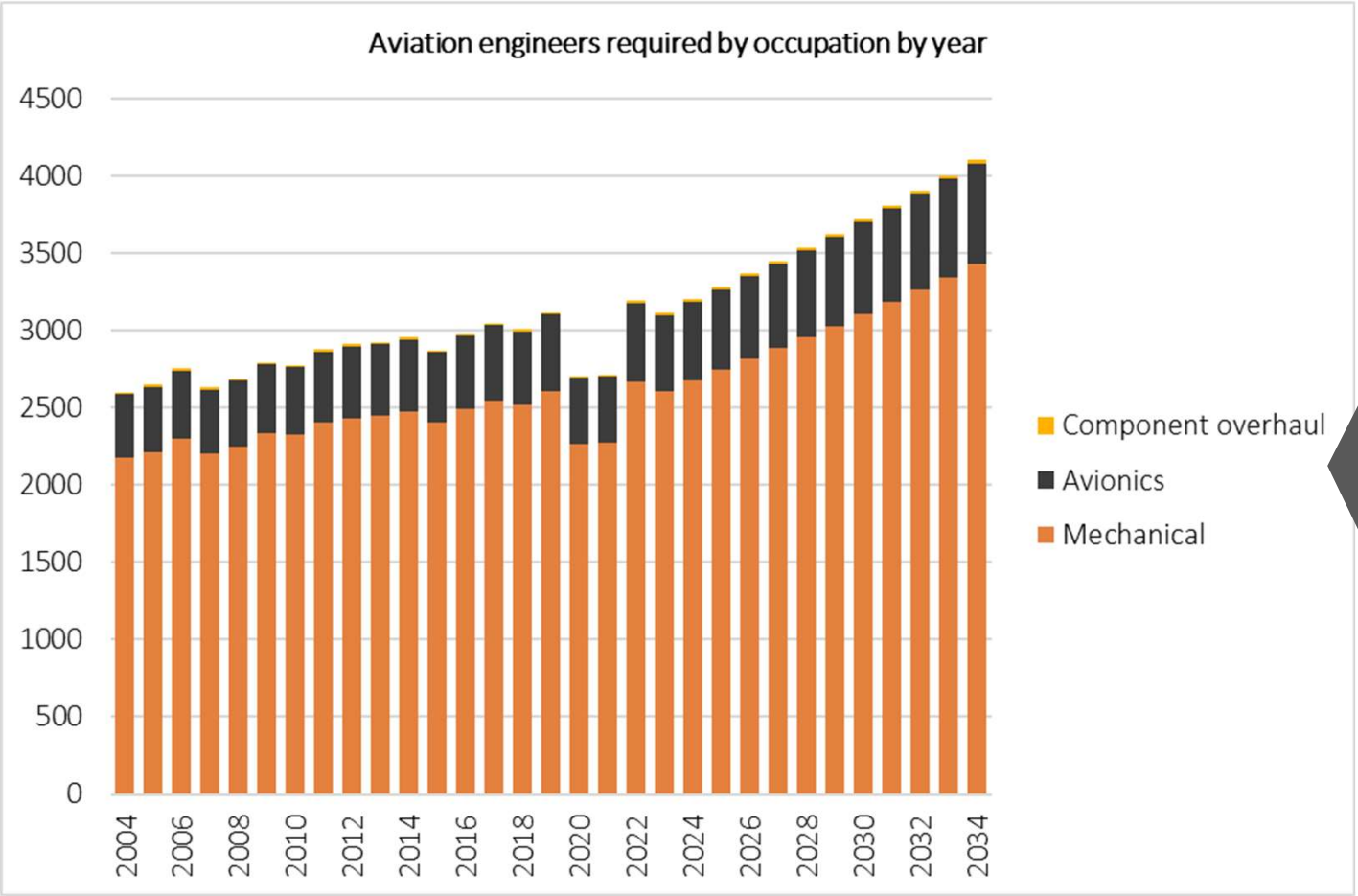
Total demand



By combining fleet size and average daily flight hours data, we calculated the total required engineering hours.

This was then used to estimate the number of full-time aviation engineers required by year, split by occupation, using the average distribution from the Census 2006, 2013 and 2018.

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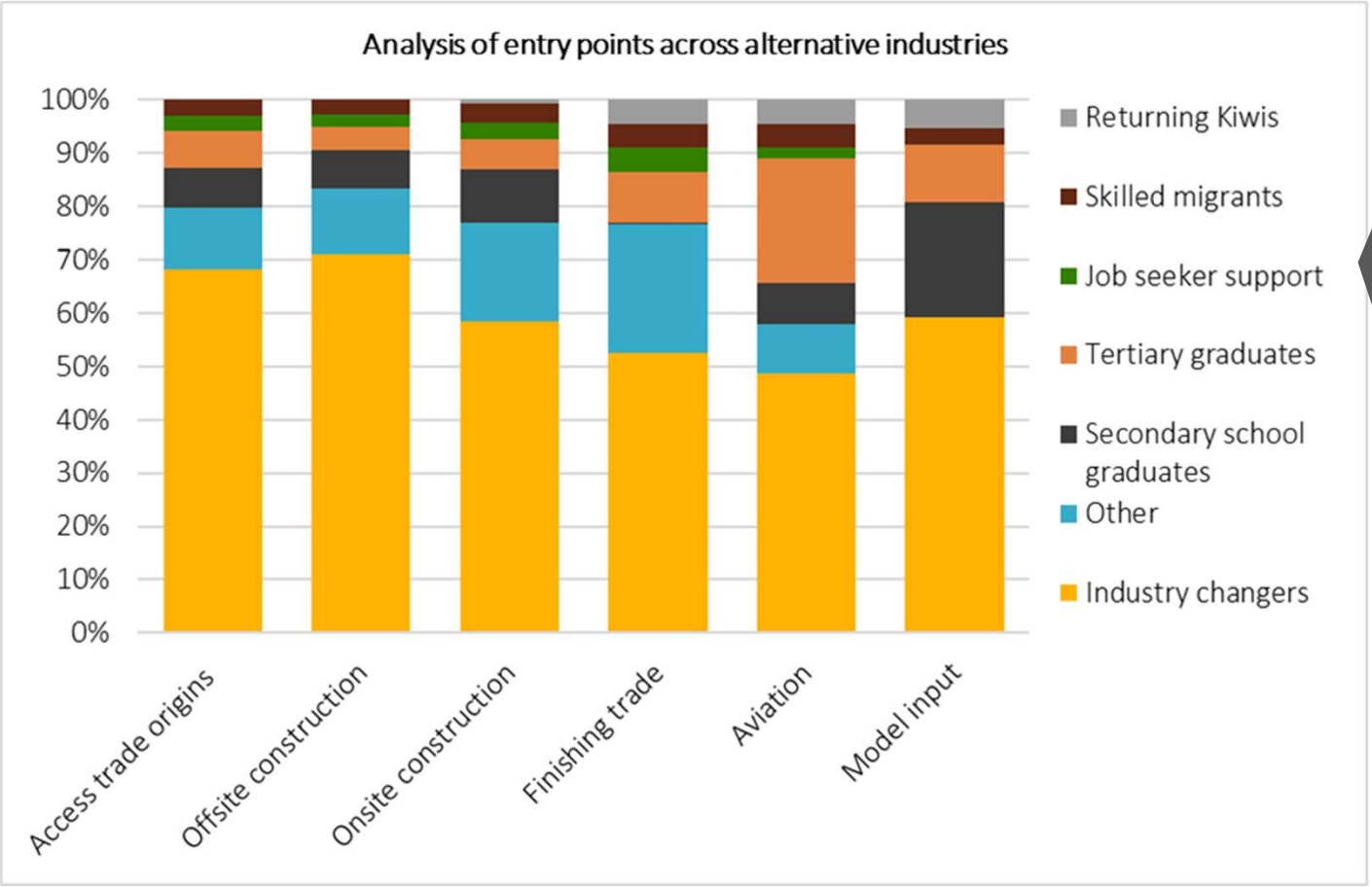
Aviation engineers – Overview of input data

Total counts of aviation engineers by Census



Calibration data indicated that 50% to 70% of new entrants were industry changers. The entry point analysis took an average of these figures, estimating that 60% of new entrants to the aviation engineering workforce are industry changers.

One noticeable difference in aviation, relative to the other industries, is the higher percentage of tertiary graduates entering the workforce. Recognising there are several training pathways to enter the aviation engineering workforce, this analysis estimated 11% of new entrants to be tertiary graduates, and 20% being secondary school leavers.

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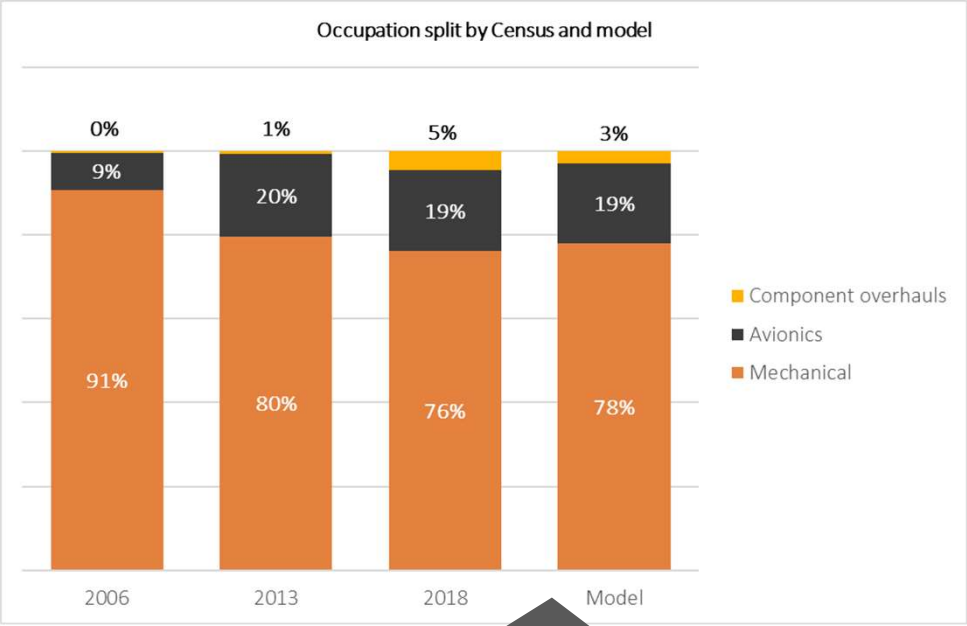
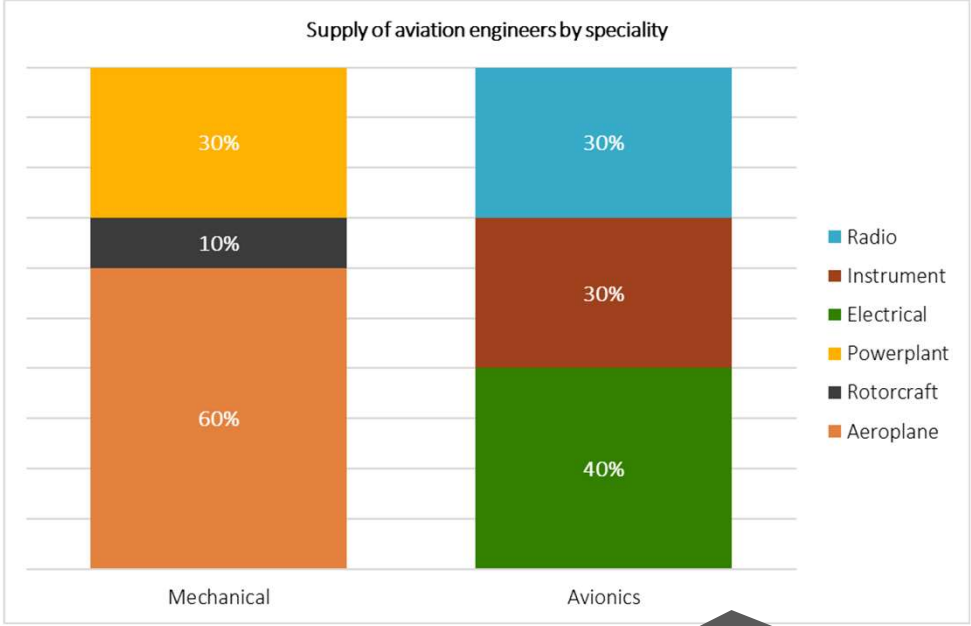
Aviation engineers – Overview of input data

Total counts of aviation engineers by Census





We utilised the splits from the Census as a key input for categorising aviation engineers by roles.

We assume there are just under 80% of aviation engineers work in mechanical maintenance, albeit although there has been a slight decline in this proportion over time.

Mechanical and avionics engineers are divided into specific sub-specialties. Within mechanical engineering, we assume that 60% focus on airplane engineering, 30% on powerplants, and 10% on rotorcraft. Within avionics engineering, the largest group consists of electrical engineers, making up 40%, while instrument engineers and radio engineers each represent 30% of the field.

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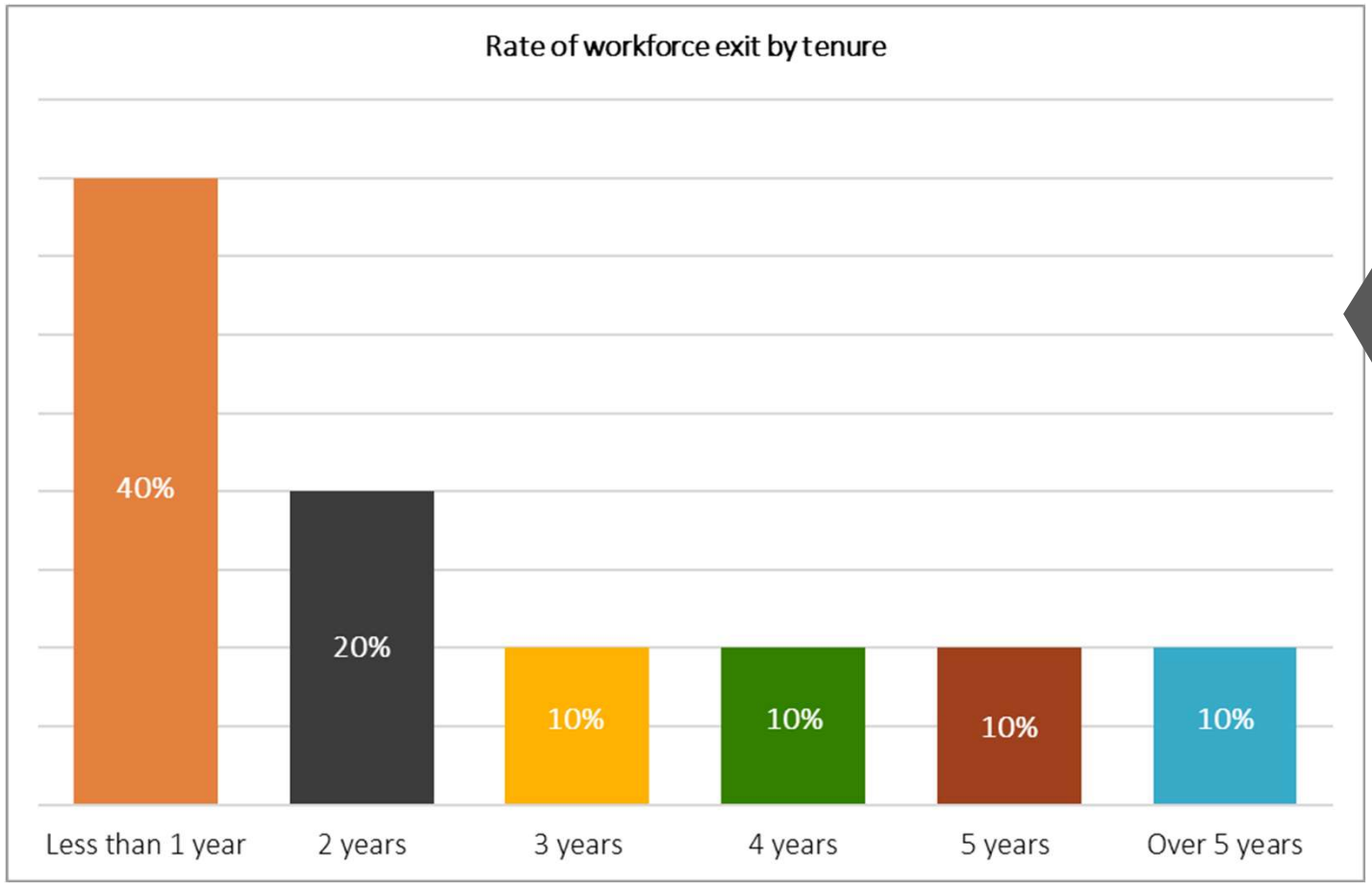
Other assumptions



We assume that the bulk of workforce exits occur within the first two years of entry into employment.

This trend is common as individuals often reassess their career choices and decide to pursue different paths.

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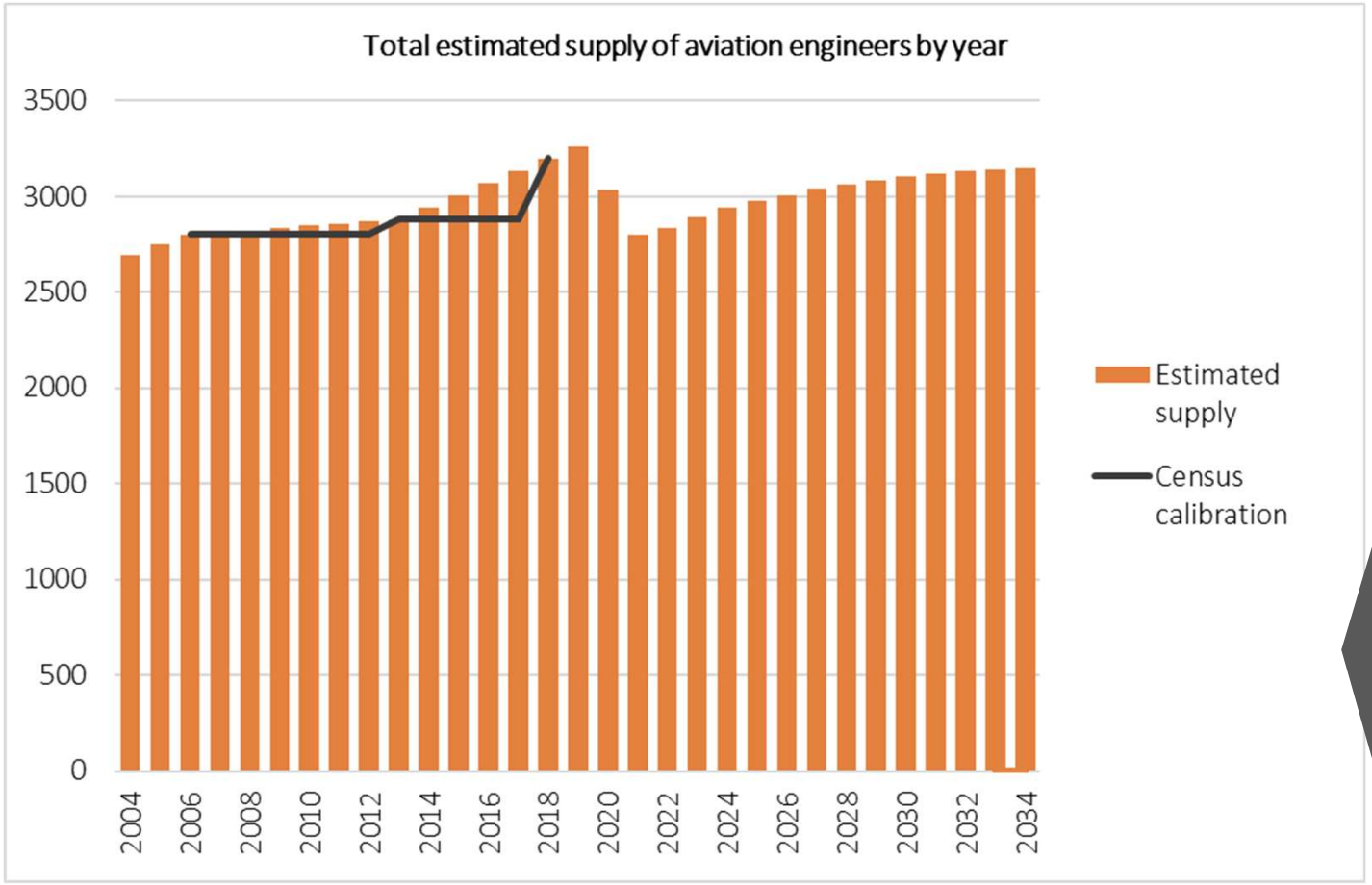
Aviation engineers – Overview of input data

Total estimated supply of aviation engineers



Occupation counts from the Census 2006, 2013 and 2018 were utilised as key data points to estimate the supply of the aviation engineering workforce.

For years in between Census, the data were imputed using linear imputation. From 2019, these data were combined with the new entrant data, along with assumptions relating to licensing and exit rates, to estimate the number of aviation engineers required up to 2034.

Other assumptions:

- We assume there is an annual growth of approximately 4 additional new entrants per year.
- Exits are growing with 7 additional each year.

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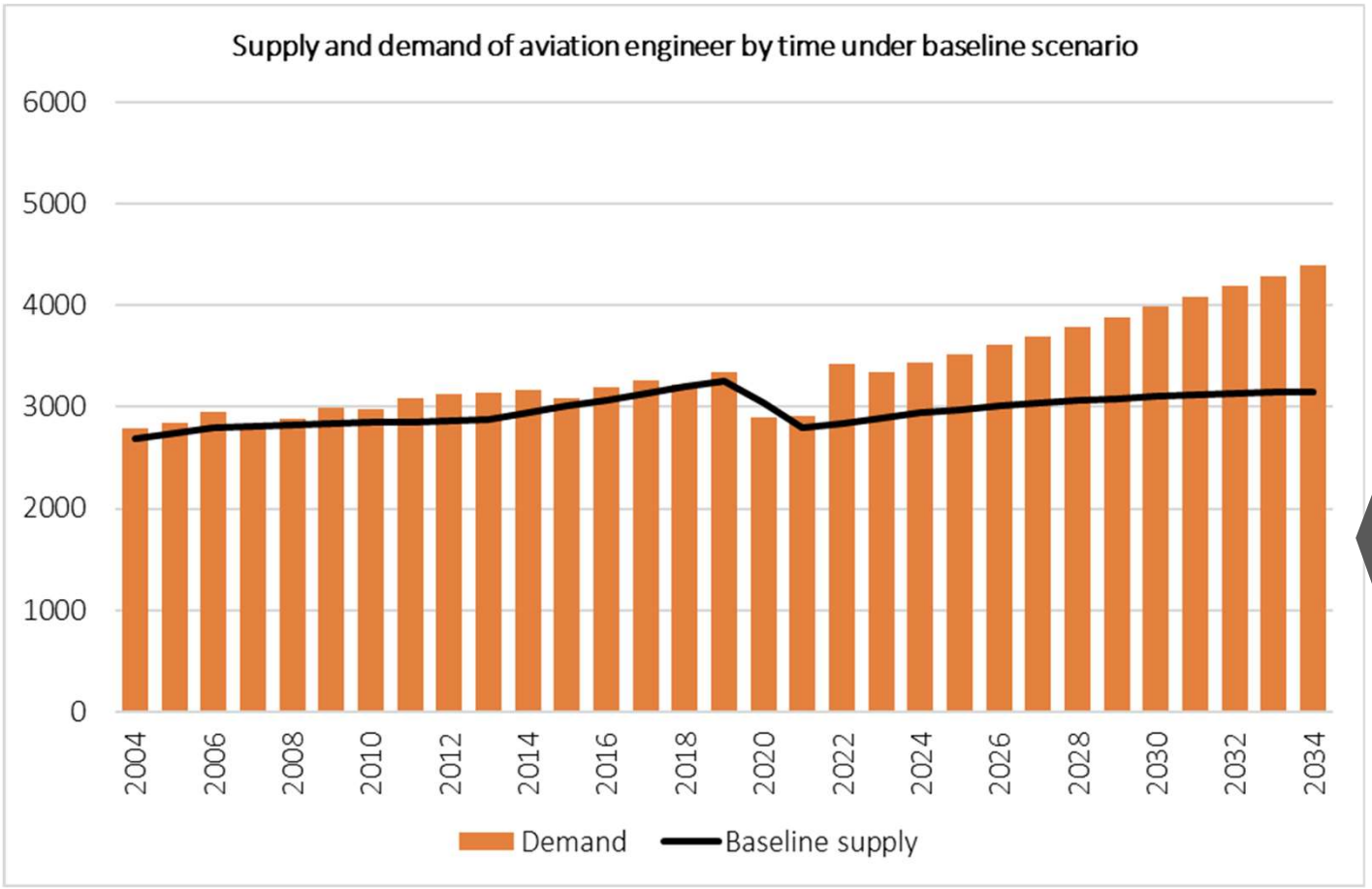
How does supply of aviation engineers compare to demand?



Demand for aviation engineers, has increased steadily since 2000, with a significant dip during COVID-19 – due to the drop in aircraft utilisation and this lower maintenance requirements.

The COVID-19 period is also where our model simulates the emergence of the current shortage, which remains across the projection window, due to a slight decrease in the growth rate of aviation engineer supply, in contrast to a consistent increase in demand.

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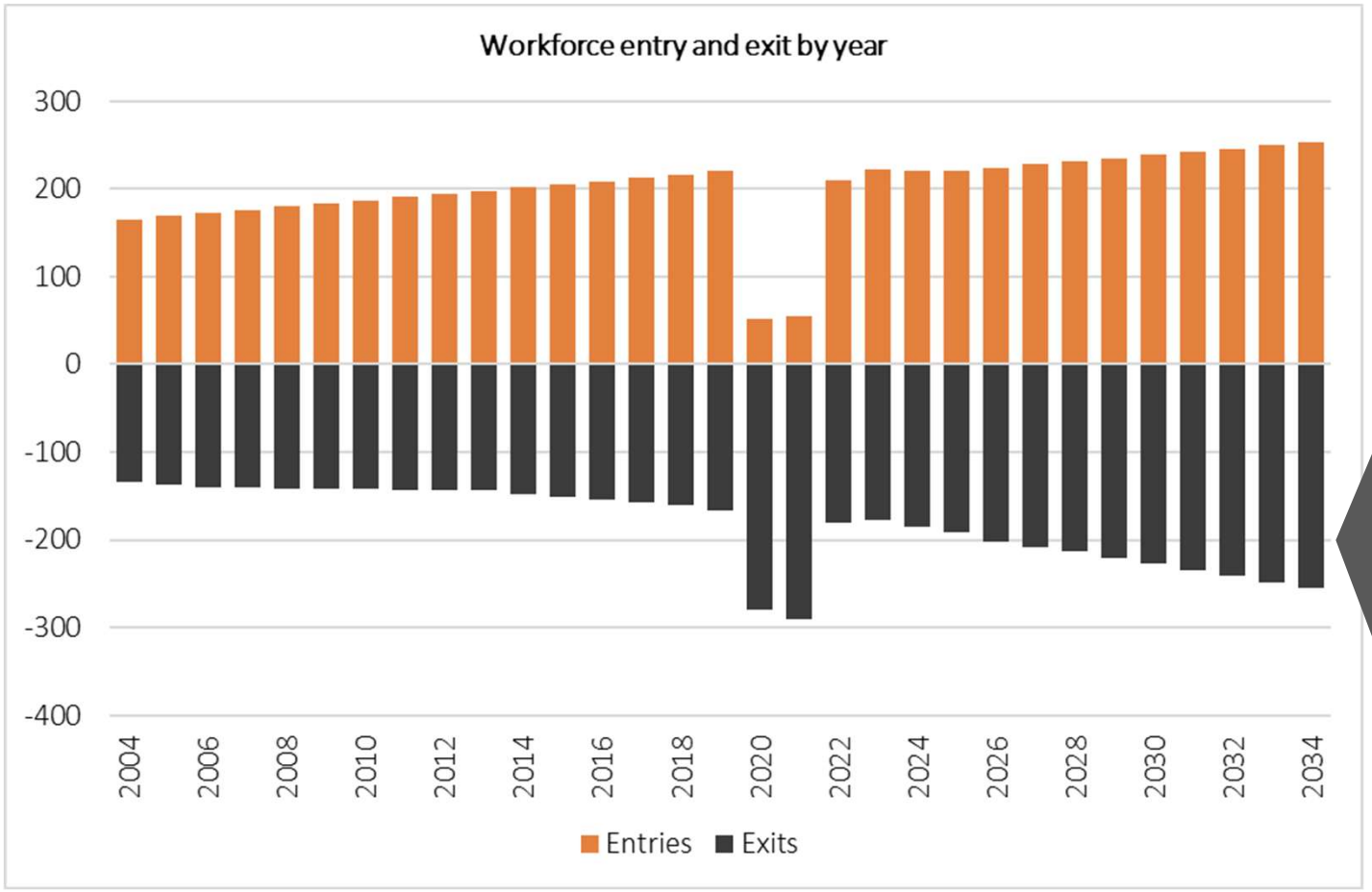
Aviation engineers – Model findings – baseline scenario

What are the inflows and outflows from the aviation engineering workforce?



Before COVID-19, aviation engineering workforce entries grew by an average of 2% annually, outpacing exits. The pandemic caused a temporary shift with exits exceeding entries.

There's a clear indication of the COVID-19 'blip' where entries were dominated by exits.

Since 2024, workforce entries are projected to grow at 1.4% per year on average, with exits slightly higher at 3% per year on average, leading to a sustained shortage without intervention.

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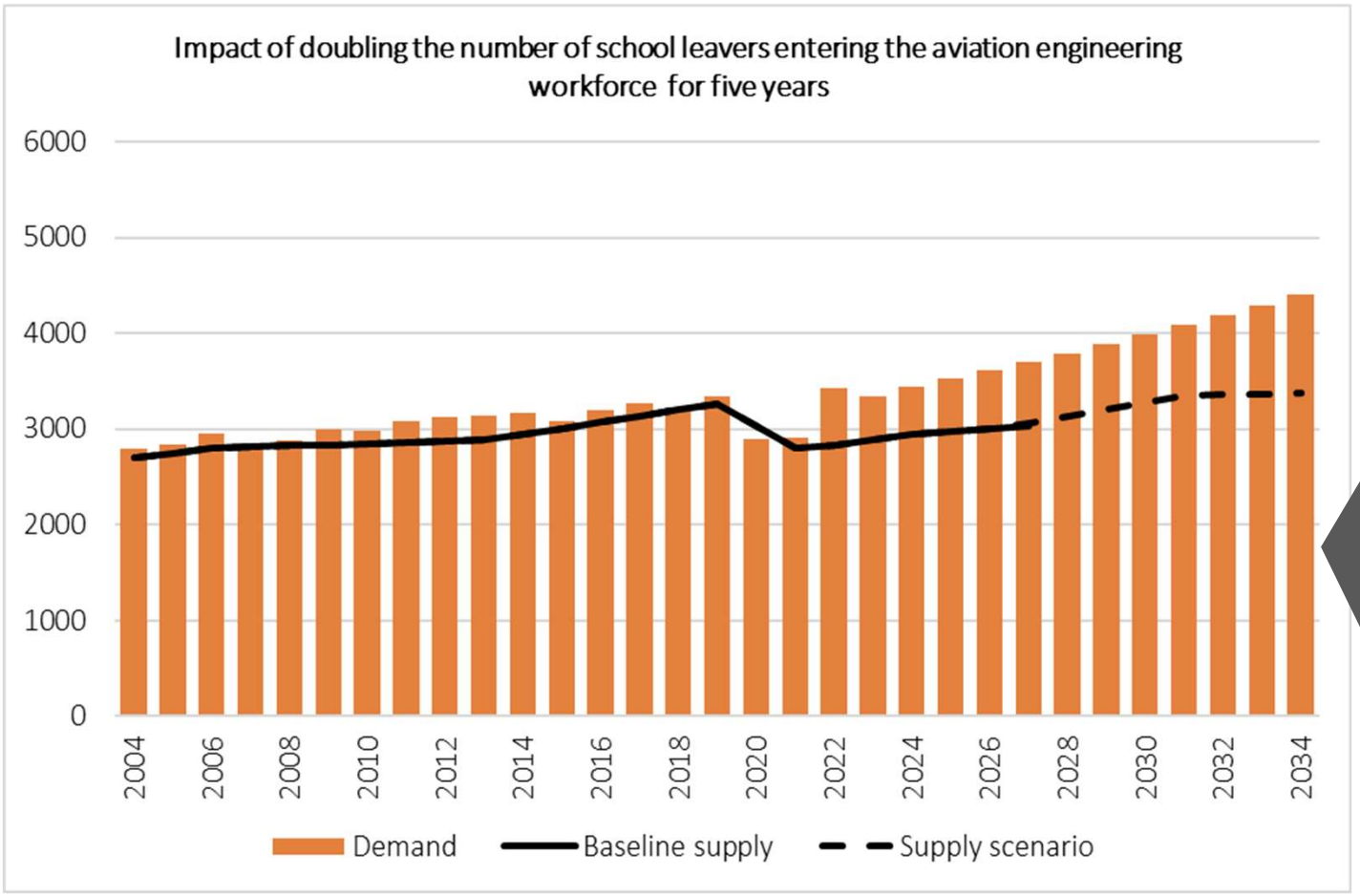
What if we doubled the number of school leavers?



Doubling the number of school leavers alone will not resolve the workforce shortage. Over a five-year period, there will be a consistent reduction in the shortage, dropping just below 350 in 2031.

To resolve the shortage, approximately 100 additional leavers would be needed each year, above the projected 51 entering the pipeline in 2026, for a period of at least 7 years.

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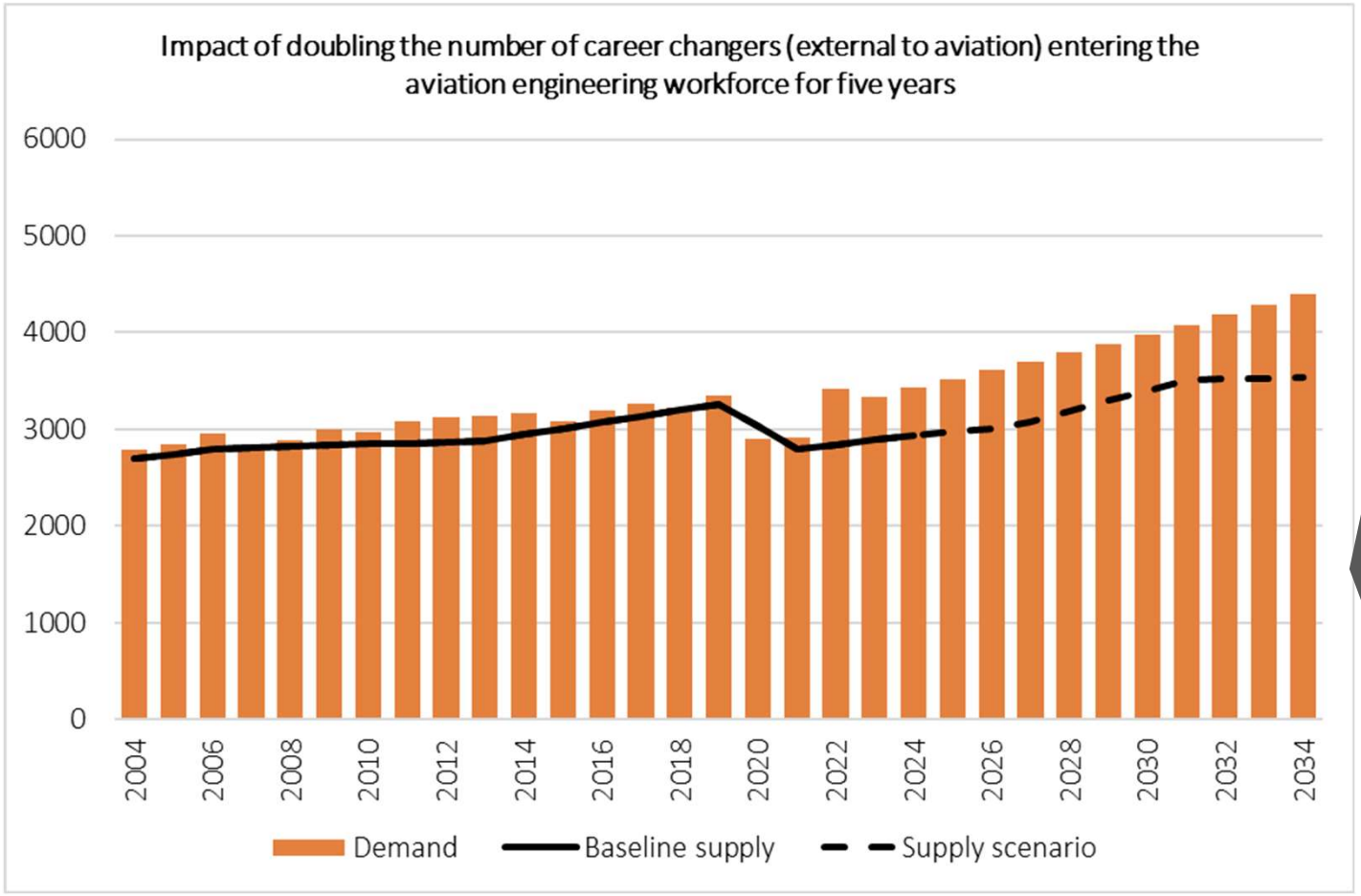
What if we doubled the number of career changers?



Doubling the number of career changers (external to aviation) will also not resolve the workforce shortage as a single point of intervention.

Alternatively, an additional 170 leavers would be needed each year, above the projected 86 entering the pipeline in 2026, for a period of at least 5 years.

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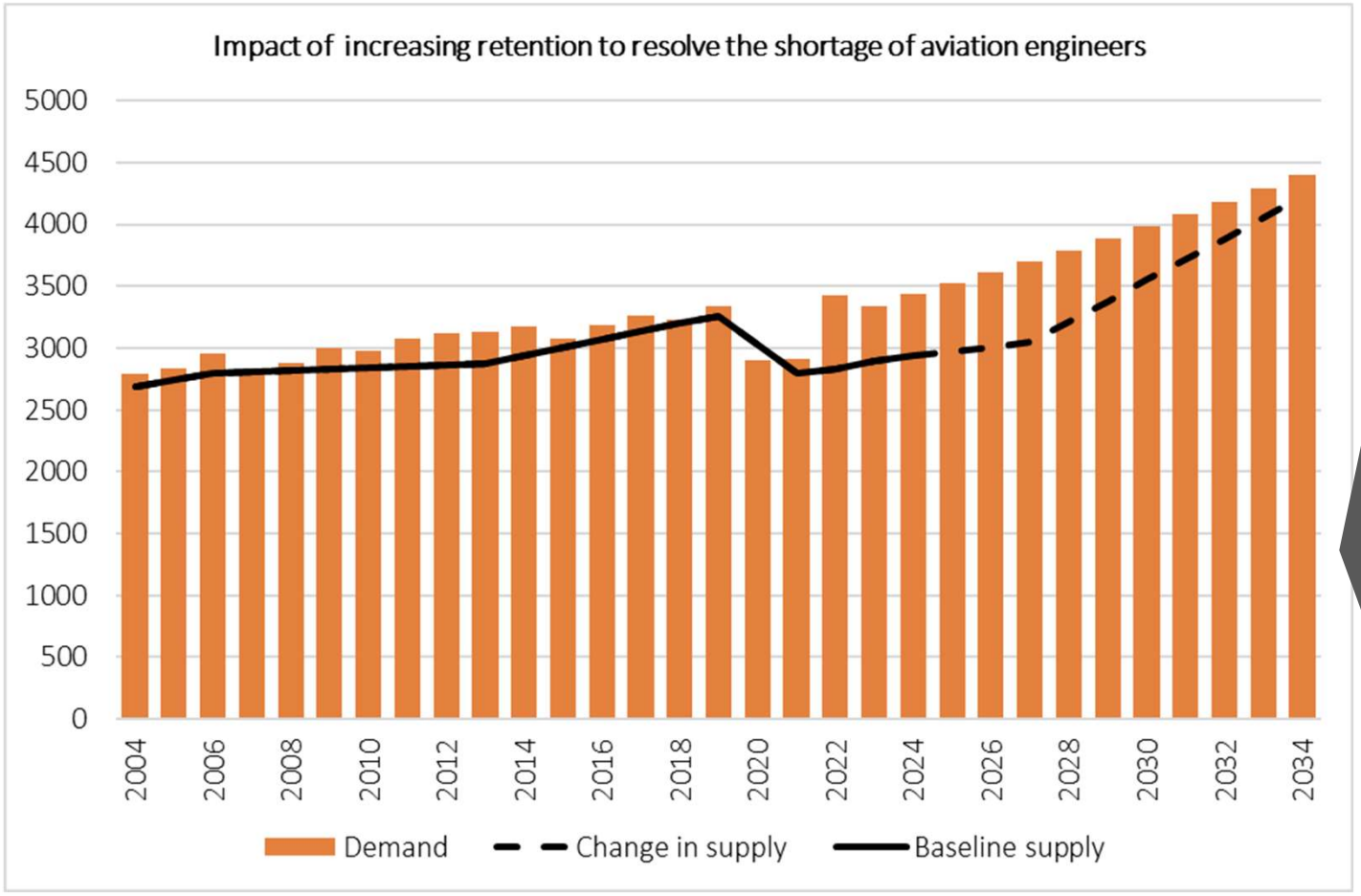
Decreasing the number of exits of aviation engineers 50% for 14 years?



This scenario reduces exits of aviation engineers by 50% for 14 years from 2026. Increasing the retention rate by reducing exits alone may not suffice to address the shortage promptly. Projections indicate that with this approach, it will take until 2036 to surpass the projected line. To resolve the issue more swiftly, an additional intervention is likely needed

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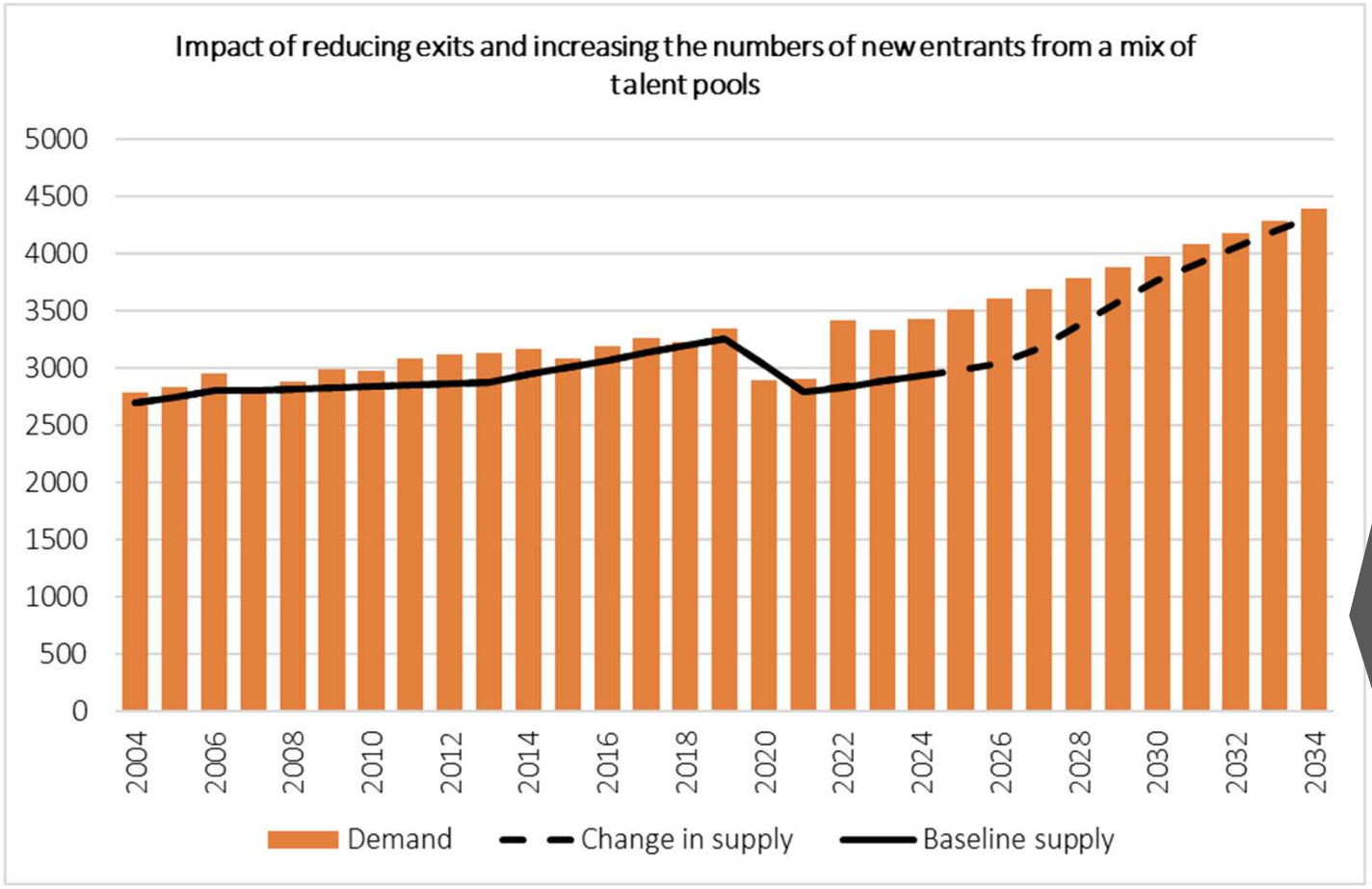
Aviation engineers – Model findings - interventions

What if we reduced exits and increased new entrants from a mix of talent pools by 50%?



This scenario reflected a more realistic opportunity whereby a combination of interventions are implemented concurrently.

This scenario models the impact of:

- Reducing annual exits by 20%
- Bringing in an additional 50 aviation engineers in from 2025 for 5 years
- Increase the entry from all talent pools by 50% each year, above their projected 2026 levels.

Although workforce shortages are only resolved by 2034, short-term pressures are reduced by relying on skilled migrants. This also allows interventions to be developed in implemented to build longer term domestic workforce capacity.

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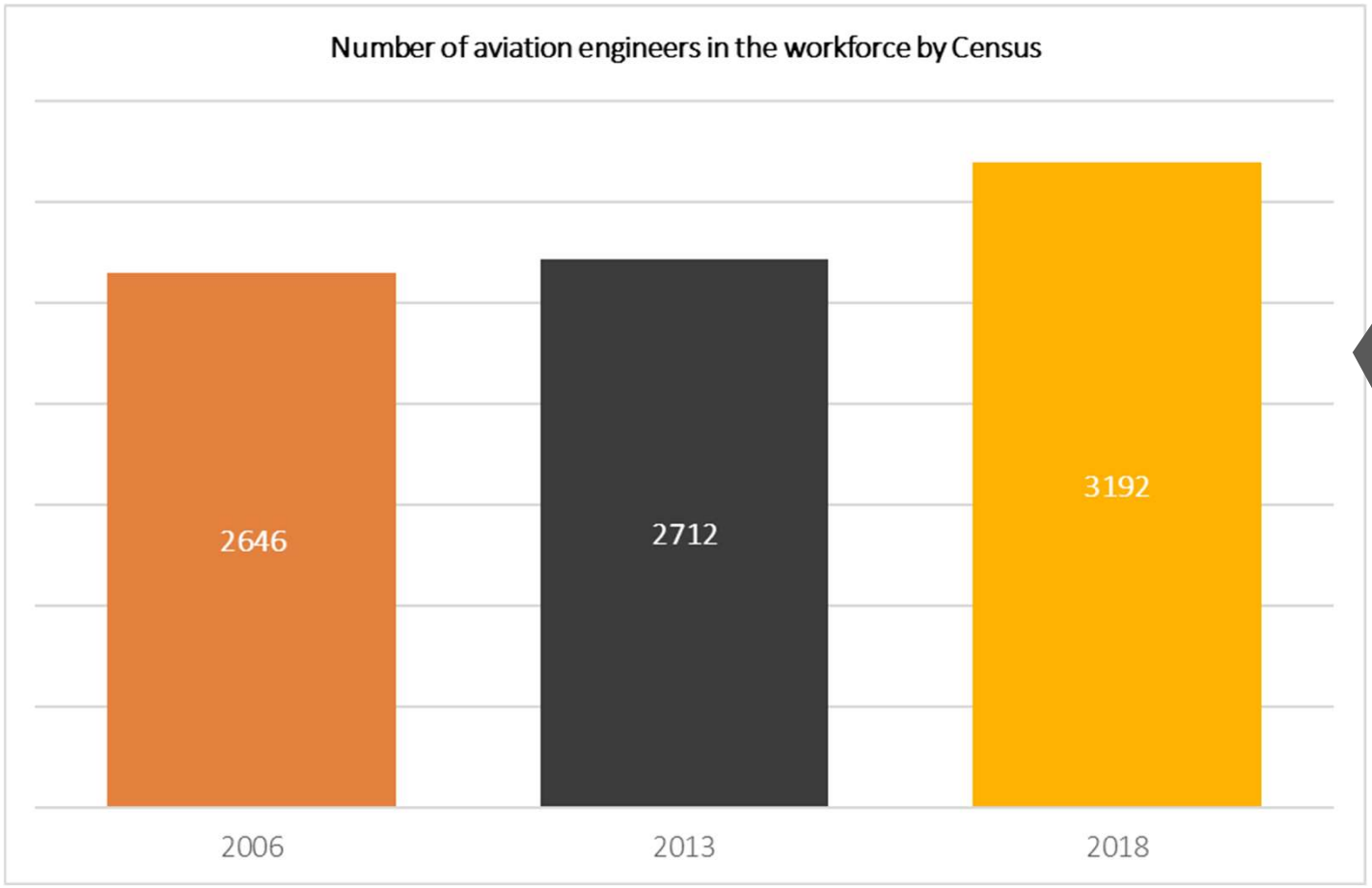
What does the aviation engineering workforce look like by size?



The aviation engineering workforce has experienced steady growth over a 12-year period. The period from 2013 to 2018 saw the workforce grow by around 18%.

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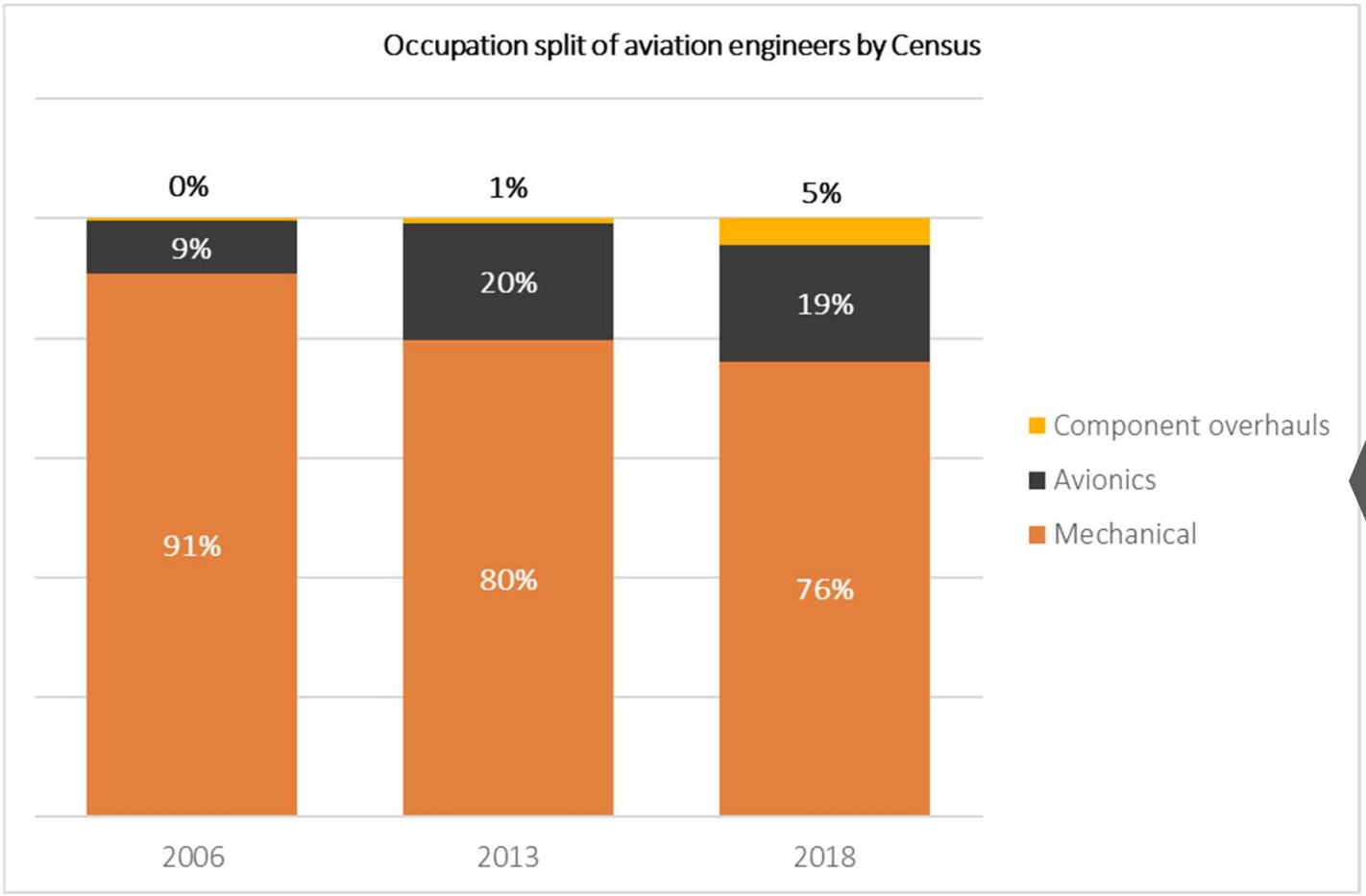
What does the aviation engineering workforce look like by role?



Mechanical engineers make up the majority of the workforce.

Between 2006 and 2013, there was apparent growth in the proportion of avionics engineers. However, this change can probably be attributed to inconsistency in coding between Censuses rather than being a real change in the composition of the workforce.

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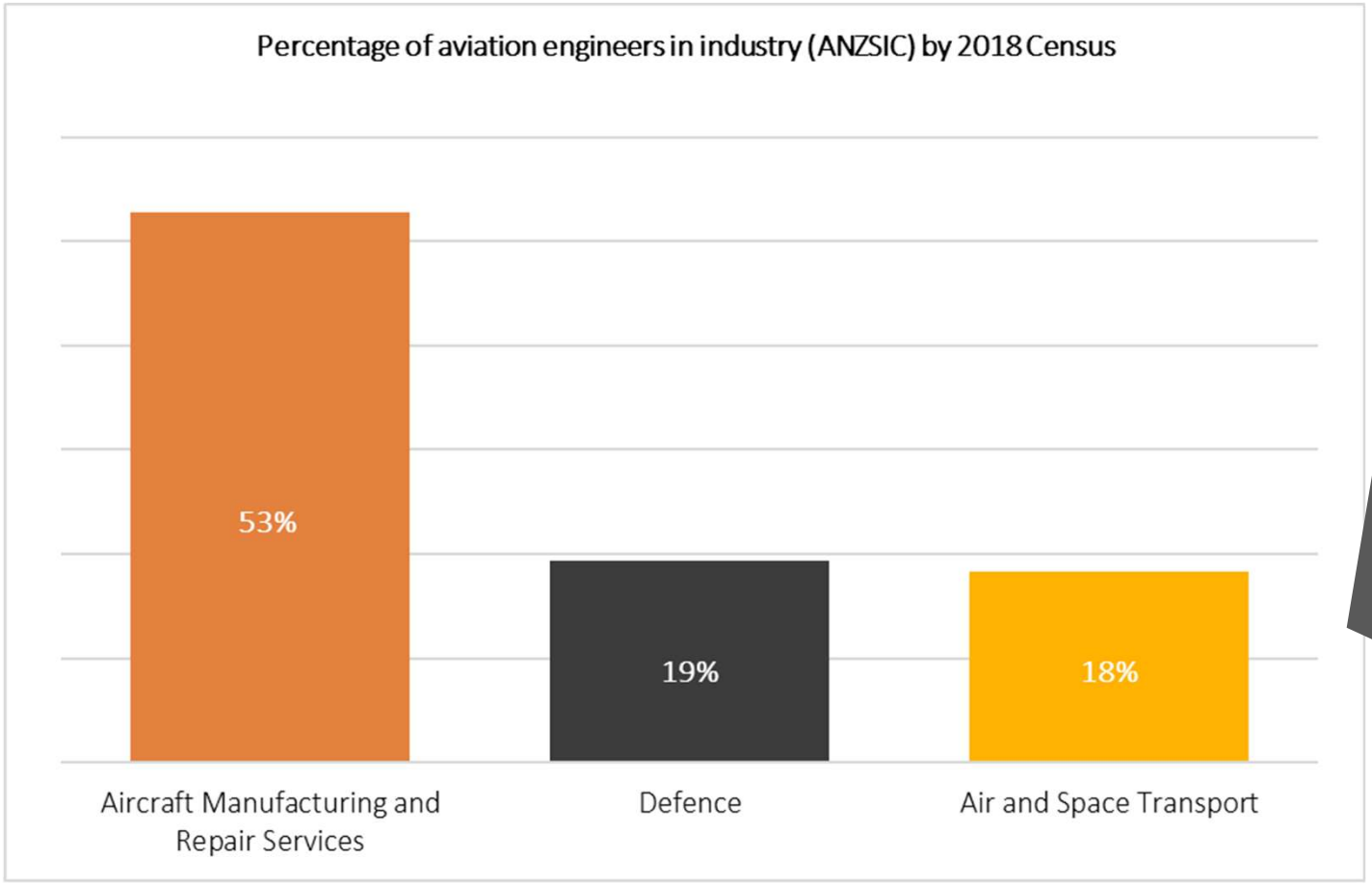
What does the aviation engineering workforce look by industry?

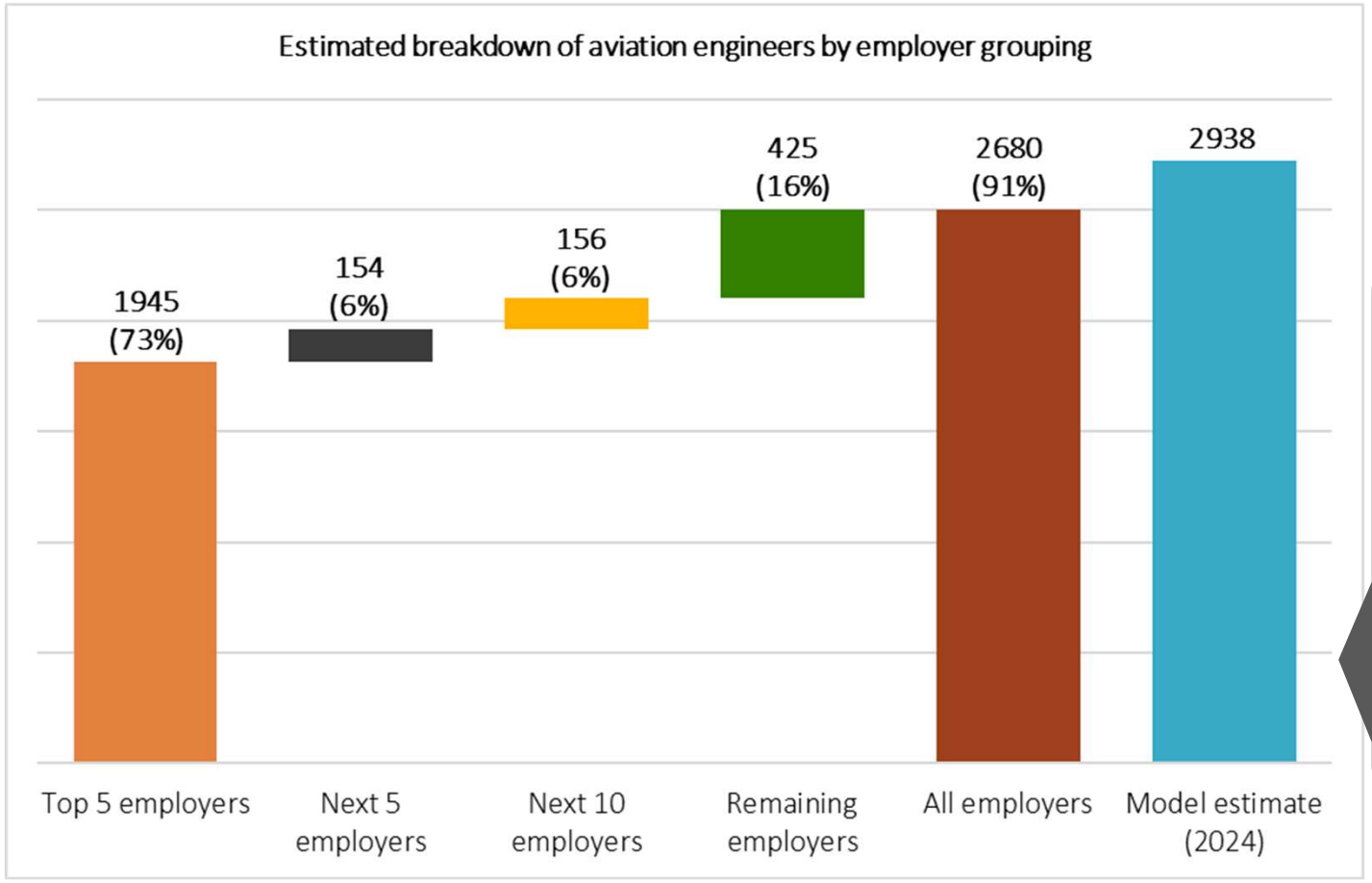


90% of aviation engineers are concentrated within these three industries.

More than twice the percentage of aviation engineers work in Aircraft Manufacturing and Repair Services than the next two largest industries – Defence and Air and Space Transport – combined.

Relative to the size of their fleet and the number of pilots, defence is overrepresented in the workforce.

What does the aviation engineering workforce look by employer?



We **tentatively estimate** that approximately just over 60% of aviation engineers are employment by the top 5 employers.

This concentration of industry leadership among a few employers suggest that these firms should take a lead position to attract new entrants into aviation engineering and invest advocate or contribute investment toward pathways to facilitate career progression.

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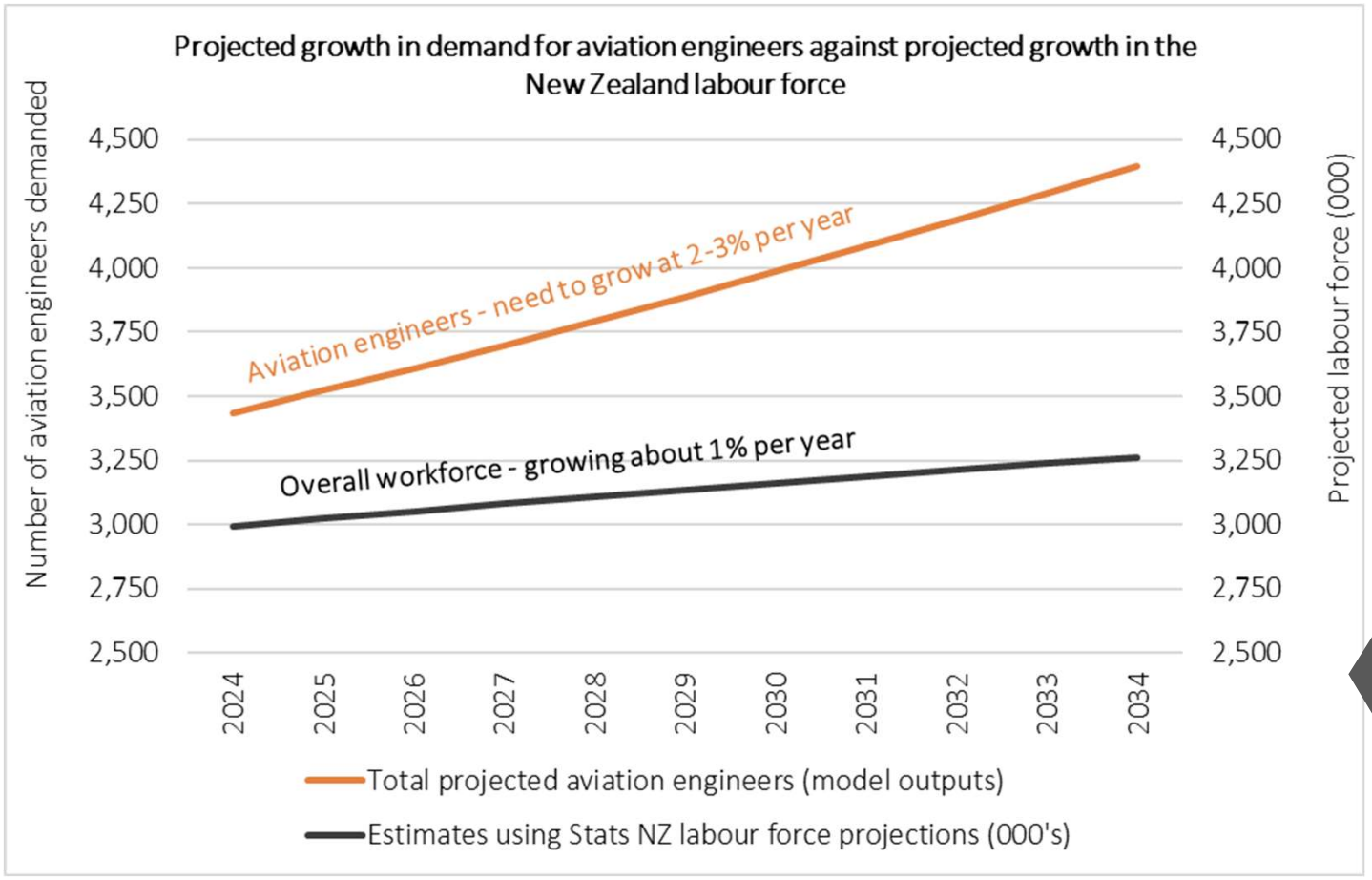
How will the aviation engineering workforce grow over time?



Demand projections indicate that the demand for aviation engineers will grow faster when compared to the New Zealand labour force.

This suggests that it will become increasingly difficult over time to compete for new talent.

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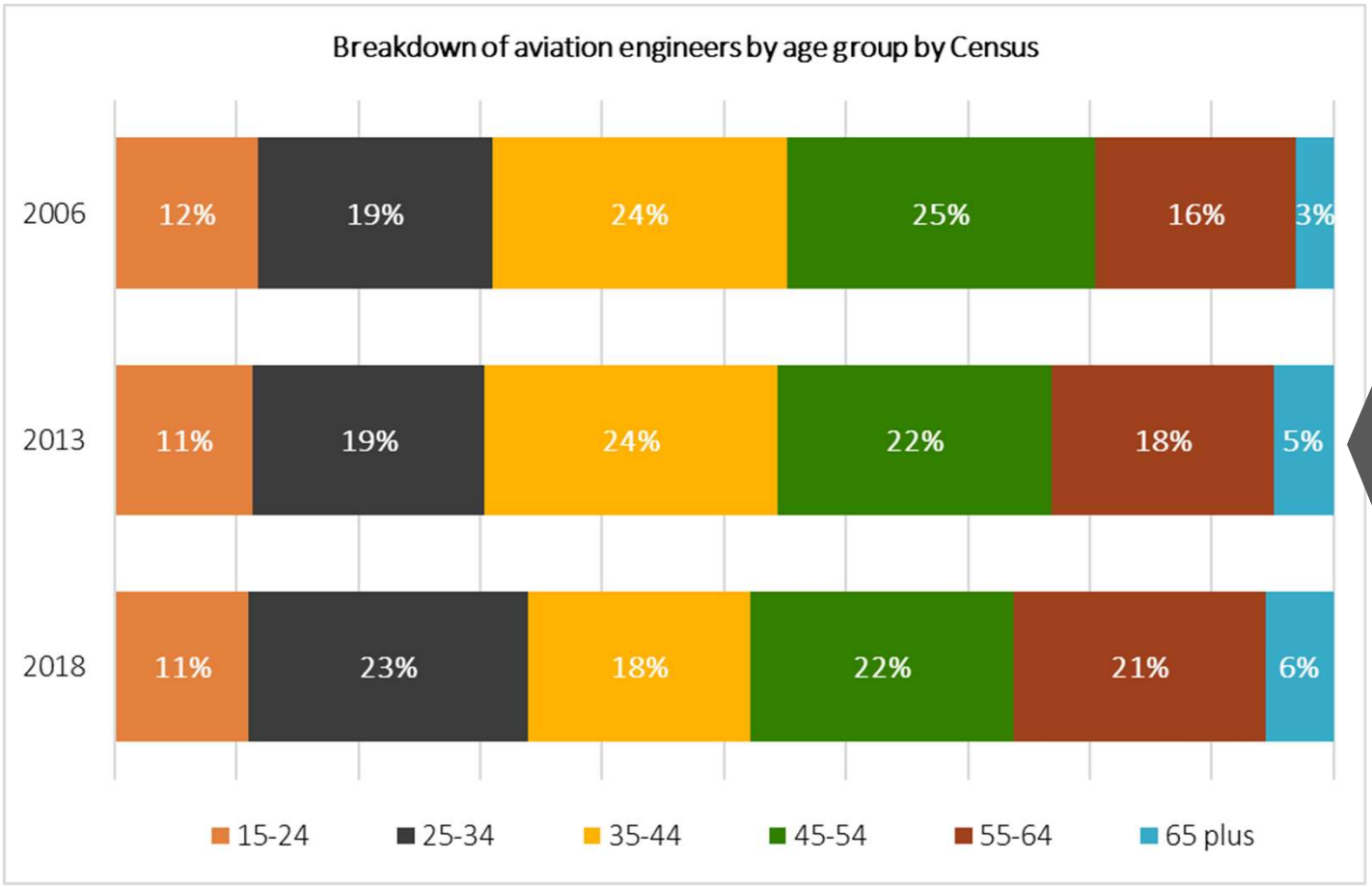
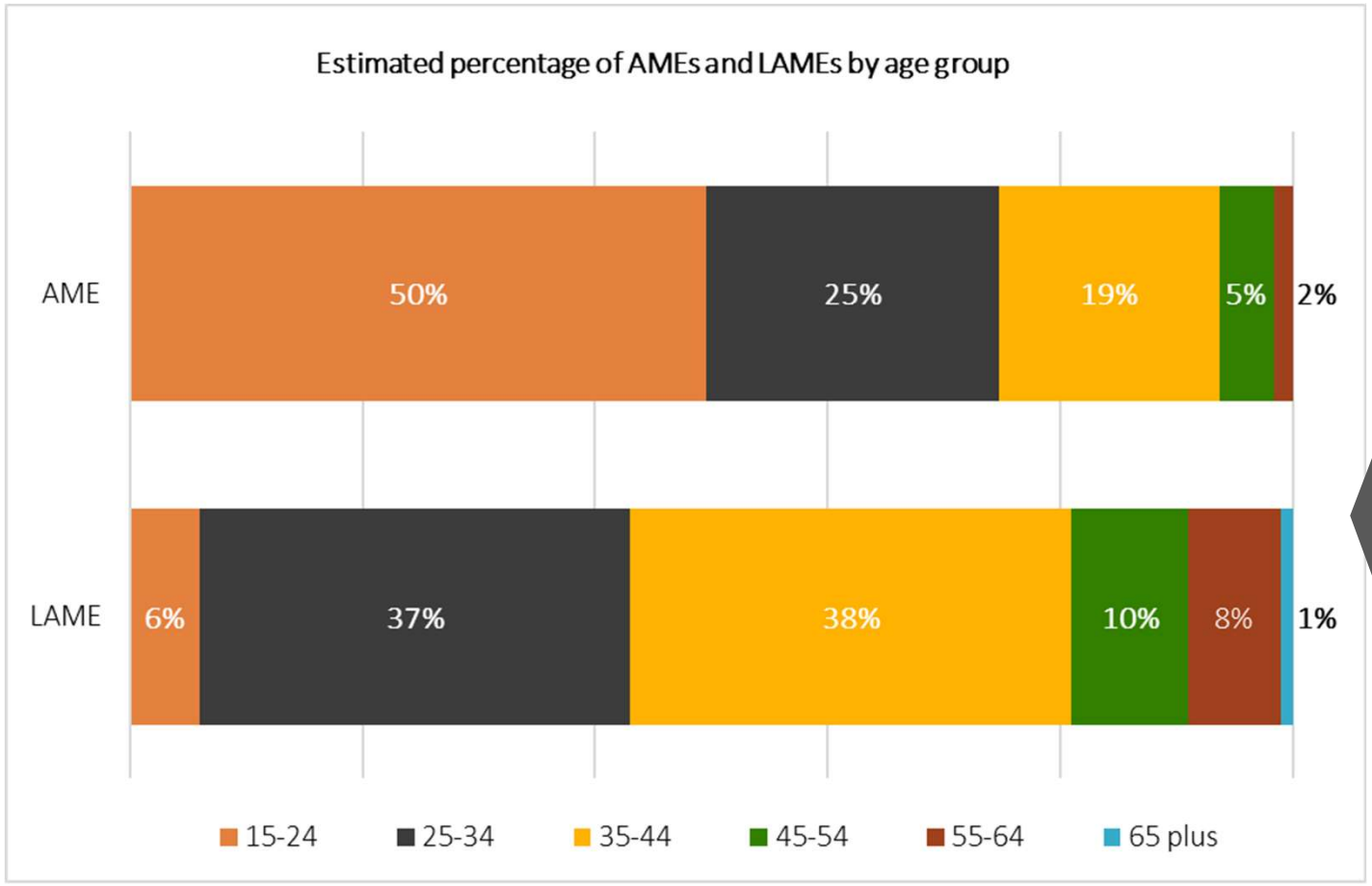
What is the composition of the workforce by age? How has this changed over time?



From 2006 to 2018, the number of aviation engineers aged 55 or above has increased slightly, while the proportion of engineers aged 15 to 34 has also risen, suggesting a decline in the middle-aged workforce.

This decline could risk skill gaps in the future as older aviation engineers retire without enough experienced workers to fill the gap.

What is the composition of the AMEs and LAMEs by age?

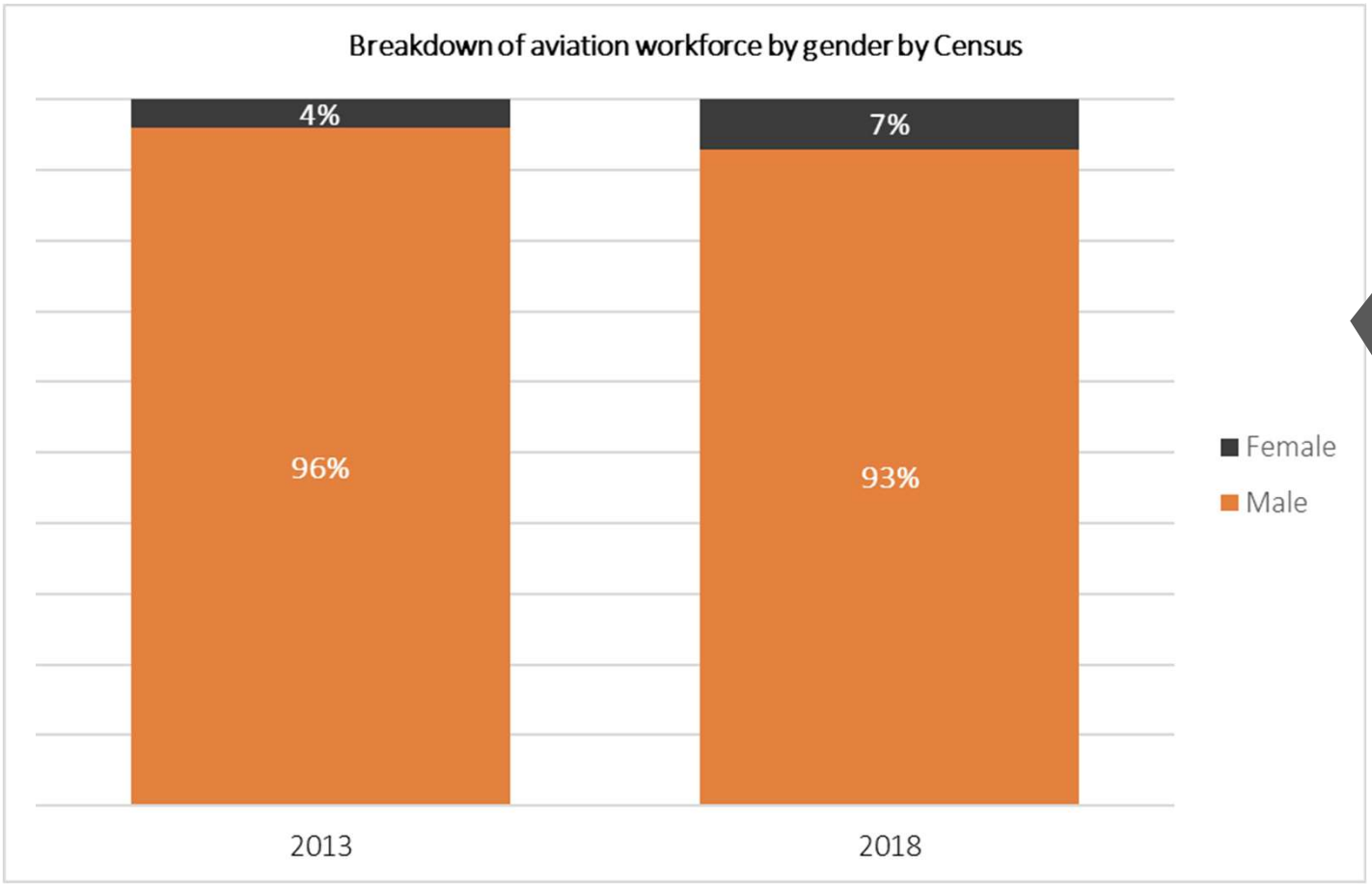


The age composition of AMEs and LAMEs reveal differences reflective of their career stages.

AMEs tend to be younger, with approximately 75% aged between 15 to 34 years, aligning with the early stages of their career journey.

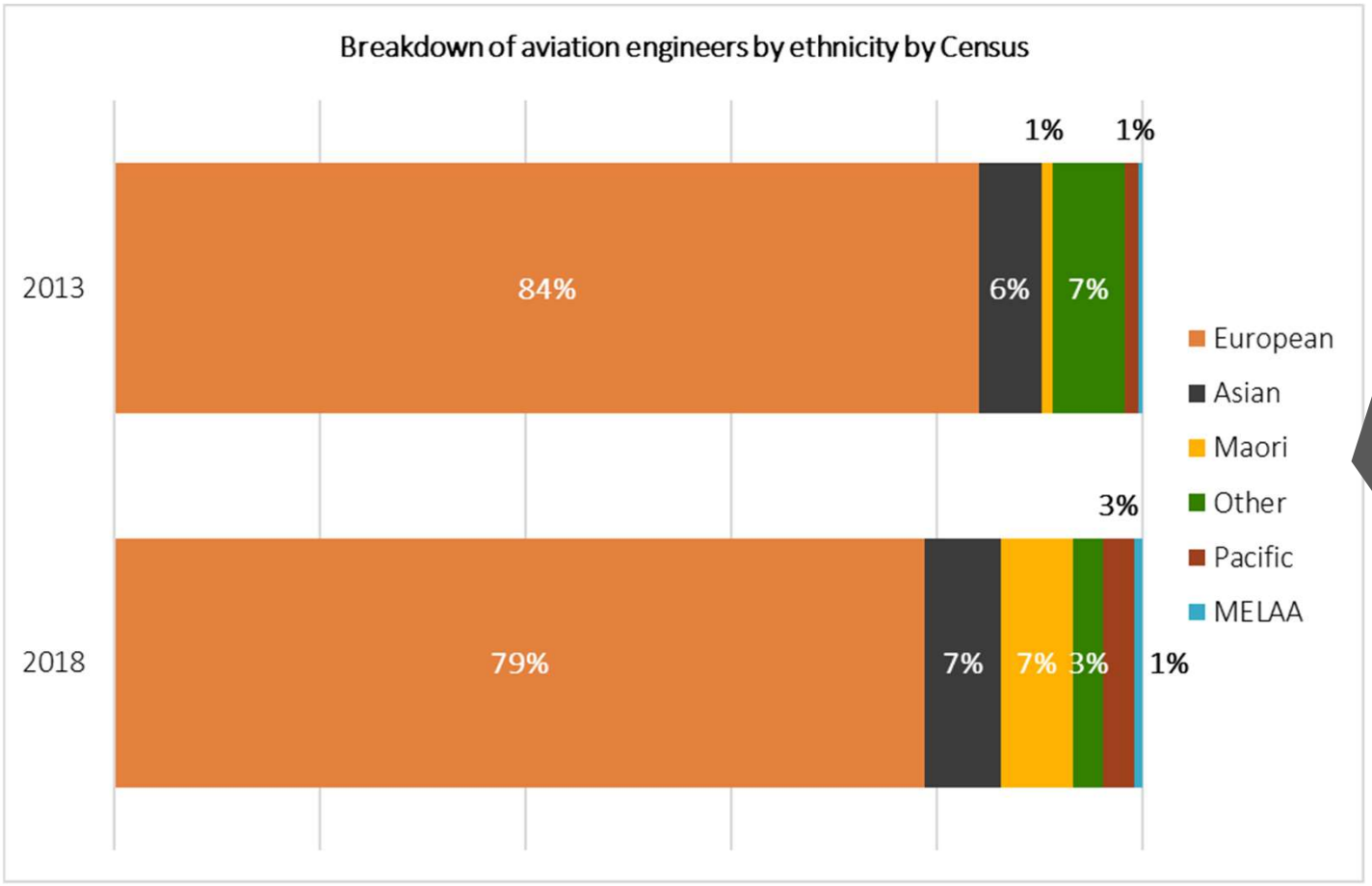
Conversely, LAMEs are primarily within the 25 to 44 age bracket, indicating a key stage of career progression.

What is the composition of the workforce by gender? How has this changed over time?



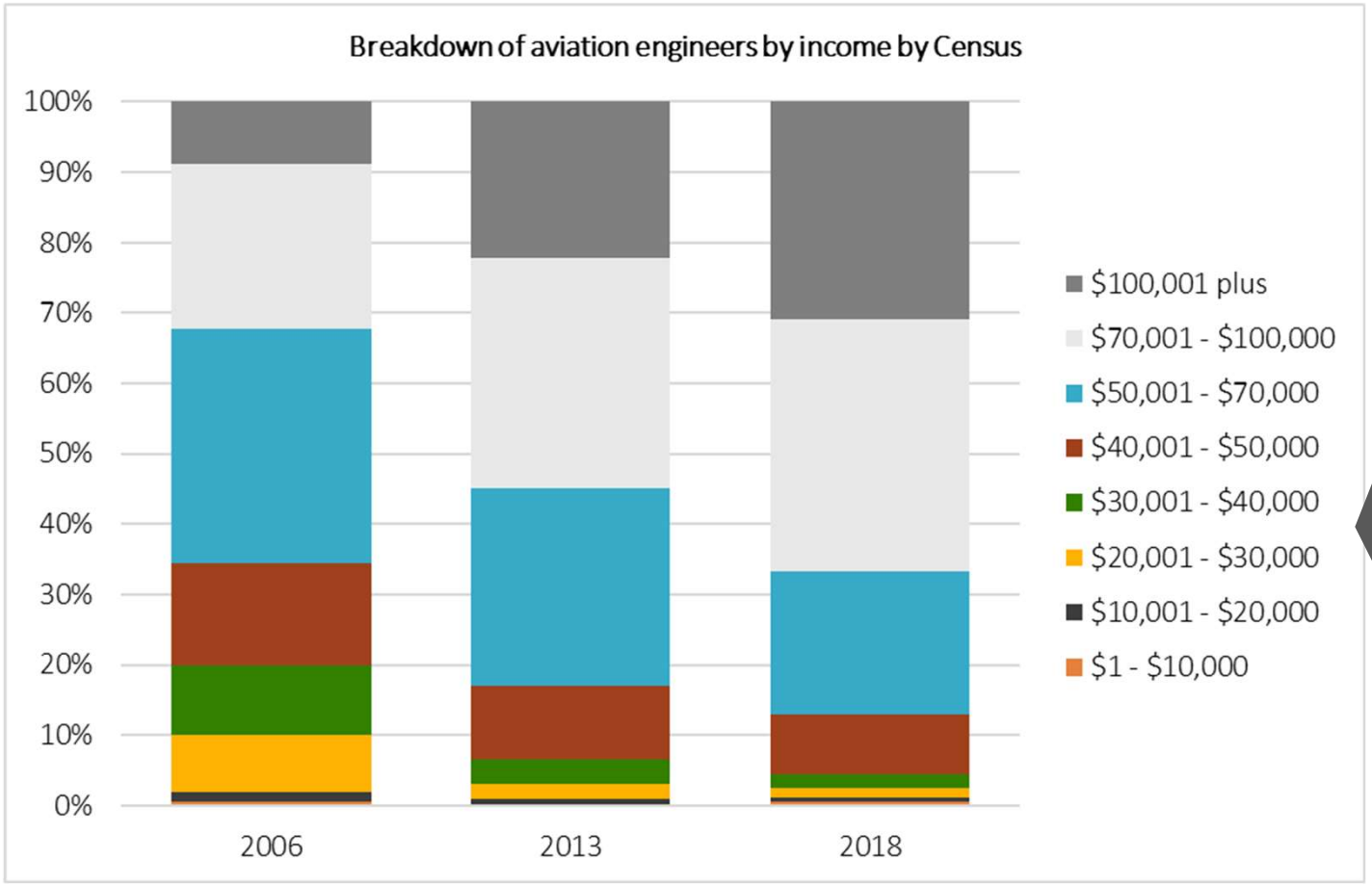
Aviation engineering is dominated by males, with around 2% female (equating to approximately 70 female aviation engineers in 2018, a marginal increase from 50 in 2013).

What is the composition of the workforce by ethnicity? How has this changed over time?



Aviation engineering is dominated by New Zealand Europeans, with over 80% in 2013, and just under 80% in 2018. There has been gradual shifts in other ethnicities, with Māori increasing by 6 percentage points, and Pacific by 2 percentage points over the 5-year period.

What is the composition of the workforce by income?



In 2018. more than two thirds of aviation engineers earned over $70k per year. This proportion has doubled since 2006.

There has been clear an upward shift in the distribution of income over time, with those earning less than $40k per year decreasing from 20% in 2006 to 4% in 2018.

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Opportunities to improve modelling, calibrations and reconciliations

Supply model

- Get data on licensing rates. Current rates are estimates, albeit calibrated by steering group members.
- Get data on average years of experience working in aviation engineering.

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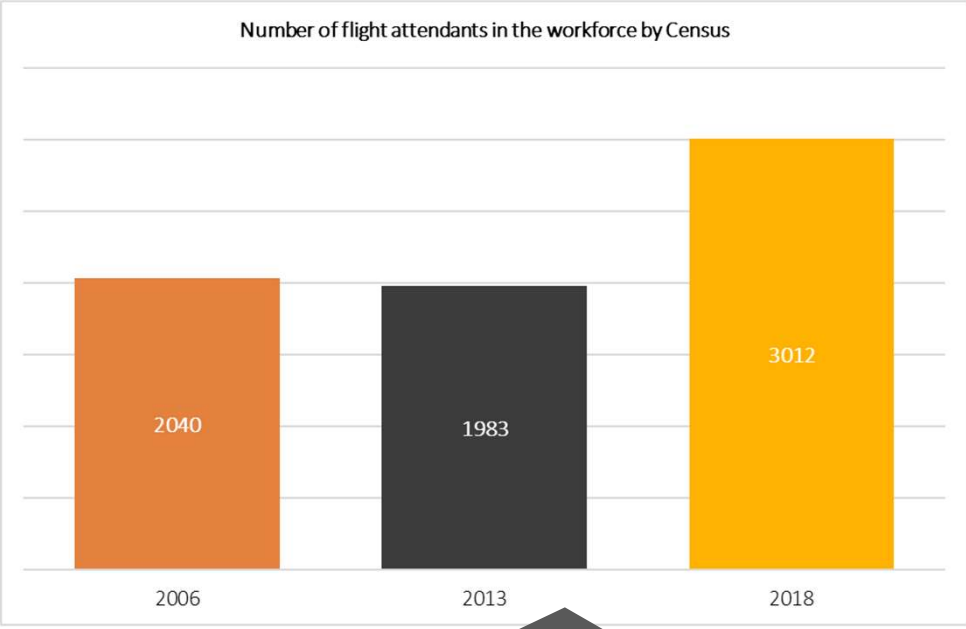
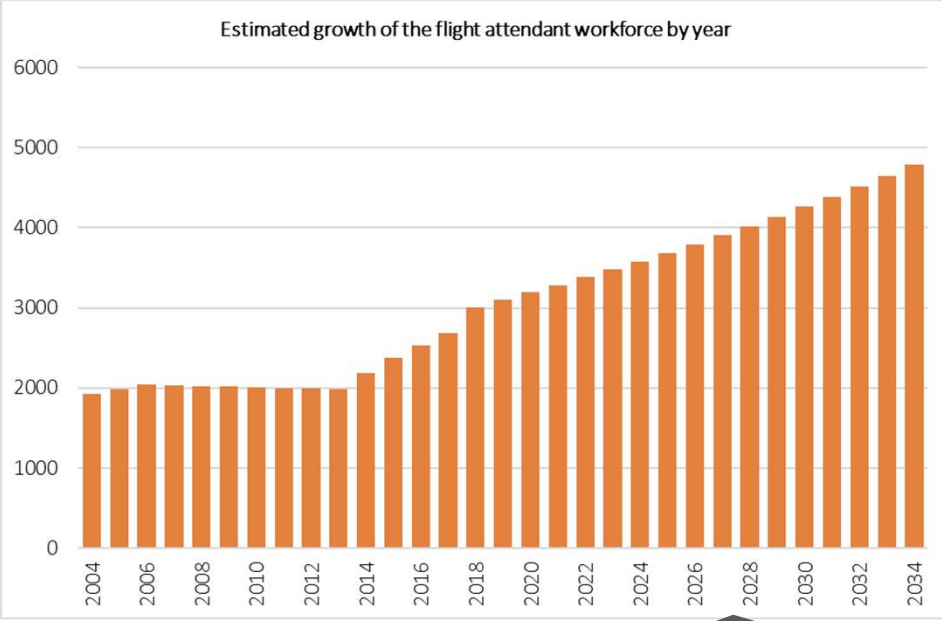
Other occupations – Flight attendants

What does the flight attendant workforce look like by size?



Between 2006 to 2013, the workforce remained steady at approximately 2000 flight attendants. In 2018 however, the workforce grew by 52%, possibly reflecting industry growth between 2013 to 2018.



The size of the workforce was estimated using a combination of imputation between Census counts, and a growth assumption from 2019. Consistent with the Census counts, the size for the workforce increased from 2006 to 2018, which then continues to increase at 3% per year – our growth rate assumption.

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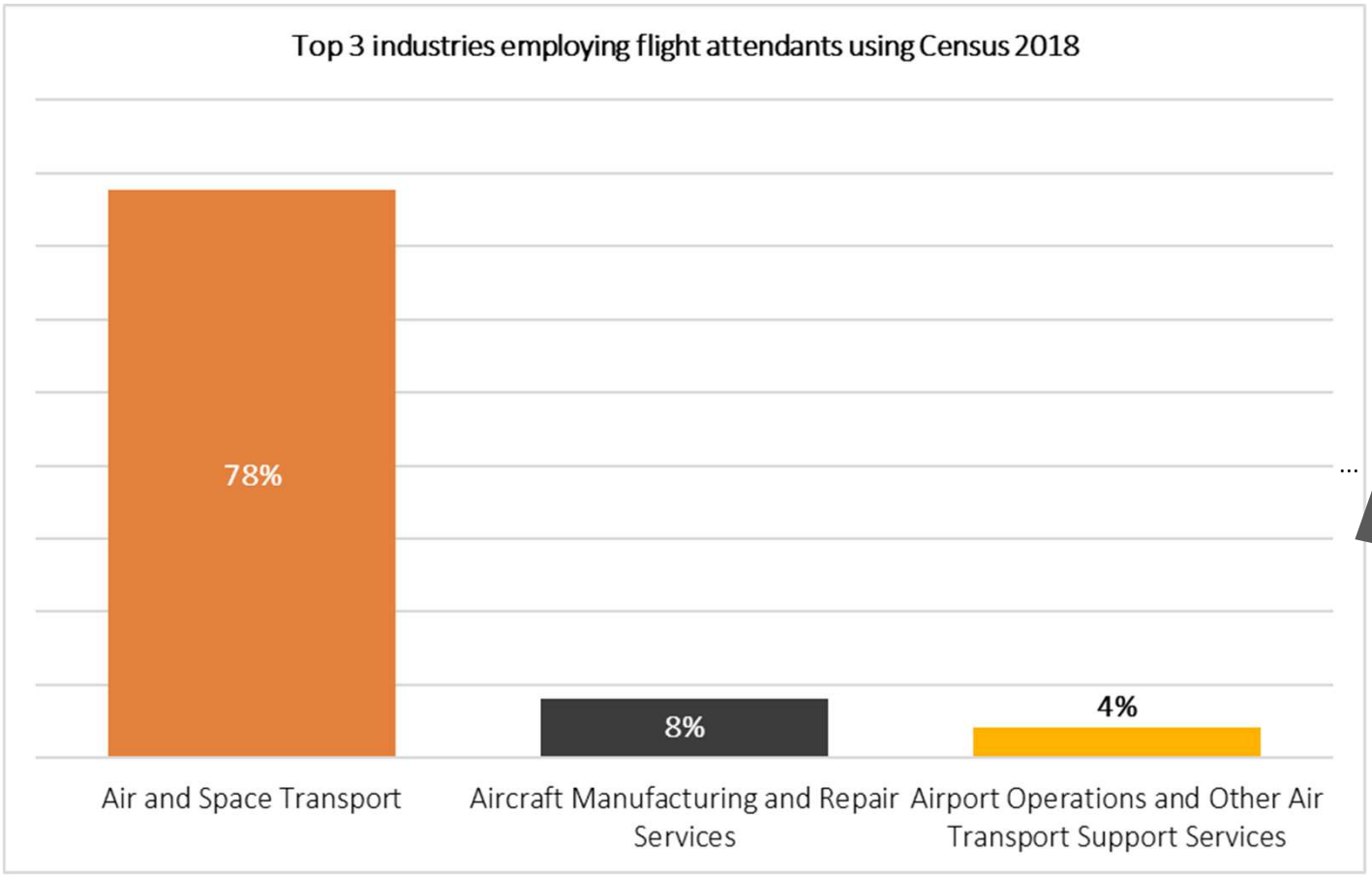
Other occupations – Flight attendants

What industries do flight attendants work in?



Just under 80% of flight attendants work within the industry Air and Space Transport in 2018 – also the primary industry for flight attendants in 2006 (83%) and 2013 (87%).

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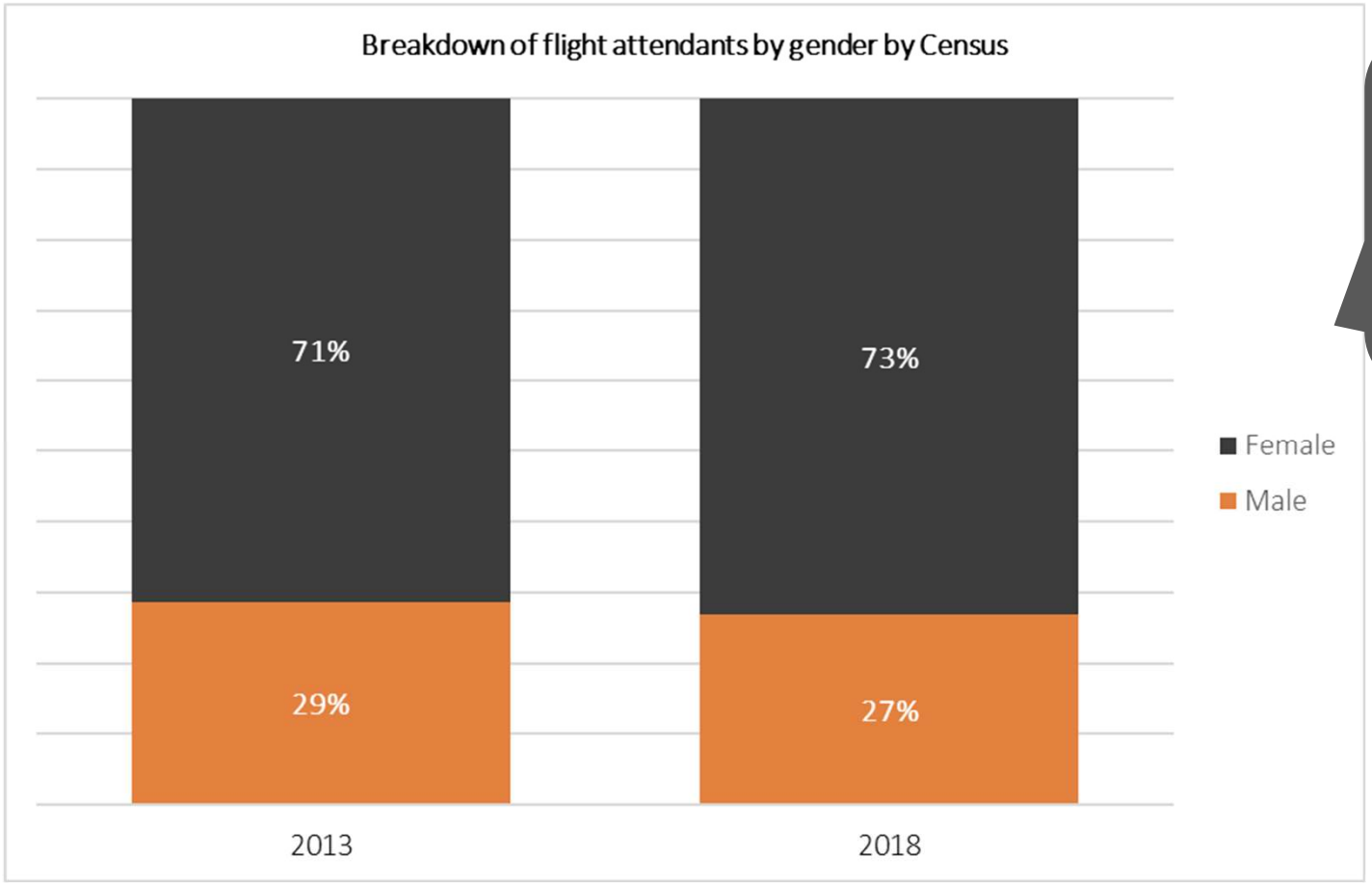
Other occupations – Flight attendants

What is the composition of flight attendants by gender?



The gender composition is consistently weighted toward female, with just over 70% of flight attendants reporting their gender as female in both 2013 and 2018.

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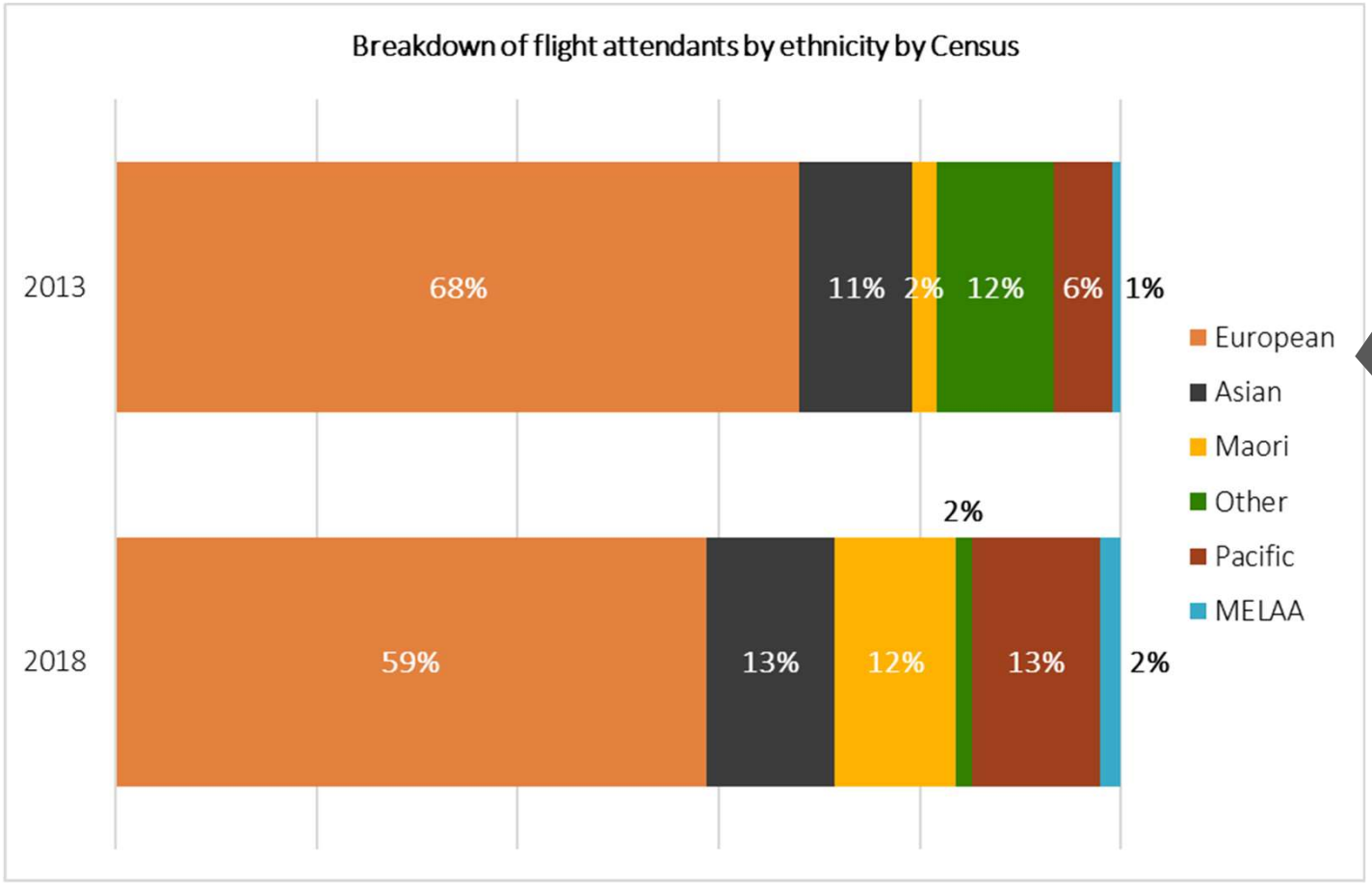
Other occupations – Flight attendants

What is the composition of flight attendants by ethnicity?



From 2013 to 2018, the diversity among flight attendants increased, with the proportion of Māori rising from 2% to 12% and Pacific from 6% to 13%.

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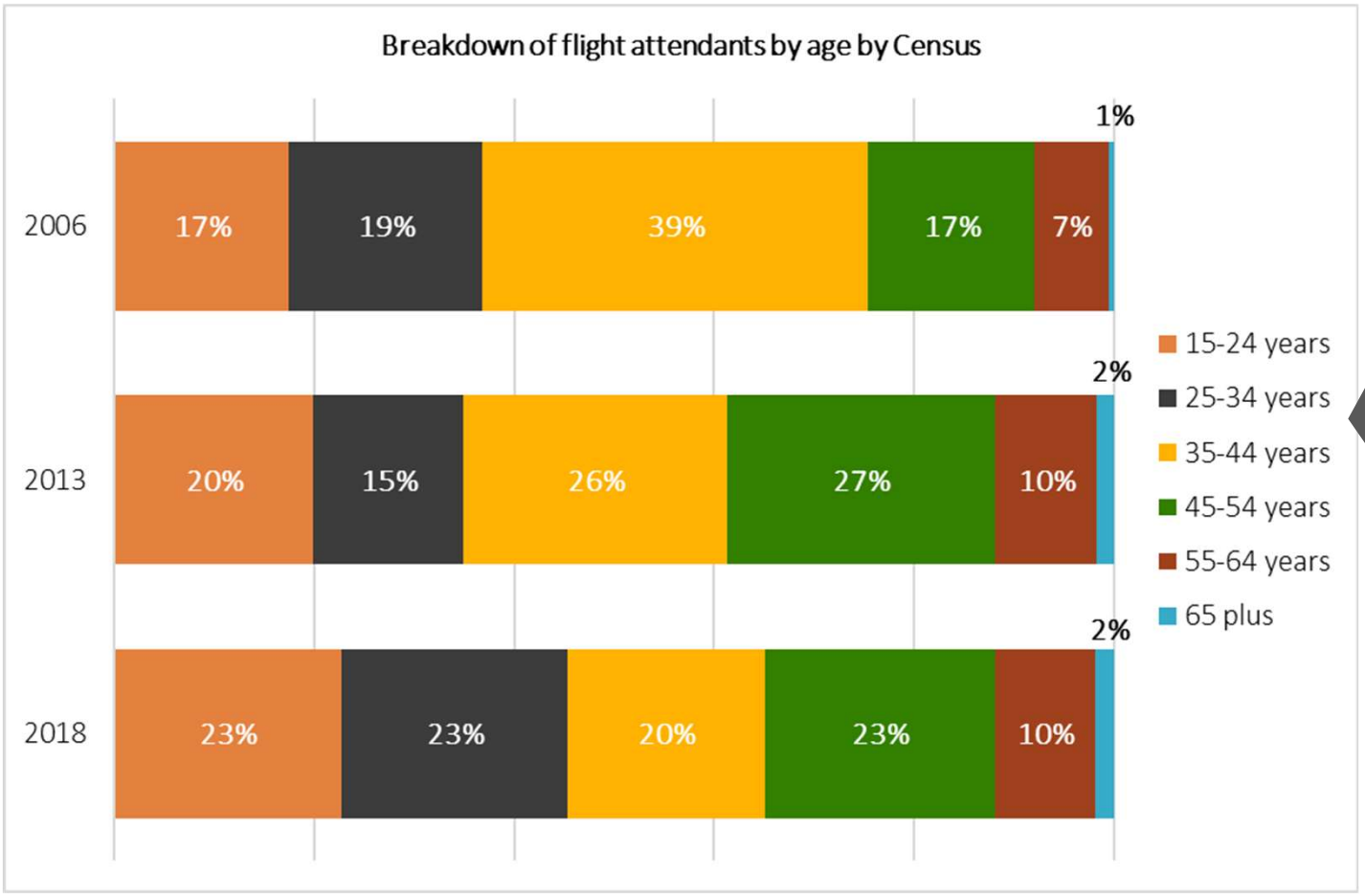
Other occupations – Flight attendants

What is the composition of flight attendants by age?



In 2013, the age distribution of the flight attendant workforce has seen a slight shift towards older age groups when compared to 2006. However, as of 2018, two-thirds of flight attendants are aged 44 or younger.

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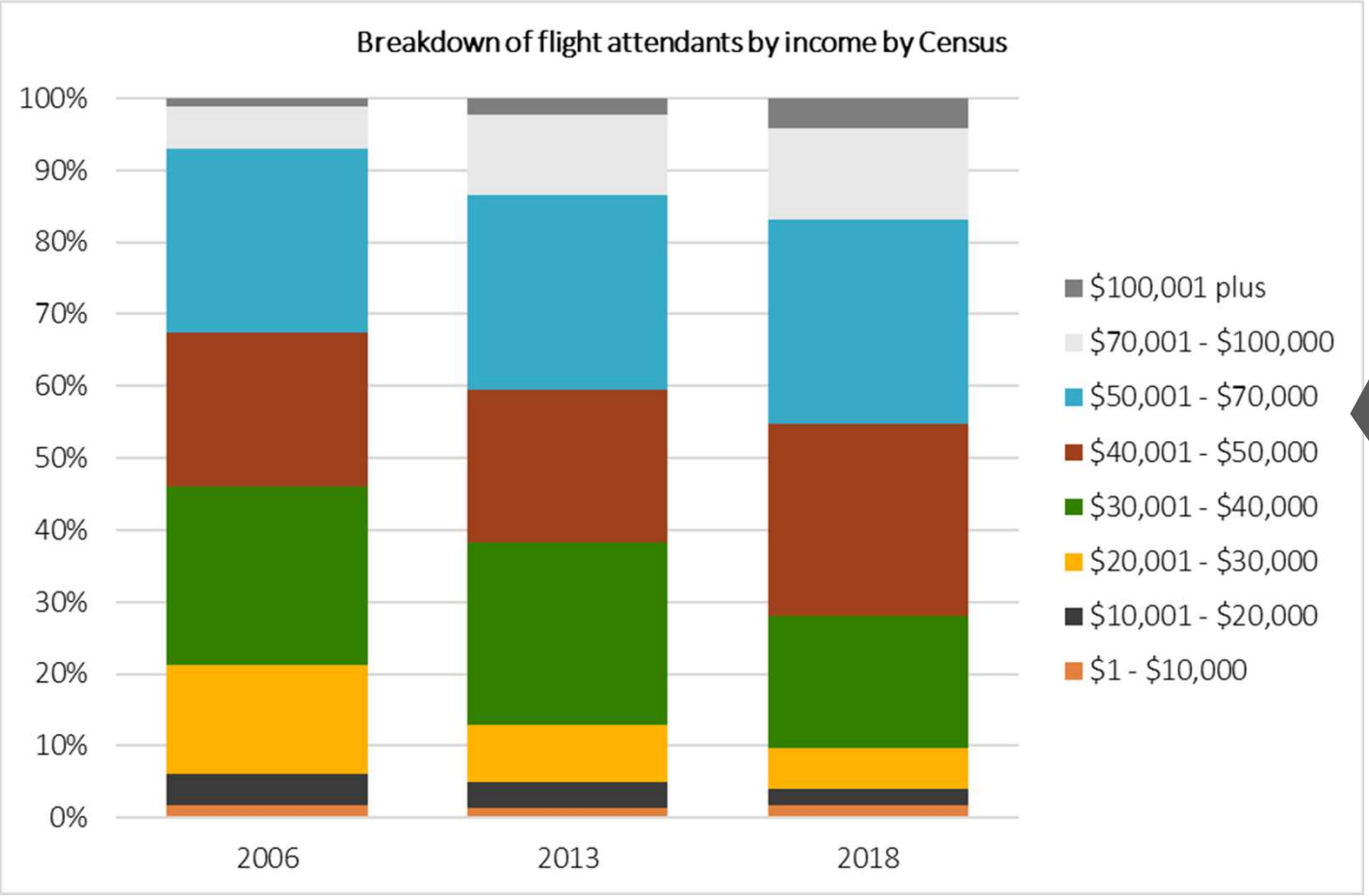
Other occupations – Flight attendants

What is the composition of flight attendants by income?



There appears to be upward movement in the income of flight attendants between 2006 to 2018. In 2006, just over 30% earned $50k or above, compared to around 45% in 2018. The proportion earning between $70-100k more than doubled.

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Other occupations

- Flight attendants
- Aircraft baggage handlers and airport ground crew

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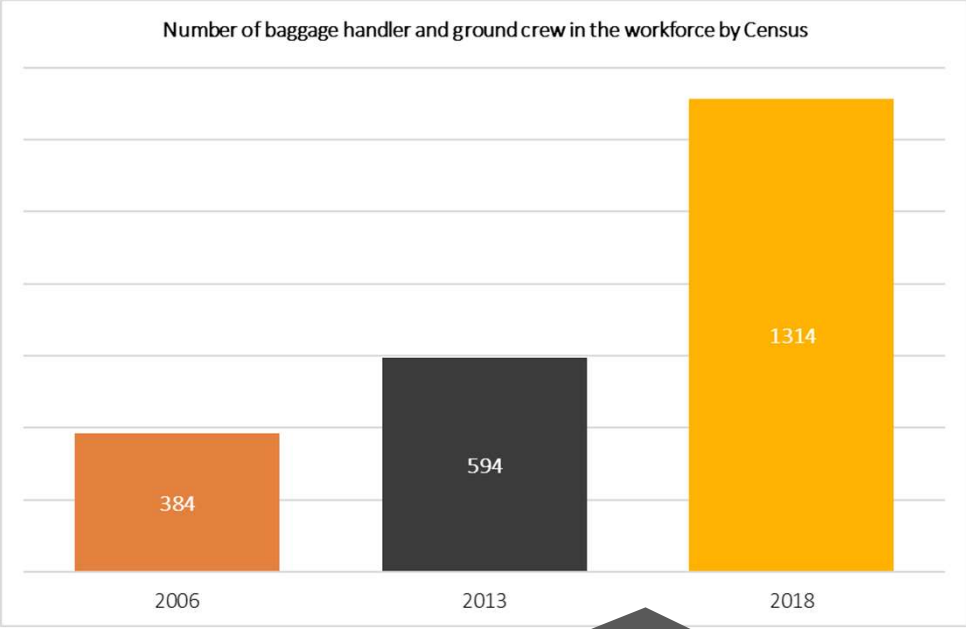
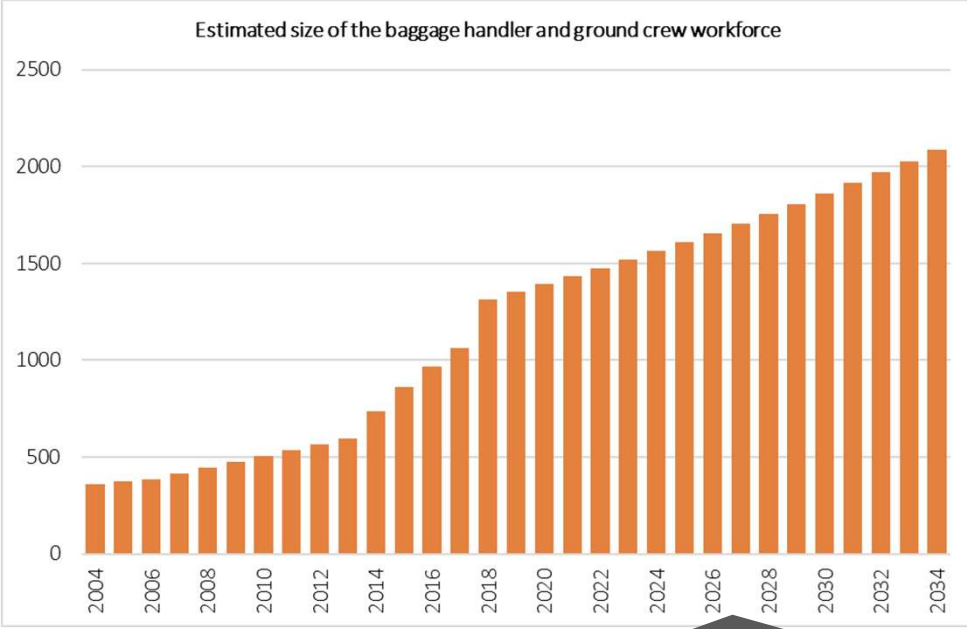
Other occupations – Aircraft baggage handlers and airport ground crew

What does the baggage handler and ground crew workforce look like by size?



From 2006, the size of the workforce has increased at each subsequent Census. Between 2013 to 2018, the size of the workforce increased by approximately 120% - either reflecting industry growth or possibly due to inconsistency in coding between Censuses.



The size of the workforce was estimated using a combination of imputation between Census counts, and a growth assumption from 2019. Consistent with the Census counts, the size for the workforce increased sharply between 2013 to 2018. We have then assumed a growth rate of 3% per year from 2019.

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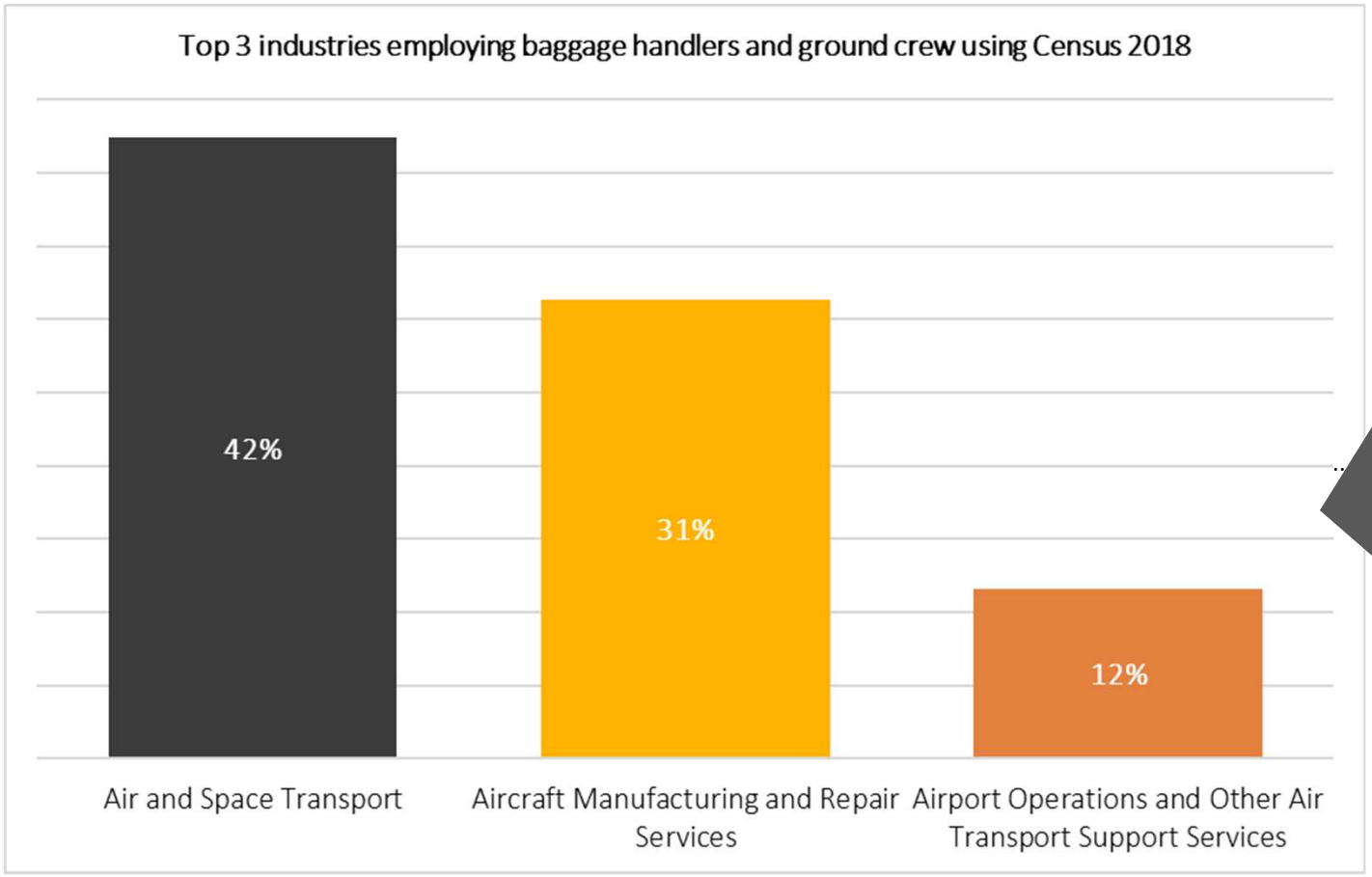
Other occupations – Aircraft baggage handlers and airport ground crew

What industries do baggage handlers and ground crew work in?



In 2018, most baggage handlers and ground crew worked in the air space and transport industries. However, this proportion has decreased from 60% in 2006 and 2013. Conversely, the proportion of people working in the airport operations and other air transport support services industry has increased from 22% in 2006 and 2013 to 31% in 2018

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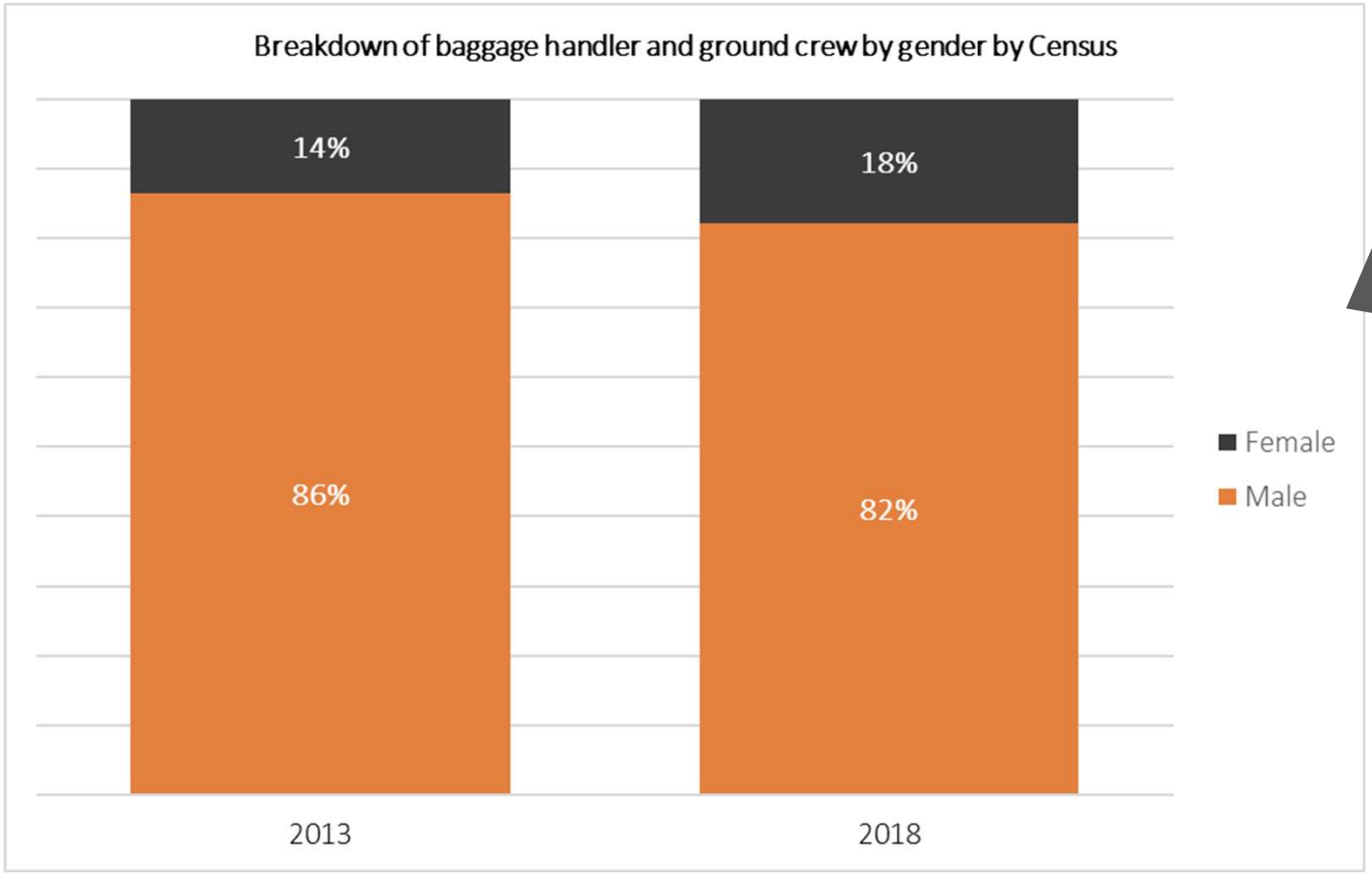
Other occupations – Aircraft baggage handlers and airport ground crew

What is the composition of the baggage handlers and ground crew by gender?



Males comprise most baggage handlers and ground crew, with over 80% identifying as male in 2013 and 2018.

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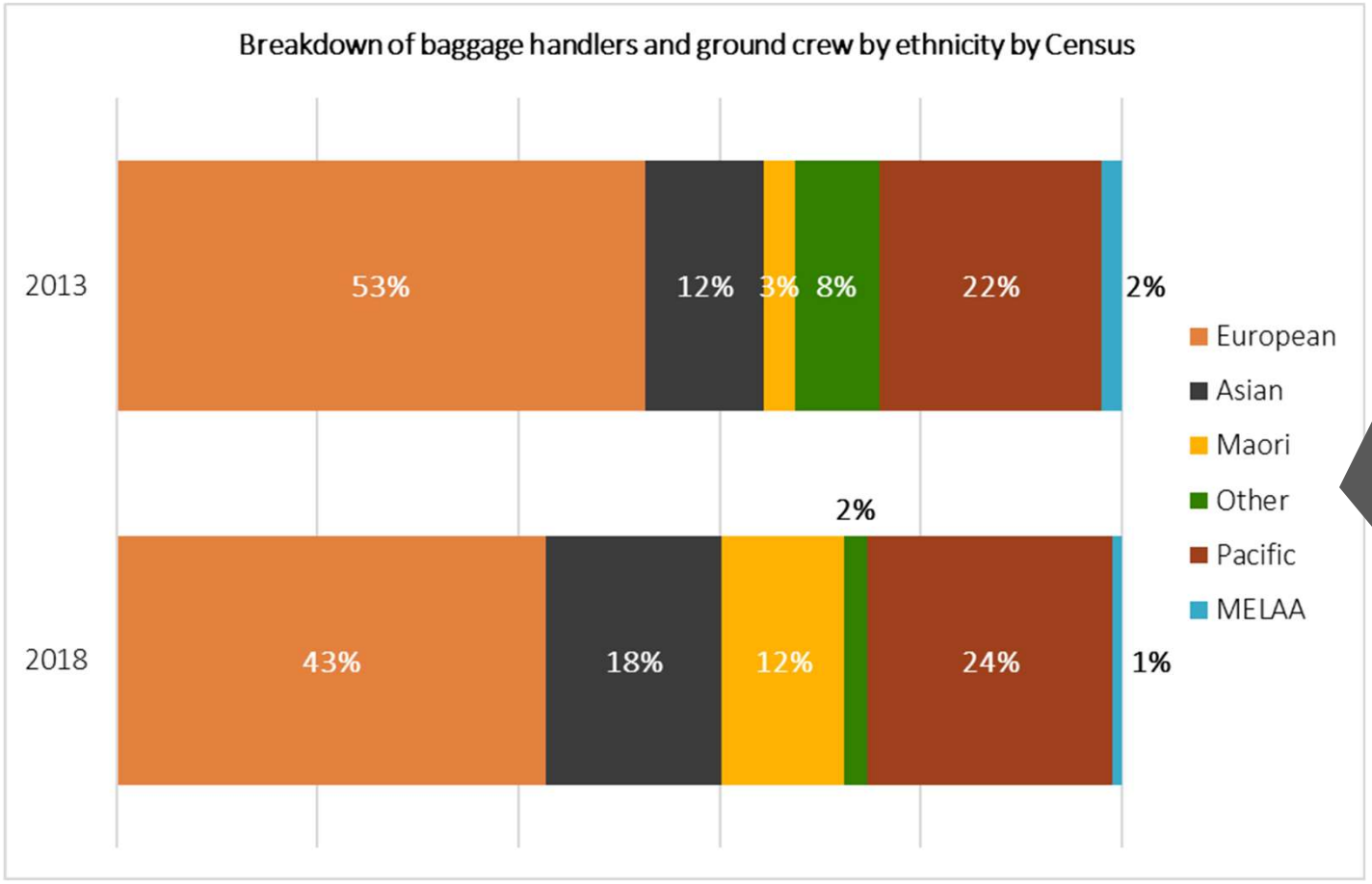
Other occupations – Aircraft baggage handlers and airport ground crew

What is the composition of the baggage handlers and ground crew by ethnicity?



Between 2013 and 2018, the ethnic diversity among baggage handlers and ground crew experienced a notable shift.

Specifically, the representation of Māori individuals surged from 3% to 12%, representing the most significant growth across all ethnic categories. Pacific and Asian employees also saw growth over the same period.

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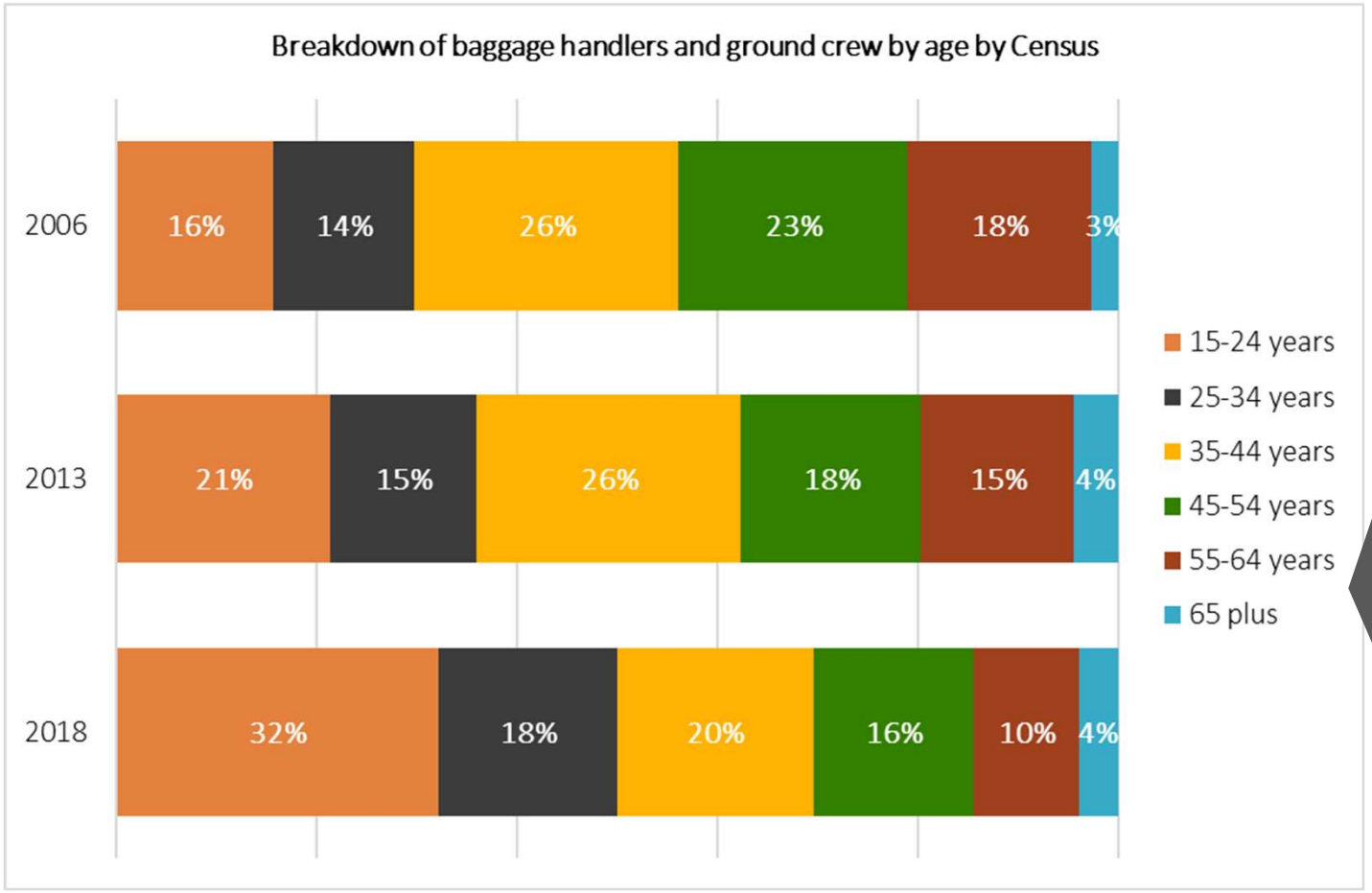
Other occupations – Aircraft baggage handlers and airport ground crew

What is the composition of baggage handlers and ground crew by age?



Between 2006 and 2018, the workforce aged 44 or younger in this sector expanded from 56% to 70%. This shift, in combination with the industry's overall growth from 2013 to 2018, suggests that the increasingly younger workforce could be a valuable pool of future talent – either remaining in this occupation or progress into alternative aviation careers (e.g., aviation engineers).

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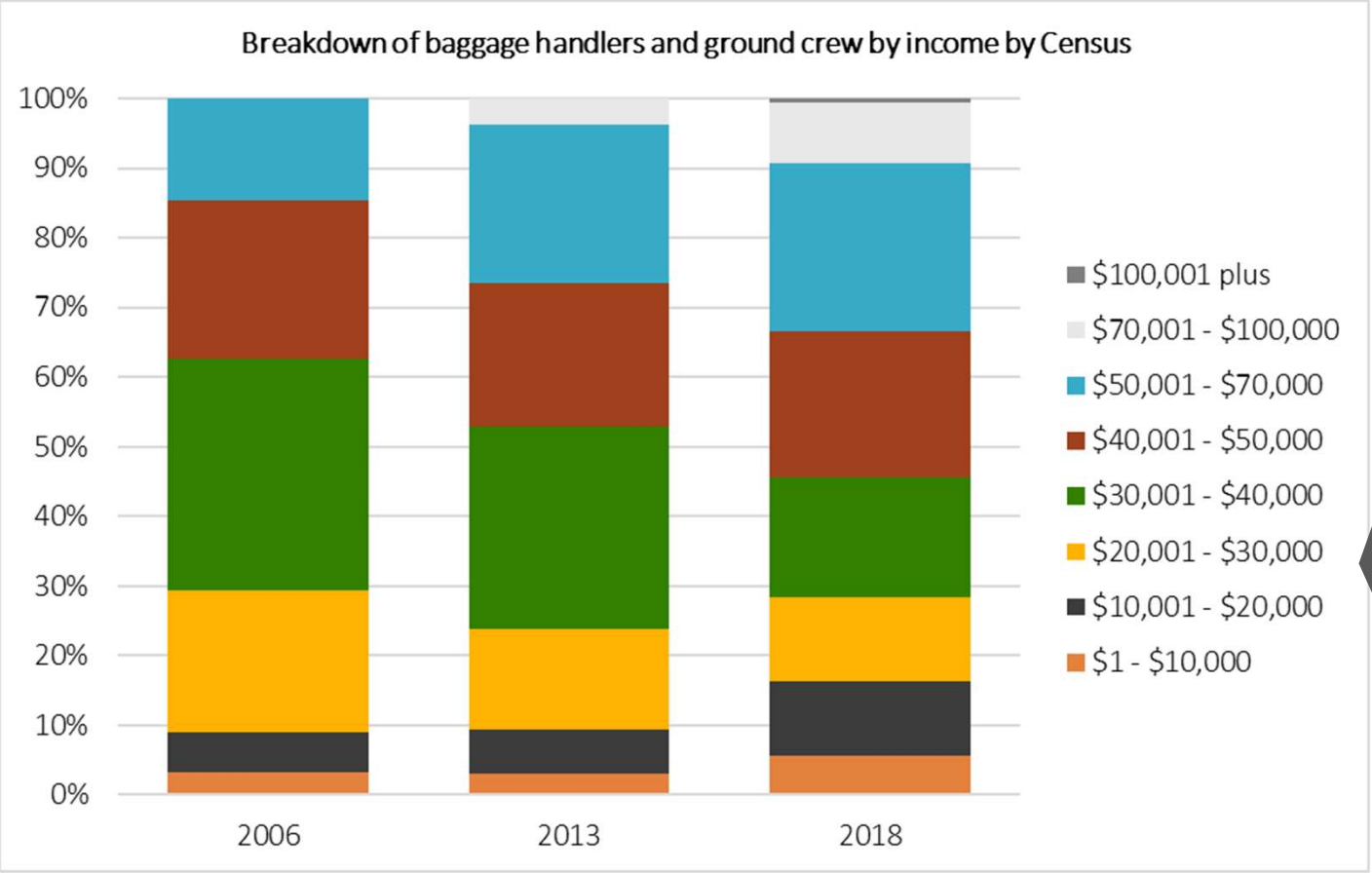
Other occupations – Aircraft baggage handlers and airport ground crew

What is the composition of baggage handlers and ground crew by income?



From 2006 to 2018, there was a notable increase in the income levels of baggage handlers and ground crew - 15% of these workers earned $50k or above in 2006, compared to 33% in 2018.

There was a rise in the proportion of lower-income earners, which led to a compression of the middle-income groups, particularly those earning between $30k and $50k.

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