Aerospace Workforce Development in Tairāwhiti: Career Pathways and Education Needs

Tē Tōia, Tē Haumatia
Nothing can be achieved without a plan, a workforce and a way of doing things

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Executive Summary

The aerospace industry presents an opportunity for future growth and development in the Tairawhiti region, but to fully realise this potential we need an informed and future-ready workforce.

This paper has been commissioned by Trust Tairāwhiti to identify the potential career pathways that would be available, the required skills for entry into the workforce and the extent to which current education provision through the schooling system is positioned to equip the young people of Tairawhiti with the skills, confidence and motivation required to take up the opportunities that such a development will afford. The scope of the study does not include financial feasibility or in-depth stakeholder engagement, although a number of stakeholders have been consulted in the course of this work to validate key findings and observations.

In part one we outline a framework that describes the segmentation of the aerospace sector in New Zealand. The basis for this breakdown is a study undertaken by Deloitte Economics in 2019 for the Ministry of Business, Innovation and Employment (MBIE). This report remains the best available published analysis of the aerospace industry in New Zealand. We have adapted the framework in the light of recent changes to the emphasis of the Government's Space and Advanced Aviation strategy published in 2024.
As a result of this analysis, we identify potential opportunities in the aerospace manufacturing, aerospace applications, and research and development segments for aerospace workforce development in the Tairāwhiti region. These opportunities rest on an assumption that industry investment in these segments are those that are most likely to be attracted to the region as part of the aerospace infrastructure development proposal that accompanies this study. Based on that analysis, we highlight three broad career pathways that offer potential for local rangatahi graduating from Tairāwhiti schools. These are: **aerospace engineering, aerospace fabrication, software engineering and data science.**

In part two we identify the main education and workforce incubation organisations in the region that could play a future role in providing opportunities for growth in STEM and obtaining aerospace-related skills and qualifications. We then explore both regional and national data, primarily from the Ministry of Education data and statistics website, Education Counts. STEM subject enrolments for years 11-13 provide an indicator of the proportion of students that have chosen STEM options for their NCEA qualifications. The regional data show a broadly similar pattern to the national data in this respect. Specific information about the subject enrolments of Māori and Pacific students was not available from this source, though information from other sources. suggests that Māori and Pacific ethnicities are under-represented in STEM pathways both in tertiary education and in science careers. This observation is supported by anecdotal information we heard from schools about participation in STEM subjects in secondary school. In the second part of this section we attempted to obtain an estimate for the potential numbers of students from the region who might be expected to pursue aerospace career pathways if opportunities in the region and an education pipeline to feed into those were established. The numbers suggest a differentiated approach with a more individualised model for the relatively small number of aerospace engineering candidates, and a more cohort-based model for computer science and fabrication pathways.

In part three, we outline the main components to consider in education design, and propose a framework for a coherent education pipeline that utilises the strengths of the providers already operating in the region to support students to pursue the three pathway options identified in part one. This will require coordination and buy-in from the stakeholders identified in this report with clear workplace opportunities, both within the region and nationally for graduates through this programme. A set of recommendations for next steps have been developed based on the work in this report. These are outlined below.

Recommendations

1. Establish a working group of education and training providers that already exist: schools and kura, Tōnui Collab, EIT, Taike e!, to design and create a coherent pipeline of educational opportunities that prepare students for careers in the industry. This will require collaboration between providers.

2. Focus on the three main areas for workforce development in the region identified in the report: (**Aerospace) Engineering, (Aerospace) Fabrication, Software Engineering and Data Science.** These are where the greatest opportunity exists for upskilling in both transferable skills and those that are foundational to aerospace specialisations.

3. Publish industry career options, graduate profile and education opportunities for rangatahi, whanau, teachers, schools careers and gateway advisors and others to create awareness and drive interest.

4. Explore options to make it attractive for students interested in aerospace careers to stay in the region to undertake advanced tertiary study (through EIT) and industry partnerships.

5. Provide ongoing support for shared initiatives with Professor Chris Hann and Canterbury University, and explore partnership models through EIT and/or Matai Research Institute for internship projects.

6. Consider the Mātai Institute model for supporting graduates from the region through scholarships and a summer internship programme. It is recommended to explore a potential relationship with Mātai for building on the model they have already established.

7. Note that the success of all of the above is linked to there being visible role models and opportunities for careers in this field in the region. The development of a proposed hub and aerospace initiatives in association with Gisborne Airport[1] would provide tangible and visible evidence that aspiring to careers in this field is a reality for local people. The Mātai model has achieved exactly this for the field of neuroscience and advanced medical imaging.

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[1] Aerospace Tairāwhiti Business Case, (Potter, 2023) and Aerospace Infrastructure Report, (Lamb, 2024)

Introduction

The aerospace industry presents an opportunity for future growth and development in the Tairawhiti region, but to fully realise this potential we need an informed and future-ready workforce.

Aerospace encompasses both space and advanced aviation activities, according to the recent eponymous New Zealand Government strategy for 2024-2030.[2] The space sector relates primarily to vertically launched rockets and satellite capabilities that reach Earth's orbit and beyond, whereas advanced aviation may cover a range of activities and technologies including a variety of Unmanned Aerial Systems (UAS) and aircraft, the majority of which can be runway launched, and fly at a range of altitudes from low-level drones to innovative craft that can operate at the outer edges of the earth's atmosphere.

The national strategy sets out a bold vision for positioning New Zealand firmly on the world stage in both space and advanced aviation and includes a goal to "Build an aerospace-capable workforce", noting the need to develop a skilled local workforce to meet the demands of this growing industry.

The Tairāwhiti Aerospace Business Case (Potter, 2023) lays out the economic and societal case for the development of a regional aerospace industry and associated capabilities. That report highlights the potential for growth of a regionally-based workforce to meet the demands of the industry, and an opportunity to develop career pathways for local people, especially youth, to develop skills and take on roles that become available in this field.

In particular there exists the possibility to provide a new range of exciting and fulfilling career pathways for Māori and Pasifika rangatahi that would enable them to remain connected to their whenua and whānau, whilst still meeting their own aspirations.

This paper seeks to address questions in three core areas that arise from the vision outlined in the Potter report:

- What is the spectrum of job roles and workforce skills base that will be required as the aerospace sector continues to grow in Aotearoa? Can we estimate the numbers that will be required? What are the opportunities for Tairāwhiti graduates who want to stay in the region?

- How well prepared are the region's school graduates to be successful in applying for and taking up roles in the aerospace industry? Is there a projected shortfall in numbers, and if so in what areas? What does the education to career pipeline look like in Tairāwhiti? Are there gaps and barriers to student progression in STEM generally and aerospace in particular?

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[2] A strategy to support the growth of our space and advanced aviation sectors | Ministry of Business, Innovation & Employment

- If gaps and barriers are identified, what can be done to improve the situation, to nurture and grow a nascent regional aerospace workforce, and to put these opportunities in reach of local rangatahi? What is the best approach for the Tairāwhiti context?

Part 1: Industry segmentation and career opportunities within the aerospace industry in Tairāwhiti and Aotearoa

The aerospace sector is a growing and dynamic industry with applications in both civilian and military aviation, space exploration, and related technologies. It encompasses a range of segments that are often interconnected but distinct in terms of technology, expertise, and workforce requirements.

The most recent and comprehensive overview of the aerospace industry in New Zealand is a Deloitte report commissioned by MBIE in 2019. That report provides a segmentation of the aerospace industry that follows established international convention. The high-level industry segments are represented in the schematic below:

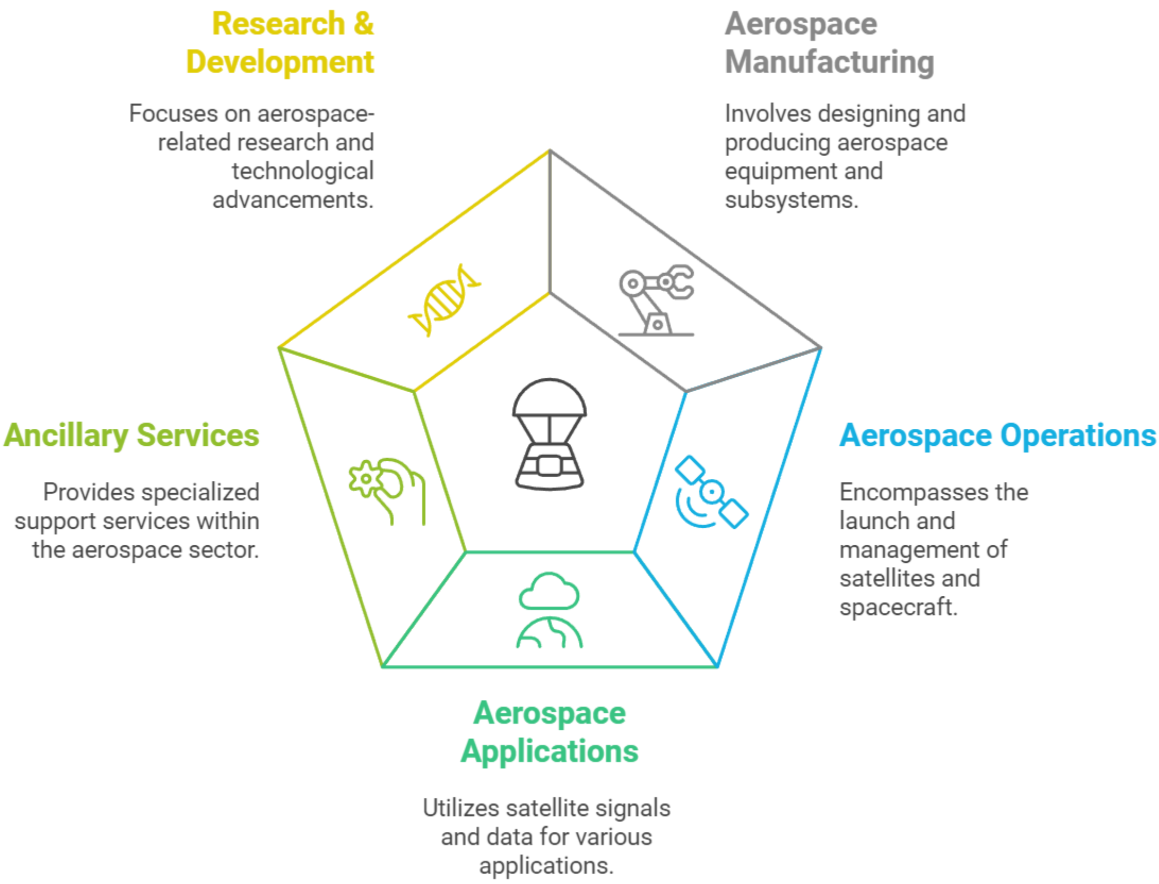


Figure 1: Industry segmentation of the NZ aerospace sector. Adapted from: Deloitte Access Economics, 2019

It should be noted that the definitions in the Deloitte report focus much more on the 'Space' component, rather than the 'Advanced Aviation' component. This potentially reflects an underlying shift in the overall shape of the industry in NZ since 2019 when the Deloitte analysis was undertaken. In the above diagram and the definitions used throughout this report, whilst we have used the same basic segment characterisation that was used in the

Deloitte report, we have broadened the definitions from space, to aerospace, in order to reflect the current landscape which favours more emphasis on the advanced aviation aspect of the strategy.[3]

1.1 Aerospace Manufacturing Sub-sector

This industry segment is concerned with the design and manufacture of space equipment and systems including launch vehicles, satellites and ground equipment. Organisations operating in this segment are either responsible for complete assembly of flight systems or act as systems integrators for space and ground sub-systems. Traditionally this area has been dominated by large companies with government contracts (especially in defence) such as Boeing, Airbus, Lockheed Martin. Newer commercial players in this space include vertically-integrated manufacturing and operations companies such as RocketLab and SpaceX. A range of innovators in the advanced aviation sector in New Zealand, which include Dawn, Kea and others, are also operating in this sector.

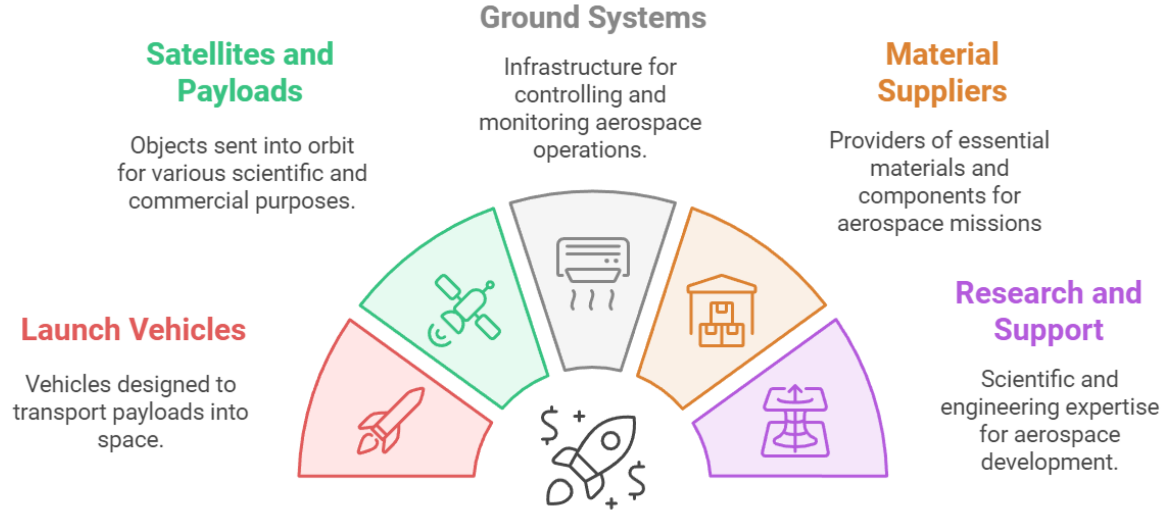


Figure 2: Aerospace Manufacturing Sub-sectors

Some of the key job roles in Aerospace manufacturing are outlined below.

Aerospace Engineering
The aerospace manufacturing segment is dominated by specialist engineering roles. These include:

- Aerospace manufacturing engineer
- Satellite systems engineer
- Propulsion engineer
- Software Engineer
- Spacecraft / Aircraft structural engineer
- Quality assurance / Test engineer
- Unmanned Aerial Systems (Drone) Engineer

[3] Plans to build rocket launchpads at Kaitorete Spit fail to get off the ground | RNZ News

These are highly technical and specialised roles requiring at minimum a Bachelors degree in aerospace engineering, mechanical or electrical engineering, robotics and computing, computer science, or control systems engineering. Advanced computing skills are an integral part of these engineering disciplines. Many roles will also require additional postgraduate qualifications in a relevant field.

RocketLab currently remains the predominant advertiser of roles in this field in NZ across the various engineering disciplines outlined above. [4]

Manufacturing Technician
Manufacturing technicians support the assembly, installation, and testing of spacecraft and space-related components. This role involves working with hardware and computer aided design and manufacturing systems, ensuring that all components are properly constructed and aligned.

The skills required for these roles would include:

- Practical knowledge of space hardware assembly techniques, including soldering, welding, and the use of precision tools.
- CNC machining and 3D printing
- Understanding of aerospace system integration, Computing hardware, wiring, and troubleshooting.
- Ability to conduct quality control checks and ensure systems meet operational standards.
- Familiarity with safety protocols and procedures specific to aerospace and space environments.

Whilst a Bachelor's degree or Certificate might be advantageous in these roles, more emphasis would be placed on vocational training and experience in high-precision manufacturing environments.

Specialist machining shops catering to the aerospace sector are beginning to appear in New Zealand. One such company: United Machinists in Dunedin, was highlighted at the 2024 Aerospace Summit. The CEO Sarah Ramsey highlighted the value of trades apprenticeship pathways in this area.[5]

Supply Chain and Logistics Management
This role involves overseeing the procurement, supply chain management, and distribution of materials needed for space manufacturing. Aerospace manufacturing requires highly specialized materials, and this role ensures the right components are delivered on time and within budget.

The skills in this area emphasise:

- Strong knowledge of supply chain logistics and inventory management, specifically in technology industries.
- Experience managing vendor relationships, contracts, and procurement.

[4] Rocketlab is advertising 10 jobs on Seek in this area at the time of writing 26/11/24.
[5] https://www.unitedmachinists.co.nz/

- Understanding of global aerospace standards and regulations for materials.
- Proficiency in supply chain software and project management tools.

Whilst a Bachelor's degree in **logistics**, **supply chain management**, **business administration**, or **engineering** may be helpful, experience in technology or aerospace supply chains, with knowledge of aerospace materials and components is potentially more relevant.

1.2 Aerospace Operations Sub-sector

The **aerospace operations sector** focuses on the management and execution of space missions, satellite operations, space station management, mission control, and ground operations. This sector is vital for ensuring that space-based systems and missions run smoothly, safely, and effectively, whether for scientific, defense, or commercial purposes.In New Zealand, this sector is for the most part concerned with satellite operations (Deloitte, 2019) and Rocketlab is the principal employer at present.

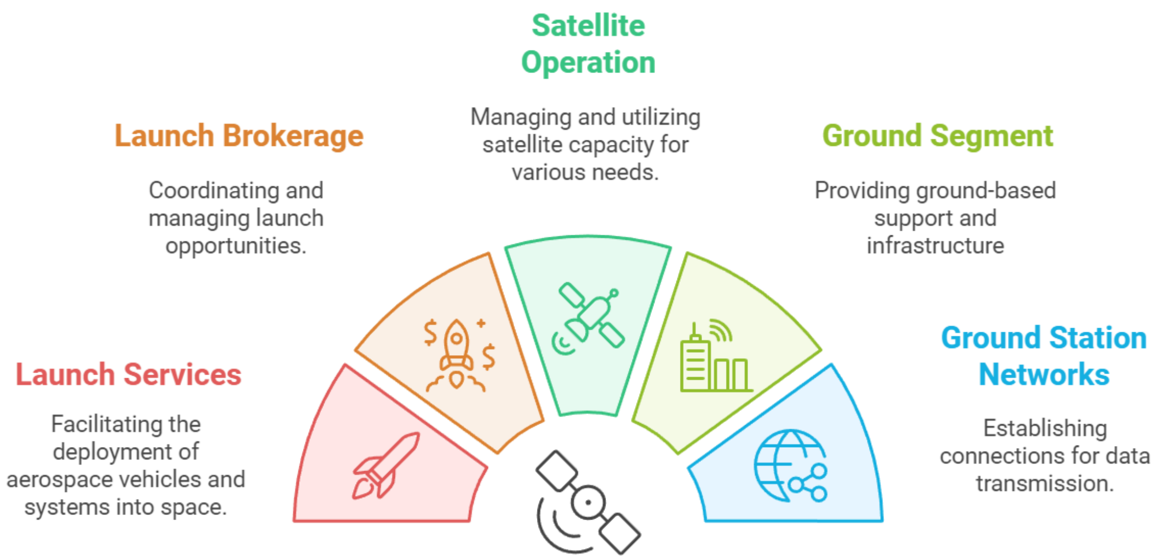


Figure 3: Aerospace Operations Sub-sector

Key roles in this segment include:

Aerospace Operations Manager
This role oversees the planning, execution and coordination of space missions and related activities. They manage teams involved in mission control, spacecraft operation and ground support, ensuring that missions run efficiently, safely and in compliance with regulations.

Mission Control
These specialists are responsible for overseeing and managing the real-time operations of space missions. This includes monitoring spacecraft, satellites, or space station activities, managing mission parameters, and ensuring that all operations are executed correctly from launch through to mission completion.

Spacecraft Operations Engineer
Spacecraft operations engineers ensure that spacecraft (such as satellites or space probes) are operating according to their mission objectives. They analyze spacecraft health, troubleshoot problems, and ensure that spacecraft are properly aligned with mission goals.

Launch Operations
Launch operations specialists focus on the planning, scheduling, and execution of rocket and spacecraft launches. They are involved in preparing spacecraft, conducting pre-launch checks, coordinating launch teams, and ensuring that launches proceed according to plan.

Space Communications Specialist
Space communications specialists manage the communication systems for spacecraft and space missions. This role involves ensuring continuous and reliable communication between mission control and spacecraft, monitoring communication signals, and troubleshooting when problems arise.

Other roles would include **Operations Analysts** who analyse mission data, assess spacecraft performances and provide recommendations for mission optimisation, and **Operations Safety Officers** who ensure the safety of all space operations, assess hazards and implement safety protocols and standards

1.3 Aerospace Applications Sub-Sector

This sector is concerned with the application of space-derived data to solve non-space problems. This can include remote sensing data, satellite navigation data (e.g. GPS), Broadcasting services, satellite communications and many other applications.

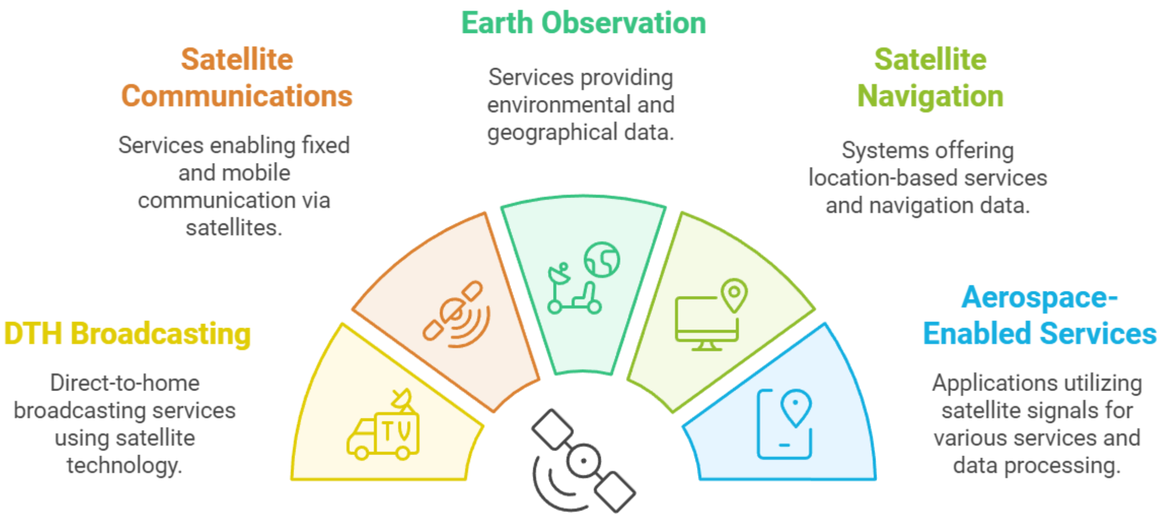


Figure 4: Aerospace Applications Sub-sector.

Space-based services may be applied to agriculture, transportation, entertainment, climate-change and defence applications. Organisations involved in this sphere are as likely to come from non-space backgrounds, as to be companies whose core purpose is associated with space, (Deloitte, 2019).There are a variety of job roles and specialisations available, including many in the software engineering and data science specialisations.

Amongst the specialisations in this sector are those typical of the digital technology industry with some additional key aerospace specialisations:

- Software engineer
- Software architect
- Data architect
- Machine learning engineer
- Data scientist
- Technical programme manager
- Communications and signal processing specialist
- Geospatial data analyst
- Business analyst
- Test analyst
- Technical writer

These skills areas are highly relevant to the current paper since many of them are transferable across industries and may attract Tairāwhiti applicants to either stay in the region or return to the region if companies have a local base.

1.4 Ancillary services

In addition to the core aerospace-oriented roles described above, there are a range of ancillary services associated with the industry that draw on professional expertise in other areas. These are captured in Figure 5 below.

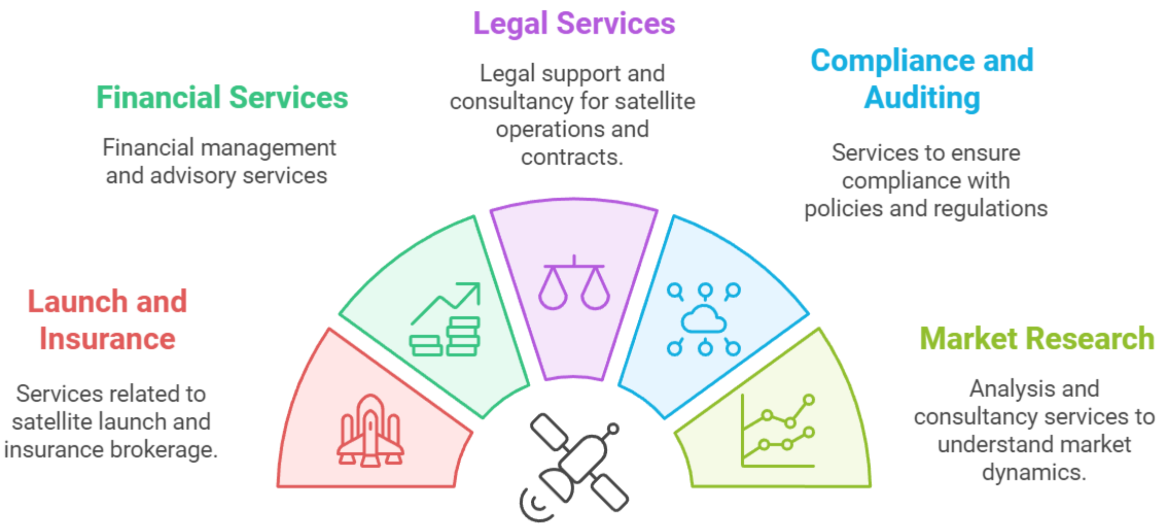


Figure 5: Ancillary services

1.5 Research and Development

New Zealand has a strong research and development focus in New Zealand. Both Auckland university and Canterbury university offer strong programmes in aerospace engineering and related disciplines with doctoral research programmes and the ability to attract international funding.

Figure 6: Components of Research and Development Activity

1.7 Size of the opportunity for employment in the NZ Aerospace Economy

The Deloitte report from 2019 states that the space economy in New Zealand supports approximately **12,000 full-time equivalent roles** (FTEs). Of these around 5,000 FTEs are directly employed within the space economy and 7,000 by sectors that provide services to the space economy.

Thus Space Manufacturing, Space Operations and Space Applications would be direct employers, whilst ancillary services and government for example would constitute indirect employment opportunities.

The breakdown of job numbers by industry sub-sector from that study is reproduced below:

Table 1: space-economy job numbers and relative proportion in each sub-sector

Sub-sector	FTE jobs (2019)	% of FTE jobs

Space Manufacturing	1,417	28%
Space Operations	1,223	24%
Space Applications	1,579	32%
Ancillary Services	415	8%
Research and Development	415	8%
Total	**5,048**	**100%**

Source: Deloitte Access Economics, 2019

The figures above provide some indication, but necessarily only provide a retrospective snapshot and do not constitute a forward projection. Furthermore they are based on assumptions that may not continue to hold in the years to come. However what can be gleaned from these figures is that the largest areas of opportunity for the Tairāwhiti region would be in space manufacturing and space applications, and the Deloitte report suggests this is also true of New Zealand more generally.

Aerospace operations jobs are predominantly with Rocketlab, which is now an international public company headquartered in the US, and able to draw from an international talent pool. The NZ Defence Force also provides a significant employer. There are operations jobs with smaller advanced aviation companies and a small number of roles in academia (e.g. the Auckland University Space Institute), but a review of the aerospace operations category on the Seek website at the time of writing indicates that, compared to Rocketlab, they are relatively few[6]. Moreover many of those listed that are not with Rocketlab are traditional aviation jobs, rather than advanced aviation.

Again, it must be emphasised these are point in time observations, but taken together they suggest that the main areas of opportunity in the Tairāwhiti region are Aerospace Manufacturing and Aerospace Applications, along with some Research and Development potential.

Within aerospace manufacturing, there are two main pathways that are evident. The first is an **Aerospace Engineering** pathway. This would attract students who excel in Mathematics, Computer Science, Physics and Chemistry and who have a core interest in both Aerospace and Engineering. The second is a **Fabrication / Manufacturing Technician** pathway. This is still highly-skilled, but less academically specialised than aerospace engineering and would potentially appeal to a greater range of students for whom hands-on work with 3D printing, electronics, CNC machining technologies are appealing.

Within aerospace applications there are a wide-range of specialisations and opportunities that are possible. Most of these have a common root in computer science, software

[6] https://www.seek.co.nz/aerospace-operations-jobs

development and data science. We characterise them here as **Software Engineer and Data Scientist**

These career pathways are the core aerospace opportunities explored in the remainder of this paper.

Part 2: The Education Context in the Tairāwhiti Region

2.1 Educational Ecosystem

The current educational ecosystem in the region includes a variety of state-funded, community and private providers. Each of these has an important role to play in a future-focussed model for preparing students to take up opportunities in the aerospace sector specifically and in STEM roles more generally. In this section we identify the key organisations relevant to the current study.

Schools and Kura

Schools and kura are the principal providers of education for school age children in New Zealand. Under the Education and Training Act, 2020, it is mandatory for children to attend school between the ages of 6 and 16. Secondary and Composite schools in the state system cater for students up to year 15, although the majority finish after year 13 or earlier.

Because the focus of this report relates to career pathways in post-secondary education, we include in this study schools that cater for secondary students (up to year 15). The schools and kura included, are outlined in Table 2:

Table 2. Tairāwhiti Schools and Kura included in the study

School name	Location	Years	No. Students yrs 11-13 (2023)	School roll for 2023
Campion College	Gisborne City	7-15	175	461
Gisborne Girls High School	Gisborne City	9-15	371	719
Gisborne Boys High School	Gisborne City	9-15	402	799
Lytton High School	Gisborne City	9-15	347	623
Ngata Memorial College	Ruatoria	1-15	37	109
Tolaga Bay Area School	Tolaga Bay	1-15	75	279
Te Karaka Area School	Te Karaka	1-15	11	95
Te Kura Kaupapa Māori o Kawakawa mai Tawhiti	Hick’s Bay	1-15	23	134
Te Kura Kaupapa Māori o Horouta Wananga	Gisborne City	1-15	12	152
Te Kura Kaupapa Māori o Nga Uri A Maui	Gisborne City	1-15	28	228
Te Kura Kaupapa Māori o Te Waiu o Ngati Porou	Ruatoria	1-15	24	112

Te Waha o Rerekohu Area School	Te Araroa	1-15	21	88
Manutuke School	Manutuke	1-15	0	138
Totals			1526	3937

Note: Data sourced from Education Counts website, Ministry of Education.

School Gateway Programmes
School Gateway programmes are an important vehicle within schools to provide students with the opportunity to complete a work placement in a trade/vocation that they choose, and to complete industry qualifications or NZQA-recognised standards. The Gateway programme is set up and funded by the Tertiary Education Commission (TEC). A well-functioning Gateway programme is an integral part of the secondary-tertiary or secondary-workplace transition stage.

Tōnui Collab Charitable Trust[7]
Tōnui Collab is a specialist STEMM (Science, Technology, Engineering, Maths and Mātauranga Māori) education partner dedicated to creating innovative reo rua / dual language STEMM learning opportunities for learners in Te Tairāwhiti. Rangatahi are invited to explore the diversity of STEMM through experimentation with animation, engineering, 3D design, robotics, coding, game development, virtual reality and other activities.

Tōnui Collab can provide offerings for learners of any age, but is particularly well-suited to cater for years 7-8 and 9-10. Tōnui Collab also collaborates with teachers to support the impactful adoption of digital technologies. Through professional learning and development partnerships, teachers are supported in developing the confidence to introduce emerging technologies into contemporary learning environments.

Taike E![8]
Taike E! Is an innovative community organisation, built on kaupapa Māori principles, that occupies a unique position in the region’s education ecosystem. It provides a collaborative space realising the concepts of whakawhanaungatanga and manaakitanga in a social entrepreneurship context as an *Aroha Economy*. The whare is equipped to support projects in hi-tech fabrication and proto-typing with 3D Printing, laser-cutting tools, high-speed internet, computing workstations and more. Also there is a wealth of expertise in the community to support learners. The most important aspect, however, lies in the culture of the organisation, which is ideally placed to nurture regional talent in both technical and the soft skills that are essential to thrive in the workplace.

Eastern Institute of Technology (EIT)[9]
Eastern Institute of Technology (EIT) EIT is the primary Tertiary Education provider operating in the region, with a campus in Gisborne. EIT offersTrades Academy Computer Technology L2 and L3 free certificates for years 11-13 (L3 gain UE credits that will enable students to

[7] TŌNUI Collab | STEMM* Workshops
[8] Tāiki e!
[9] Study Programmes & Courses | Eastern Institute of Technology

enter the Bachelor of Computing Systems). It also offers L2: Robotics, and L3: Drone Programmer in Python. Within these programmes, students develop a prototype considering fitness for purpose in the broadest sense. They use complex techniques to develop an electronic outcome and complex programming techniques to develop a computer program.

Students can also take bachelor's and master's degree programmes in computing, information systems, and other related areas.
Recently, a computing lecturer, Dr. Anastasia Mozhaeva, obtained principal approval to be a supervisor and offer PhD research positions based locally with accreditation through Waikato University.

Mātai Research Institute[10]
Mātai is a world-leading medical imaging research institute. The institute's website describes Mātai as "a research, education and innovation institute located in Tairāwhiti Gisborne, New Zealand". The core focus of Mātai is to enhance the capabilities of medical imaging through advanced software, post-processing techniques, and artificial intelligence. By doing so, Mātai seeks to advance preventative and predictive approaches through medical innovation and discovery. The strength of Mātai lies in the creativity, expertise, and collaborative efforts of its team. Positioned as a leader in medical research, Mātai drives innovation and strives to make a lasting impact on healthcare, social issues, education, and economic outcomes."

Mātai provides an important context for the current study, since the story of its contribution to the awareness and consequent aspirations of local rangatahi in the fields of neuroscience, advanced computation and bio-medical engineering has been highly influential, and provides a model of success in both attracting world leading research and funding to the region, whilst at the same time providing engagement opportunities and opening career pathways for local students through their internship and scholarship programmes.

2.1 STEM Participation in the Tairāwhiti region

One of the key aspects of preparedness for entry into careers in the aerospace sector is taking STEM options in years 11-13. This opens up both university entrance and workplace training opportunities with a science and technology foundation.

Engagement with STEM subjects at school has two different dimensions. On the demand side participation can be assessed as numbers of students enrolling in STEM subjects. Whilst on the supply side, we can look at the variety of STEM subjects offered in schools.

Table 2 shows aggregated enrolment in a variety of STEM subjects at years 11-13 as both total number of students, and as a percentage of the total population of year 11-13 students. The data source is the education counts subject enrolment pivot table for 2023[11]. For the Tairāwhiti schools the proportion represents a percentage of the total number of year 11-13 students in the five schools outlined in Table 1 (as taken from the school roll data), whereas for the national figures, all schools in Aotearoa are used. This enables a direct comparison of the proportion of Tairāwhiti students taking each subject, with the national proportion, irrespective of the difference in the total numbers.

[10] Mātai Medical Research Institute – World leading research through MRI
[11] https://www.educationcounts.govt.nz/statistics/subject-enrolment

Table 3:Enrolments in STEM subjects in Tairāwhiti and Nationally for years 11-13.

STEM Subject	Tairāwhiti Total	National Total	Tairāwhiti %	National %
Agriculture / Horticulture	64	7362	4.1	4.4
Computer Science / Programming	27	3362	1.7	2
Design, Drawing and Graphics	90	7831	5.7	4.7
Earth Science / Astronomy	7	2432	0.4	1.4
Materials Technology	221	15970	14.1	9.5
Mathematics	744	92287	47.6	54.9
- Maths with Calculus	151	14080	9.6	8.4
- Maths with Statistics	276	27582	20.3	16.4
Science	532	51682	34	30.7
- Biology	202	32711	12.9	19.5
- Chemistry	130	26609	8.3	15.8
- Physics	144	27117	9.2	16.1
Technology	106	10412	6.8	6.2

Note: For the purposes of calculating percentages, the population of Tairāwhiti year 11-13 students is taken to be 1564; for the national population, the figure used is 168,160.[12]
Note: The science sub-disciplines are predominantly only offered in year 12 and 13 in Tairāwhiti, but nationally students take these subjects from year 11, thus skewing the relative percentages for these subjects.

Key points from Table 3:

- Enrolment in the main STEM subjects (Maths, Science and Technology) in Tairāwhiti is closely matched to national participation.
- Enrolment figures are substantially higher regionally in materials technology. It is also higher in the advanced maths categories.
- Participation is somewhat lower than the national average in the individual science disciplines.[13]
- Uptake of computer science as a subject in school, both nationally and regionally is very low.

Provision of STEM subjects in the Tairāwhiti schools

[12] Source: https://www.educationcounts.govt.nz/
[13] See note above

There are a number of subjects in the national dataset that do not appear to be provided in the bulk of Tairāwhiti schools, or at least have no or very few students actively enrolled if they are. These include: computer studies, digital technology,information and communication technology, electronics and control. However these subjects for the most part have small national enrolments, so may only be available in private schools, Te Kura, or other specialist provision. Also, some subjects that are offered in Tairāwhiti schools do not appear in the dataset. For example mechanical engineering is in the curriculum for Gisborne Boys High School[14].

However taken as a high level picture, the region is at least on a par with national uptake of STEM subjects in years 11-13.

STEM participation for Māori and Pasifika students.
Māori and Pacific ethnicities are chronically under-represented in STEM employment positions in universities and crown research institutes. A 2020 study found that less than 5% of the FTE academic staff in science faculties across all eight NZ universities were Māori between 2008 and 2018[15]. The study reports a similar percentage for Māori scientists employed in crown research institutes. A similar pattern of results was also reported for Pasifika staff. Against this backdrop, with a paucity of identifiable role models in the sector, It is not surprising that many Māori and Pacific rangatahi do not feel that STEM disciplines have anything to offer them[16].

Unfortunately the subject enrolments pivot table from Education Counts that was used to provide the data on students subject enrolments does not capture ethnicities in order to view percentages of Māori and Pacific students enrolling in these subjects from the same dataset. Even so, it is clear that there is a need to pay particular attention to increasing the attractiveness of STEM pathways for these students. Nationally, the Pūhoro STEMM academy has had a significant impact in this space[17], although there is no representation at this time in the Tairāwhiti region. Locally, however, all of the organisations mentioned in this section (Tōnui Collab, Taike E! And Mātai Research) purposefully, as part of their kaupapa, create environments that foster STEM engagement by Māori and Pacific students.

2.2 School Leavers Academic Achievement

A second key factor for entry into a substantial segment of aerospace industry roles currently is academic achievement. Some roles (such as the majority of engineering positions) require a specific university degree (Level 7 or higher), others (such as Fabrication and Technician roles) would typically require new entrants to meet the minimum requirements for NZ University Entrance (UE), or NCEA Level 3.

In this section we provide a snapshot based on the 2023 school leavers dataset for the following Tairāwhiti schools.

Table 4: Summary of Leavers data for 2023 from selected Tairāwhiti schools

[14] https://www.gisboyshigh.net/school-info/curriculum
[15] https://pubmed.ncbi.nlm.nih.gov/39440013/
[16] Maria Jefferson, Gisborne Boys High School, personal communication
[17] https://www.puhoro.org.nz/

School	School Roll	% with L3 or above	% with UE	%Retention to age 17	%Progress to degree L7+ (2022)
Campion College	461	50	43.1	86.2	28.4
Gisborne Girls High	719	50	35.1	75.7	32.7
Gisborne Boys High	799	38.9	25.4	70.8	16.5
Lytton High	623	30.1	5.9	60.8	9.2
Ngata Memorial College	109	45.5	18.2	72.7	4.8
TKKM o Kawakawa mai Tawhiti	134	46.2	30.8	53.8	7.1
Tolaga Bay Area School	279	22.6	9.7	51.6	16.7
Te Waha O Rerekohu Area School	88	15.4	0	76.9	0

Note. National average UE% is 37.8

These data show that despite approximately 73% of Tairāwhiti students staying at school until at least age 17, 43% leave with L3 or above, 26% leave with the minimum requirements for university entrance, and 18% progress to degree or above (L7+).

2.3 Size of the Opportunity

The figures above provide information about proportions, but a key determinant of the most effective approach to nurturing and developing the regional workforce depends on the total numbers involved. How many students annually from this region may be eligible for (and have an interest in) the various segments of the aerospace industry. The data in this section provide some approximations from which estimates can be drawn.

The table below summarises the regional school leaver attainment data:

Table 5: Numbers of Tairāwhiti leavers at each attainment level 2023

Attainment Level	Total number of school leavers at each level 2023
UE	152
L3	119
L2	178
L1	95
Below L1	160

These data give an indication of the total number of students likely to consider career pathways requiring university degrees, such as aeronautical engineering, and those that might prefer vocational pathways.

2.4 Leavers Data for Māori and Pacific Students

One of the objectives of this report is to examine how to provide opportunities in this industry sector for Māori and Pacific rangatahi. Nationally, Māori and Pacific learners make up approximately 38% of the school population, whereas in Tairawhiti the figure is 76%[18]

Table 6: Attainment of Māori and Pacific Students in Tairāwhiti in 2023

Attainment Level	Total number of school leavers at each level 2023
UE	75
L3	94
L2	137
L1	79
Below L1	151

Summary of key points from this section:

- Tairāwhiti has a similar STEM engagement profile for years 11-13 to the national picture
- STEM engagement is highest in Maths (41%) and Science (31%).
- Computer science is very low (~2%) both regionally and nationally. Anecdotally this is due both to lack of provision in schools, and failure of students to sign up for these options if they are made available.
- The region has a much higher proportion of Māori learners than the national average.
- 154 students attained University Entrance requirements in the region in 2023. If 10% of UE students could be attracted to aerospace, then that would be 15 students suitable for the higher qualification career pathways such as aerospace engineering requiring a bachelor's degree or higher. Providing support for this estimate, Boys High School produce about 12 -15 students who go on to begin Engineering degrees after gaining UE annually. Based on this figure, Boys High School currently provides the vast majority of engineering students in the region[19].
- Approximately 300 students attain L2 and L3 combined. Assuming 10% potential uptake results in around 30 students that may be candidates for vocational training or apprenticeships into aerospace careers
- These numbers are important inputs to any proposal for initiatives to support educational pathways into the aerospace workforce.

[18] Note this figure uses total response ethnicity in the count from the leavers table in education counts. This may lead to a slight inflation of the numbers of selected ethnicities, however it is noted as the preferred way to calculate the total.

[19] Personal communication with Maria Jefferson, Boys High School.

2.5 Summary of the Estimated Opportunity

Based on the information collated in this section, the table below provides an overview of the main areas of opportunity in career pathways, the qualifications requirements, and an estimate of both the number of potential candidates from the region, and estimate of the current numbers of graduates pursuing these career pathways in aerospace.

It is important to emphasise that these numbers are speculative since data about where graduates from the region have gone on to work is lacking. There is currently a parallel Trust Tairāwhiti workforce study examining this question. The primary reason for inclusion here is to help determine the most effective and feasible educational approach. For example if there is a potential pool of three students annually for aerospace engineering, then individually tailored financial and educational support would be most appropriate. On the other hand if there are fifty students, then an academy might be more appropriate.

Table 7: Estimated numbers of potential candidates in each of the career pathways identified.

Career Pathway	Example Qualifications Requirements	Potential Total	Current Estimate
Aerospace Engineering	Bachelors in Electrical Engineering or related discipline; Masters in Aerospace engineering	10-15	3-5
Aerospace Fabrication (3D Printing, CNC Machining, Computer Aided Design and Manufacture).	Degree, Diploma or Certificate in Computer Aided Design, Materials Science, Engineering or Similar. Or Industry apprenticeship and qualifications if available.	20-30	<5
Software Engineering and Data Science for Aerospace Applications	Degree, Diploma or Certificate in Computer Science, Computer Engineering or Data Science. Or Industry apprenticeship and qualifications if available	20-30	<5

Note 1: Not all Tertiary qualifications are outlined, many variations are possible, these are indications only for establishing level of proficiency

Note 2: Potential numbers are estimates of the maximum number of students that could be attracted to pursue careers in these roles. Actual numbers will always be less than the potential maximum as students' interests change and they take other paths.

Based on the estimates in table 7, it is likely that a differentiated approach will be most effective. Aerospace engineering has a considerably smaller pool of candidates that may be effectively supported through scholarship and internship opportunities during the secondary to tertiary transition to take up university places due to the highly specialised nature of the discipline.

The fabrication, software engineering and data science pathways, however, offer the opportunity to grow a workforce locally through existing provider channels using a pipeline approach.

These options and the key considerations for developing a successful educational pipeline are addressed in the next sections.

Part 3: Designing a Regional Education Model to Support Career Pathways into Aerospace for Tairāwhiti Students

There are typically considered to be three main components, when thinking about education systems architecture. In figure 7, these are denoted as:

The organisation and delivery model. This refers to the mechanism for delivery of the education programme, in other words 'how' it is to be delivered. It might be a school, or a dedicated academy, or a collaboration between institutions, or an online, distance programme for example. Each of these options is a conscious design choice which has specific advantages and disadvantages depending on the situation

The Curriculum. The curriculum refers to 'what' is going to be taught. Schools in Aotearoa can develop their own curriculum, guided by the New Zealand Curriculum (NZC) and/or Te Marautanga o Aotearoa. This model allows some flexibility, although at secondary level, it is often constrained in practical terms by the assessment framework of NCEA (see below). That said there are several examples of innovative approaches to secondary curricula, even at a senior secondary level. One such example is Albany Senior High School[20]. One often-acknowledged problem in traditional school curricula is that knowledge is artificially separated into subjects. This is no doubt a convenient way to teach and assess, but arguably inhibits the development of integrative, cross-disciplinary thinking that is valued in research and design fields. Impact projects, after-school clubs, and the use of 3rd party specialist providers (such as Tōnui Collab) can extend the core curricula offered within school settings.

The Qualifications Framework. The qualifications framework refers to how knowledge and / or proficiency are assessed in the education system. The most common secondary schooling qualifications framework in New Zealand is NCEA (National Certificate of Educational Achievement) and is managed by the New Zealand Qualifications Authority (NZQA). NCEA has three levels of certification: 1, 2 and 3. It has the advantage that it is widely recognised by New Zealand Tertiary providers and employers, but has the downside that it is rather inflexible and constrains what gets taught in schools as a result. NCEA has also come under criticism for an over-reliance on internal assessment options which inherently lack the consistency and rigour of external exams. The counter argument is that externals favour students who perform well in examinations. An emerging alternative or adjunct to a national qualifications scheme like NCEA is provided by microcredentials (digital badging) schemes.

[20] https://www.ashs.school.nz/overview/

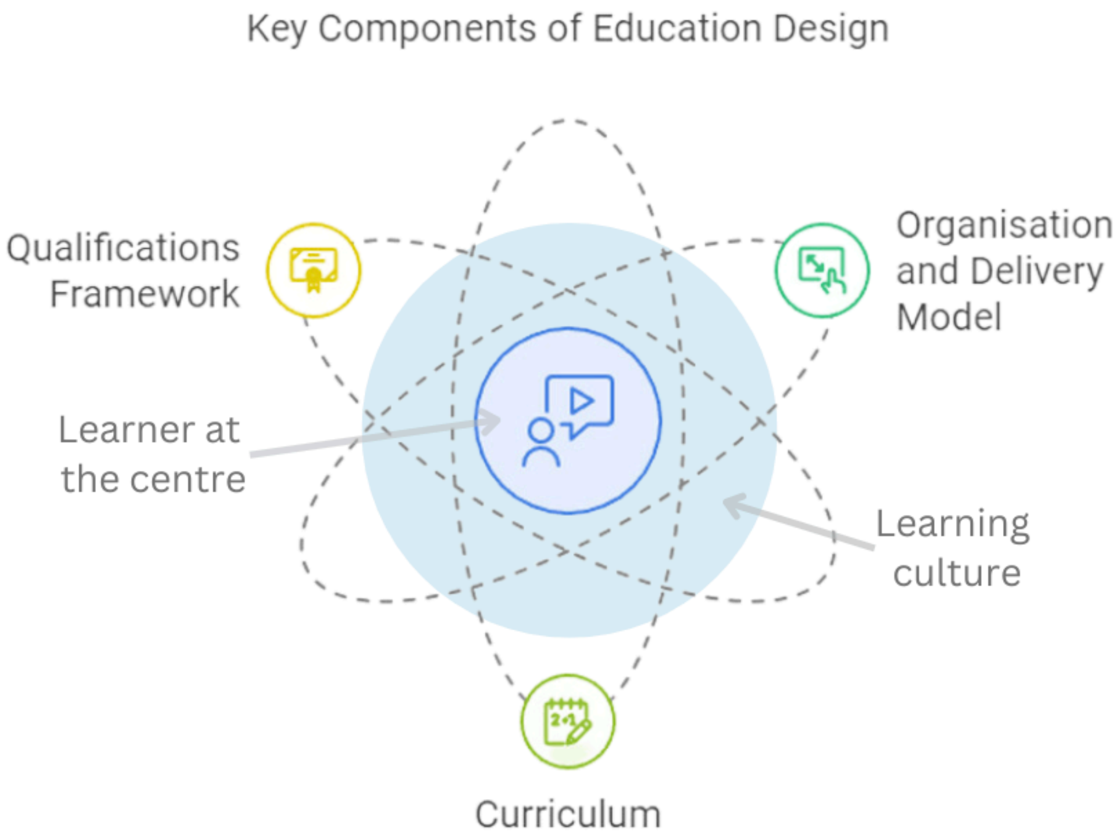


Figure 7: education system components

Using this framework leads to a number of questions to ask in relation to whether the current situation is optimised or whether there are some aspects that could be improved:

- Is the organisation model working well? Is it imposing unnecessary barriers or constraints on what or how students learn? Are there sufficient teachers? Are there timetabling reasons why some subjects or combinations are not available? How could these be addressed? Is online delivery an option? Are there gaps in the pipeline as students progress through the system?
- Is the taught curriculum fit for purpose? Is it engaging students and making sense to them? How could it be improved or extended to meet goals and industry needs?
- Is the qualifications framework fit for purpose? Does it impose barriers or constraints on students? How could it be improved?

These questions are addressed in more depth later in this section. First, however, there are two additional elements in the diagram: The learner at the centre, and around that the learning culture. These elements are addressed in the sections that follow.

3.1 Learner at the Centre

Traditional program design typically treats learners as passive recipients of standardized content, generally following an instructor-led model where knowledge is transmitted in a uniform manner regardless of individual differences.

In contrast with this, learner-centric design recognises each learner as a unique individual with distinct learning needs, capabilities, and contexts, transforming education from a one-directional information transfer to a dynamic, personalized, and adaptive learning experience that actively responds to and supports the specific requirements, preferences, and potential of each learner.

Learner-centric design is an educational philosophy and approach that places the individual learner at the core of the educational experience, fundamentally shifting away from traditional teacher-centered or content-centered models of instruction. In the context of distance and online education, this approach becomes particularly crucial due to the unique challenges and opportunities presented by digital learning environments.

The emphasis on learner centric design in the proposed aerospace programme will be essential if it is to succeed in attracting and meeting the needs of a diverse learner group.

Key Principles of Learner-Centric Design:

1. Personalisation and flexibility - the cornerstone of learner-centric design is recognizing that each learner has unique:
   - Learning styles
   - Prior knowledge
   - Personal goals
   - Time constraints
   - Technological capabilities

In the design of distance and online learning, this translates to:

- Adaptive learning paths
- Modular course structures
- Multiple content delivery formats (video, text, interactive modules)
- Self-paced learning options

There are a number of key challenges to be considered when implementing a learner-centred design approach. Firstly, it requires significant instructional design expertise that can't be assumed of someone with classroom teaching experience. Second, it demands robust technological infrastructure that will allow for the personalised access to and engagement with learning content. In addition, a learner-centred approach can be more resource-intensive in its initial development, and require ongoing iteration and improvement in response to user feedback.

By embracing learner-centric design in distance and online educational programmes, institutions can create more engaging, effective, and meaningful learning experiences that truly meet the diverse needs of modern learners. Further, such programmes provide for a greater degree of scalability and sustainability once they have been established.

3.2 Learning Culture

The concept of 'learning culture' encompasses the entire ecosystem surrounding a learner's educational journey, extending far beyond traditional notions of classroom or digital learning spaces. It represents a complex, interconnected web of physical, social, technological, and psychological factors that collectively shape a student's ability to learn effectively.

Key components of learning culture include the social and human network supporting learning, for example family understanding and encouragement; the availability of peer support networks; mentorship opportunities and the cultural attitudes towards education that are present in the learner's context.

The physical environment is also important here, and may critically impact learning potential. This includes things such as having an appropriate desk and chair, together with lighting and ventilation, adequate acoustics that are conducive to learning.

Whether learning occurs in school, at home or in other community contexts, access to and the quality of technological resources is important, including reliable internet connectivity, appropriate digital devices and availability of tech support as required.

Less tangible, but crucial to learning are the psychological and motivational factors including the degree of agency the learner has to make choices in their learning, stress management capabilities, sense of belonging and psychological safety and personal and cultural expectations about learning.

Central to understanding the importance of addressing the learning culture is recognising the inherent inequities that exist for many learners. Students are not starting from a level playing field due to variations in:

- Socioeconomic background
- Family educational history
- Technological access
- Access to learning opportunities
- Physical living conditions
- Support networks
- Cultural capital

Practical strategies for addressing these disparities in the learning culture include the provision of flexible support systems (e.g. flexible schedules, multiple communication channels); adaptive design principles (e.g. modular learning content, offline and online learning options, use of Universal Design for Learning (UDL) principles and practices); and culturally responsive approaches (incl. Avoiding assumptions about student needs and resources, providing culturally appropriate support, recognising diverse learning environments).

This approach aligns with ecological systems theory[21], which views learning as a dynamic interaction between the individual and their broader environmental context. It emphasizes that learning is not just an individual cognitive process but a socially and environmentally mediated experience.

[21] https://www.simplypsychology.org/bronfenbrenner.html

By systematically addressing the multifaceted nature of learning culture, this programme can create more inclusive, supportive, and effective learning environments that recognize and respond to the unique circumstances of each learner.

3.3 Organisation and Delivery Model

We suggest that there are two important aspects to defining an organisational model for supporting career pathways for us to consider here.

- Creating a connected and coherent education and training pipeline that builds awareness, inspiration and foundational skills early, and also provides options and support for specialisation at higher levels.
- Retention of high-school graduates in the region with high-quality tertiary options, funding, and industry opportunities

Blueprint for an Education Pipeline
When considering a blueprint for an education pipeline it is important to recognise the changing trajectories of student interest, and that programme design must accommodate this.

Adolescence is a developmental period of dynamic and often rapid-change. Recent neuro-imaging studies also provide evidence of significant neuroplasticity during the teenage years, particularly in the prefrontal cortex responsible for decision-making and long-term planning. [22]

This ongoing brain development means that a teenager's interests, motivations, and potential are far from fixed. Attempting to lock young people into specific career paths too early not only goes against their developmental trajectory of exploration and identity formation, but also fails to recognise that many of the skills that may be applied to aerospace are highly transferable, and thus a lower friction approach that affords rangatahi the opportunity and agency to change course is preferable.

The approach we recommend for designing a suitable education pipeline would be to:

- Encourage exploration of diverse interests
- Develop transferable skills
- Foster critical thinking and adaptability
- Provide exposure to various potential career paths
- Support the natural exploratory tendencies of the adolescent brain

This approach respects the dynamic nature of neural development and prepares young people for a future characterized by rapid change and continuous learning.

This thinking is built into the pipeline concept as illustrated below:

[22] https://www.upmc.com/media/news/110822-neuroplasticity-teen-brain

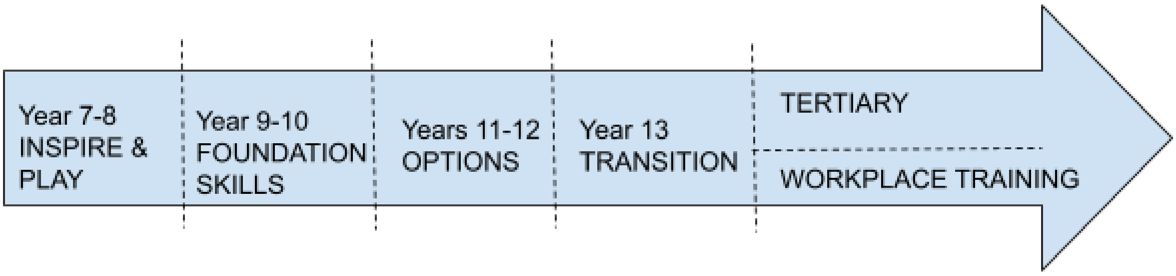


Figure 8: an education pipeline for aerospace skills and knowledge development

The stages illustrated in the pipeline diagram above focus on a series of interventions / actions that could be implemented at different stages in the learner's journey. These are specifically designed to provide a pathway for students with a wide range of interests to be accommodated within the programme.

Year 7-8: early engagement with STEM-based activities. Learning about rockets, space-exploration, and the night sky are all things that can inspire wonder in young people and lead to developing a curiosity to learn more. Fun activities can be tailored to students at this level and delivered either in the classroom or through an external agency such as Tōnui Collab. A library of resources and activities could be curated that cater to this age group. These activities may be accessed by teachers to incorporate within their classroom programmes, or directly by students to fulfil a particular interest or passion.

Year 9-10: students make decisions about their subject options for their senior years. It is also a period of relative freedom from assessment in the NCEA system. This is a key time for inspiring students to consider the choices they may make about STEM options for their senior years at school. Aerospace is one potentially exciting avenue for those choices. In this time there are a range of deeper activities and project work that could be used to help these students develop foundational skills either in the classroom or through Tōnui Collab. Specialist external providers also exist, for example Spaceward Bound, a New Zealand spin-off from the successful NASA educational programme[23] Funding the development of project-based activities for this age group. These programmes could easily be incorporated into a school's science curriculum.

Years 11-12 are a time of increased assessment, but for motivated and capable students it is also a time for deeper engagement. After school clubs such as rocketry, astronomy or computer groups can increase engagement as interests in these aspects start to deepen. It is also a key time where external providers such as Taike e!, and EIT can offer programmes to students that deepen their learning in the key subject areas we have identified in this report: aerospace engineering, CAD and fabrication, software development and data science. Both providers can offer programmes that can be started in these years and will lead meaningful, valued qualifications. If educational providers also develop relationships with industry partners in the region, then the pipeline can be extended into further study or careers from a local base.

23 https://spacewardbound.nz/about-us/

Year 13: Transition to Tertiary Education or workplace training. Students need attractive options in the region for both in order for them to stay locally rather than go elsewhere. Financial considerations are an important factor. Scholarships and Internships provide a means to support students and retain them in the region. The Mātai research institute model provides an excellent vehicle which has proved to be very successful in the neuroscience and medical imaging field. Aerospace stands to benefit from the same approach.

Portrait of an Aerospace Candidate

It is very difficult to reach a destination without a clear roadmap of how to get there. One useful tool for guiding a students learning progression towards a goal, such as a specific specialisation in aerospace, is a specification of the skills and qualities that a role would demand (a similar idea to a job specification). Such a graduate profile, or portrait of an aerospace candidate provides prospective employers with the opportunity to outline their expectations of successful future applicants. This then provides a framework to help educators and rangatahi ensure that they are putting the right building blocks in place to help the candidate achieve success. Several stakeholders we spoke to in the preparation of this report, including Cain Kerehoma and Renay Charteris of Taike E! emphasised the importance of setting students up to succeed by guiding them towards undertaking programmes of learning that are valued and respected by industry. In addition it was also emphasised that the right social skills and workplace ethics are engendered through early attention to these elements during education and training experiences.

An example, generic Aerospace Graduate Profile is outlined in Appendix 2. We propose that this should be refined and expanded for each of the three career pathways identified here. It can then be made publicly available (online) as a tool for educators and rangatahi as a follow-up action from this report.

3.2 Curriculum

The question of what curricula are appropriate for preparing graduates for aerospace careers follows naturally from the definition of a graduate profile as discussed above. There is an obvious benefit if what gets taught is well aligned with what the industry needs. That said there are a variety of curriculum challenges and constraints, as well as opportunities that can be identified. These are outlined below.

The New Zealand Curriculum (NZC) for Schools

The New Zealand Curriculum is the guiding framework for all teaching and learning activities in New Zealand English medium state and state-integrated schools. As a national framework the NZC is created and governed by the Ministry of Education. The NZC is currently undergoing a refresh, which was started by the previous Labour Government, and is ongoing (though with a revised emphasis and underpinning principles) by the current National-led Coalition. Information about the Curriculum and the refresh can be found on the Ministry of Education’s Tahurangi website[24].

24 https://newzealandcurriculum.tahurangi.education.govt.nz/new-zealand-curriculum-online/new-zealand-curriculum/current-new-zealand-curriculum/5637144666.c

The current (pre-refresh) version of the NZC, published in 2007, is intended to be non-prescriptive by design in order to provide schools with high-level guidance and coherence, whilst leaving room for each school to develop a local curriculum that is tailored to their particular local context and requirements. The curriculum has been criticised for lacking useful guidance and clarity over expectations, especially in the areas of Science and Maths. A 2019 study by NZCER commissioned by the Education Ministry[25] found that the achievement objectives for Science and to a lesser extent Maths lacked the necessary clarity to guide teachers decisions about what is expected at each curriculum level. The Science learning area in particular also lacked detailed learning progressions leading teachers to retrospectively map their lessons to achievement objectives (AOs) rather than using them to guide lesson planning.

The refreshed science curriculum will be available from around the middle of 2025 according to the Tahurangi website.

Te Marautanga o Aotearoa

The Māori language curriculum is Te Marautanga o Aotearoa. This is currently available on Tahurangi also[26]. This curriculum is also due to undergo a refresh, but no timeline has yet been released by the Ministry of Education.

Specialist Aerospace Curriculum Resources

There are a variety of additional curriculum resources, activities and programmes that specifically apply concepts from maths, computer science, science and technology to an aerospace context.

One commercial organisation that provides space education to New Zealand schools is Spaceward Bound NZ[27]. Modelled on the NASA programme of the same name, they offer educational activities and teacher professional development centred on Astrobiology.

Another NZ organisation that is seeking to support regions in developing education and training for the space industry is SpaceBase[28] based in Christchurch.

One of the leading academics in Aerospace Engineering in New Zealand, Associate Professor Christopher Hann from the University of Canterbury, is deeply involved and passionate about increasing access to aerospace engineering to young people. He has developed a rocketry programme suitable for capable Year 13 students which provides a unique opportunity for students to build, test, analyse and launch rockets. This programme would need local educational support which should be further explored.

[25] https://newzealandcurriculum.tahurangi.education.govt.nz/curriculum-levels-in-science-and-mathematics-and-statistics/5637217400.p
[26] https://kauwhatareo.tahurangi.education.govt.nz/mi/
[27] https://spacewardbound.nz/about-us/
[28] https://spacebase.co/services/

3.3 Qualifications Framework

Capturing the story of engagement and achievement for individual learners through this sort of programme design will require different ways of thinking about assessment and broader measures of success.

Our current education system places a great deal of emphasis on qualification structures such as NCEA, that require completion of a full year's study in a particular course or programme. While this approach works well for some students and for some areas of study, it has two areas of weakness in terms of being used for a more innovative programme as being promoted here:

(a) It assumes a student is committed to and will sustain engagement with this particular subject, and doesn't allow for the changes in career-related choices they may make during that period; and

(b) It limits the ability to provide an agile response to changes in the particular area, in this case, aerospace engineering and associated industries. With the rapid advances being made in associated fields, the ability to respond quickly with learning opportunities that address these things becomes important.

While NCEA pathways will remain valuable for some students, we will need to consider alternatives such as micro-credentials. The arguments for each are outlined as follows.

NCEA

Full-year NCEA courses offer depth, context, and comprehensive skill development. A full-year course allows students to develop sustained engagement with a subject,

For students interested in an aerospace industry career, there are a number of existing NCEA courses that would provide foundational and advanced skills:

Mathematics and Statistics Courses:

- Level 1, 2, and 3 Mathematics
- Statistics and Probability
- Calculus (where available)

Science Courses:

- Physics (crucial for aerospace understanding)
- Chemistry
- Earth and Space Science
- Technology subjects with physics/engineering focus

Technology and Digital Courses:

- Digital Technologies
- Design and Visual Communication
- Engineering Technology
- Computer Science

- Programming and Coding standards

For many students, the benefits of full-year NCEA courses is that they go beyond surface-level skill acquisition and enable students to develop deep conceptual understanding through a carefully structured progression of knowledge. By exploring interconnected ideas within a broader context, learners can build increasingly complex intellectual frameworks that support sustained critical thinking and analytical skills. Unlike many modular learning approaches, full-year courses create an intellectual journey where each concept builds upon previous learning, allowing students to develop increasingly sophisticated approaches to problem-solving and understanding. The sustained engagement provides time for deep reflection, complex idea exploration, and the development of robust cognitive skills that extend far beyond simple information retention, ultimately preparing students not just with knowledge, but with the capacity to think deeply, critically, and innovatively about complex challenges.

Microcredentials

Micro-credentials offer a way to break up programmes of learning into manageable chunks, whilst still ensuring progression and, ultimately, a recognised form of qualification. Recognising smaller 'chunks' of learning in this way also helps attract and engage learners who may still be wondering about whether this is something they're prepared to commit to for the longer term, and so allows them to engage in an area of immediate interest and receive assessment recognition for this. In addition, carefully designed micro-credentials will address a balance of both content knowledge and skills, as well as the more transferable skills and capabilities that students may need and use in a variety of settings.

Micro-credentials offer a more dynamic, personalized approach to recognizing learning, moving beyond the limitations of traditional transcripts and standardised assessments. They acknowledge the unique learning journeys of individual students, providing a more holistic and forward-looking approach to educational achievement and personal development. They offer a number of significant benefits for school-aged learners, particularly in addressing emerging interests and skills that fall outside traditional academic subjects, including:

- Quickly respond to emerging industry skills
- Allowing learners to acquire cutting-edge knowledge rapidly
- Enabling updating of specific skill sets without committing to lengthy programs
- Bridging gaps between traditional education and current workplace demands

Micro-credentials are valuable supplementary learning tools, but should not be regarded as a replacement for the comprehensive developmental journey of a full-year course. The true power lies not in choosing between traditional courses and micro-credentials, but in understanding how they can complement traditional credential systems to support lifelong learning and professional development. The educational value lies in creating balanced learning ecosystems that incorporate both structured, comprehensive courses and flexible, targeted learning opportunities.

3.4 Professional Development Support

The successful introduction of aerospace education in secondary schools hinges critically on the professional knowledge, confidence, and capability of teachers. While many science educators possess a strong foundational understanding of scientific principles, the specialised and rapidly evolving nature of aerospace requires a strategic, multi-faceted approach to professional learning.

Creating a comprehensive suite of support mechanisms will be required to develop a future-focused workforce aligned with emerging technological landscapes. This might include the provision of specialized aerospace education qualifications, targeted professional learning short-courses, short-course intensive training modules and the use of online professional development platforms.

Together with such traditional approaches, it will be useful to consider approaches that provide teachers with exposure and immersion to the aerospace industry, including industry internship programs for educators, workplace shadowing opportunities, participation in collaborative research projects, technology transfer workshops and site visits to aerospace facilities.

Consideration should also be given to the provision of a broader support network that could include mentorship programs connecting educators with aerospace professionals, peer learning networks, regular industry-education symposiums, online professional learning communities and expert-in-residence programs.

Further opportunities could be provided through collaborative approaches such as aerospace experts embedded in educational settings, team-teaching models, guest lecture and demonstration programmes and various kinds of cross-sector knowledge exchange.

When designing and implementing this suite of professional development opportunities consideration will need to be given to the funding required for dedicated professional development. This is required to ensure investment is available for things such as release time for teachers, provision of current forms of technology, travel and immersion support, digital learning resources and support for industry partnership development.

3.5 Financial Considerations

The total cost of going to university is prohibitive for many students and their families, and it hits particularly hard in a region such as Tairāwhiti with an overall lower socio-economic profile than other regions. This is undoubtedly a factor affecting decision-making around career choices for many highly capable students. Despite existing scholarship avenues and the Government's fees-free year policy (now applied to the final year of study rather than the first year as was the original Labour Government policy), the remaining fees combined with the cost of living away from home, impose a financial burden that can be unsupportable. This is an issue that places an additional barrier on Māori and Pacific students in particular[29].

[29] https://www.rnz.co.nz/news/te-manu-korihi/131394/living-costs-kill-maori-students'-degree-dreams-advisor

One avenue for addressing this problem in the context of the subject of this paper is to obtain industry or community funding for additional scholarships for Tairāwhiti students. An additional approach is to increase the availability of tertiary and workplace training options in the field locally. As discussed elsewhere in this paper, EIT is actively working to increase the range of options, including supervising doctoral students in computing.

3.6 Summary and Conclusion

In part one we drew on existing work that characterises the segmentation of the aerospace sector in NZ. From that we identified three key segments that offer potential opportunities for aerospace workforce development in the Tairāwhiti region: **aerospace engineering, aerospace fabrication , software engineering and data science**

In part two we identified the main education and workforce incubation organisations in the region that could play a future role in providing opportunities for growth in STEM and aerospace-related knowledge and skills acquisition. We then examined a range of schools and kura data in an attempt to estimate the potential numbers of rangatahi who might be attracted to these pathways. This is important for determining an appropriate and effective approach for supporting them.

In part three, we have provided a framework for designing a coherent education pipeline that utilises the strengths of the providers already operating in the region to support students to pursue the three pathway options identified in part one. It is suggested that a differentiated approach will be required for each of the three areas. This will require coordination and buy-in from the stakeholders identified in this report with clear workplace opportunities, both within the region and nationally for graduates through this programme.

A set of recommendations for next steps have been developed based on the work in this report.

Appendix 1: Example Job Specifications

Aerospace Manufacturing Engineer	
Description	Aerospace manufacturing engineers are responsible for designing and optimizing the production processes for components used in space systems, such as satellites, rockets, and space vehicles. They ensure that parts are manufactured to meet strict safety, quality, and performance standards while also focusing on cost efficiency.
Skills	● Expertise in manufacturing processes like additive manufacturing (3D printing), machining, and assembly. ● Knowledge of materials science, particularly high-performance materials like composites, titanium, and specialized alloys. ● Proficiency in CAD (Computer-Aided Design) software and CAM (Computer-Aided Manufacturing) tools. ● Problem-solving abilities, focusing on optimizing production efficiency and quality control. ● Strong understanding of tolerances, precision, and inspection methods.
Qualifications	● Bachelor's degree in **aerospace engineering**, **mechanical engineering**, or a related field. ● Specialized knowledge in manufacturing processes and techniques for aerospace components. ● Advanced degrees (Master's or PhD) may be preferred for specialized roles in space vehicle design or advanced manufacturing processes. ● Experience with certifications like **AS9100** (Quality management systems for aerospace).

Satellite Systems Engineer	
Description	Satellite systems engineers are responsible for the design, integration, and testing of satellite systems. They work on components such as communication payloads, propulsion systems, power systems, and thermal control systems, ensuring that satellites function effectively in space.
Skills	● Knowledge of satellite subsystems such as propulsion, power generation, and communication. ● Understanding of space environment factors (e.g., radiation, vacuum, temperature extremes) and their impact on satellite performance. ● Expertise in systems integration and testing procedures. ● Familiarity with software tools for simulation and modeling

	● Problem-solving skills in troubleshooting issues related to satellite performance.
Qualifications	● Bachelor's or Master’s degree in **aerospace engineering**, **electrical engineering**, or **satellite communications**. ● Knowledge of satellite standards (e.g., **ESA**, **NASA**) and international space protocols. ● Experience with systems engineering practices and satellite system integration. ● Certification in space-related areas (e.g., **Certified Systems Engineering Professional (CSEP)**). ●

Propulsion Engineer	
Description	Propulsion engineers design and test propulsion systems that power rockets, satellites, and other spacecraft. They work on the development of rocket engines, thrusters, and fuel systems that enable spacecraft to reach and maneuver in space.
Skills	● Expertise in thermodynamics, fluid dynamics, and rocket propulsion systems. ● Knowledge of different propulsion technologies (e.g., chemical propulsion, electric propulsion). ● Understanding of space launch requirements, including thrust-to-weight ratios and fuel efficiency. ● Experience with testing and validation of propulsion systems under space-like conditions. ● Familiarity with modeling and simulation software ●
Qualifications	● Bachelor's or Master’s degree in **aerospace engineering**, **mechanical engineering**, or a related field with a focus on propulsion. ● Advanced degrees (Master’s or PhD) may be necessary for research and development roles. ● Professional certifications in propulsion technology or aerodynamics are a plus.

Spacecraft / Aircraft Structural Engineer

Description	Structural engineers focus on designing and analyzing the structural components of spacecraft, such as the fuselage, wings, and payload sections. They ensure that these components can withstand the extreme conditions of space travel, including launch stress, thermal loads, and micrometeoroid impacts.
Skills	● Strong knowledge of material properties, especially those used in high-stress aerospace applications (e.g., composites, aluminum, titanium). ● Expertise in structural analysis and fatigue testing. ● Ability to analyze and test for load-bearing capacity, vibration, and thermal expansion. ● Collaboration skills to work with other engineers (e.g., propulsion, avionics) to integrate structural components with other spacecraft systems.
Qualifications	● Bachelor's or Master's degree in **aerospace engineering**, **mechanical engineering**, or **structural engineering**. ● Experience with aerospace materials and structural integrity testing. ● Experience in structural analysis and design software (FEA tools). ● Certification in structural engineering or quality assurance practices may be beneficial. ● ● Professional certifications in propulsion technology or aerodynamics are a plus.

Software Developer	
Description	Software developers design, develop, and maintain high-quality software solutions, including embedded systems tailored to meet business needs. This role involves collaborating with cross-functional teams to understand requirements, write efficient code, and deliver robust applications as part of a team.
Skills	● Proficiency in Programming languages like Python or Java. ● Strong understanding of databases (SQL and NoSQL) ● Familiarity with version control tools such as Git. ● Knowledge of cloud platforms like AWS or Azure. ● Ability to work on software within larger systems, understanding hardware, firmware, and software dependencies. ● Knowledge of systems integration, testing, and validation. ● Familiarity with DevOps practices, CI/CD pipelines, and containerization ● Experience with assembly language for low-level hardware interactions. ● Knowledge of guidance, navigation, and control (GNC) algorithms.
Qualifications	● Bachelor's or Masters degree in Computer Science, Software

	Engineering, Aerospace Engineering, Electrical Engineering, or a related technical field.

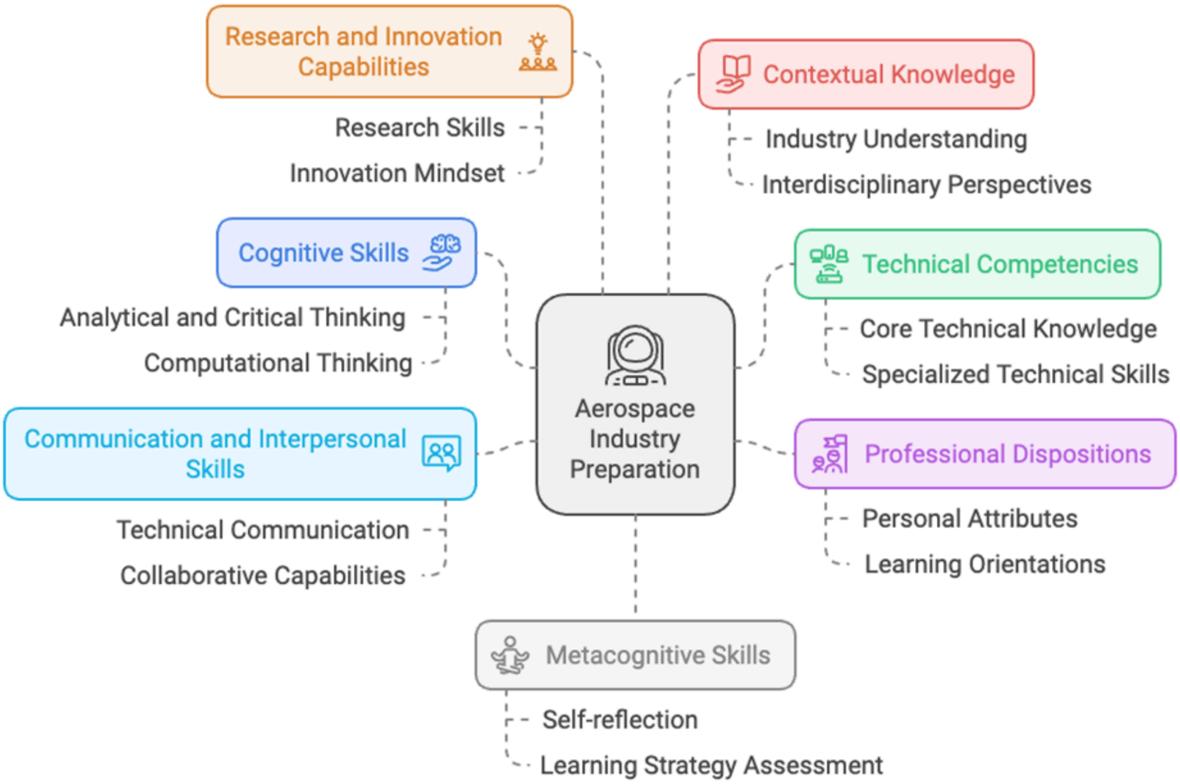
Data Scientist	
Description	A data scientist plays a critical role in analyzing and interpreting complex data to drive informed decision-making.They use statistical methods, machine learning algorithms, and data visualization techniques to uncover patterns, trends, and actionable insights. By integrating domain expertise with advanced analytical tools, data scientists help solve business challenges, improve operations, and predict future outcomes. Their responsibilities often include data preprocessing, model development, and communicating results to stakeholders, bridging the gap between technical data analysis and strategic business objectives.
Skills	● Proficiency in Programming languages like Python or Java. ● Strong foundation in probability, linear algebra, calculus, and statistics. ● Experience applying statistical methods to solve real-world problems. ● Expertise in working with large datasets using tools like Pandas, NumPy, and dplyr. ● Knowledge of data wrangling and cleaning techniques. ● Experience with supervised and unsupervised learning algorithms (e.g., regression, classification, clustering). ● Familiarity with advanced topics such as deep learning, natural language processing (NLP), and reinforcement learning. ● Knowledge of distributed computing tools like Hadoop, Spark, or Dask. ● Familiarity with cloud platforms (AWS, Azure, Google Cloud) for data storage and processing. ● Knowledge of distributed computing tools like Hadoop, Spark, or Dask. ● Familiarity with cloud platforms (AWS, Azure, Google Cloud) for data storage and processing.
Qualifications	● Bachelor’s degree in Data Science, Computer Science, Statistics, Mathematics, or a related field. ● Master’s degree or Ph.D. in a quantitative field like Machine Learning, AI, Statistics, or Operations Research.

Aerospace Manufacturing Technician	
Description	An aerospace manufacturing technician is responsible for assembling,

	testing, and maintaining aircraft or spacecraft components, ensuring they meet strict safety and quality standards. They work with advanced tools, machinery, and materials to fabricate and install parts like engines, fuselage sections, or avionics systems.
Skills	● proficiency in blueprint reading, technical drawing interpretation ● hands-on experience with CNC machines or composite materials. ● Experience with 3D printing ● Strong attention to detail and manual dexterity ● familiarity with industry standards like AS9100 or ISO 9001
Qualifications	● Trades Academy Certificate, Diploma or Bachelor's degree in a relevant field ● Specialised training or certification in aerospace manufacturing or engineering technology preferred.

Appendix 2: Generic Aerospace Graduate Profile

Skills, Dispositions, and Knowledge Framework for Aerospace Industry Preparation



1. Cognitive Skills

Analytical and Critical Thinking

- Advanced problem-solving capabilities
- Systems thinking
- Ability to analyze complex technical scenarios
- Critical reasoning and logical decision-making
- Capability to break down complex problems into manageable components

Computational Thinking

- Algorithmic reasoning
- Data interpretation and visualization
- Mathematical modeling
- Pattern recognition
- Computational problem-solving strategies

2. Technical Competencies

Core Technical Knowledge

- Advanced mathematics (calculus, linear algebra, trigonometry)
- Physics principles (mechanics, thermodynamics, fluid dynamics)
- Basic engineering and electrical principles
- Programming and coding skills
- Computer-aided design (CAD) capabilities
- Data analysis and statistical methods

Specialized Technical Skills

- Software proficiency (Python)
- 3D modeling and simulation
- 3D printing
- Understanding of engineering design processes
- Basic robotics and autonomous systems knowledge
- Familiarity with aerospace-specific technologies

3. Professional Dispositions

Personal Attributes

- Intellectual curiosity
- Resilience and persistence

- Adaptability to technological changes
- Attention to detail
- Ethical decision-making
- Safety consciousness
- Collaborative mindset

Learning Orientations

- Growth mindset
- Commitment to continuous learning
- Openness to interdisciplinary approaches
- Willingness to challenge existing paradigms
- Self-motivation and independent learning skills

4. Communication and Interpersonal Skills

Technical Communication

- Clear technical writing
- Ability to explain complex concepts simply
- Presentation skills
- Data visualization
- Technical report writing
- Interdisciplinary communication

Collaborative Capabilities

- Teamwork in diverse environments
- Cross-cultural communication
- Conflict resolution

- Project management basics
- Networking skills
- Ability to work in multicultural teams

5. Research and Innovation Capabilities

Research Skills

- Scientific method understanding
- Experimental design
- Data collection and analysis
- Critical literature review
- Hypothesis formation and testing

Innovation Mindset

- Creative problem-solving
- Design thinking
- Prototype development
- Understanding of innovation processes
- Entrepreneurial thinking

6. Contextual Knowledge

Industry Understanding

- Aerospace sector overview
- Global and local industry trends
- Technological innovation landscapes
- Regulatory environments
- Ethical considerations in technology

- Sustainability and environmental impacts

Interdisciplinary Perspectives

- Connections between aerospace and other industries
- Social implications of technological development
- Economic aspects of aerospace technologies
- Geopolitical considerations in space exploration

7. Metacognitive Skills

- Self-reflection
- Learning strategy assessment
- Performance improvement techniques
- Emotional intelligence
- Stress management
- Personal effectiveness strategies

Appendix 3: Aerospace Education Experience Pilot - Tonui Collab

Outcomes from survey and write up of the day