

Australia-European Space Agency (ESA) Cooperative Agreement: Economic Review

October 2026

Executive Summary

ESA Cooperative Agreement

- Australia has an established operational relationship with the European Space Agency (ESA), including deep-space ground infrastructure. In 2025, the Australian Government announced a mandate to negotiate a cooperation agreement; such an agreement is distinct from ESA membership (Australian Space Agency, 2026a; European Space Agency, n.d.-a).

- The ESA is independent of the European Union (EU). Non-EU countries including the United Kingdom, Norway and Switzerland are ESA members, while Canada participates under a distinct 'cooperation agreement' which does not confer membership (Australian Space Agency, 2026a; European Space Agency, n.d.-a).

- No binding Australian quotation for a single-astronaut mission had been made publicly available at the time of this review. The scenarios use published costs from previous missions and do not establish a current price for Australia.

- No public quotation has established the cost of an Australia–ESA cooperation agreement, with or without an International Space Station (ISS) astronaut mission or optional programme participation.

Economic Modelling

- This report uses transparent local scenario calculations and compares them with publicly described departmental economic models. The specialist departmental models were not run for this report. Their access limits and the calculation-by-model comparison appear in Section 18 and Appendix E. Appendix D records Australian budget and STEM evidence; Appendix C presents a design-to-budget alternative whose return and superiority remain unproven.

- No audited incremental domestic-return modelling by the Australian Government or a space-industry representative organisation was identified that is sufficiently robust to establish the economic return of either a cooperation agreement or an associated single-astronaut flight.

- This report separates published and media observations and statements of economic benefit from transparent scenario calculations. It draws on publicly available reports from comparable countries and their reported space-industry participation.

- ESA geographical-return coefficients are considered to clarify the distribution of eligible weighted industrial contracts and to distinguish that measure from a national benefit–cost ratio (Canadian Space Agency, 2023).

- Various agencies, media outlets and representative organisations have suggested that an Australian astronaut flight would produce a positive economic return. The scenarios in this report do not establish that return.

- A same-cash-budget Australian portfolio is explored, allocating funds to analogue habitats, procedural astronaut training, space medicine, mission control and payload facilities, with up to five years of staffing and operations (Appendix C).

- The review did not identify a comparable published federal appraisal of alternatives to an ESA cooperation agreement. Direct purchase of flight access from a US provider is one possible alternative, subject to a verified quotation and comparable assessment of access, mission objectives and full costs.

KPIs and ROI

- The Government has not articulated a quantified return on investment (ROI) with the conditions governing Australian participation in Moon to Mars manufacturing supply chains. Any assessment should distinguish access opportunities from guaranteed

contracts and identify where employment, participation and career development would occur.

- Any prospective ROI is conditional on the agreement's terms, actual costs, additional Australian benefits and a suitable counterfactual.
- Key performance indicators (KPIs), ROI and cooperation-agreement charges should not be collapsed into a single figure or treated as settled. Each should be clearly defined and assessed against its costs and benefits to the Australian population.
- The economic question is whether additional Australian public expenditure would purchase additional domestic capability, industrial contracts, sustainable employment and other outcomes, and whether comparable access could be obtained through a differently configured agreement, bilateral procurement or direct purchase of a flight.
- International evidence varies in scope. The UK evaluation reports benefits from its established ESA portfolio, while Canada documents procurement access and industrial contracts; Canada's 2023 evaluation does not establish a precise aggregate social return (Canadian Space Agency, 2023; UK Space Agency, 2025a).
- Poland's €65 million Ignis mission provides an observed mission-cost comparator and identifiable experiments, but not an audited single-flight national return (Ministry of Economic Development and Technology, 2025).
- Indian and Swedish flights provide research and operational experience, but a comparable single-flight social benefit–cost ratio was not verified (Appendix C).
- The United Kingdom's published £7.49 per £1 estimate evaluates its established space programme and cannot be transferred to Australia without a counterfactual. Poland's reported €65 million Ignis cost is a mission-specific benchmark; neither figure is an Australian quotation or proof of a positive Australian single-flight return (UK Space Agency, 2025a; Ministry of Economic Development and Technology, 2025).

- Australia could also explore negotiated supply-chain access and scientific cooperation with ESA and the United States. This may broaden opportunities for Australian researchers and practitioners, but access, attribution of research outcomes and lower costs cannot be assumed; the alternatives require negotiation and comparable appraisal.

- Under the author-specified central planning case:
    - USD$110 million for the flight plus USD$10 million of non-overlapping ancillary costs at USD$0.65 per A$1 gives AUD$184.62 million.
    - At a 7% real discount rate this requires AUD$26.29 million of additional net Australian benefits annually for ten years to break even; a three-year delay raises that threshold to AUD$32.20 million.
    - These are switching values from 648 sensitivity cases, not forecasts of benefits or Treasury model outputs (Australian Centre for Evaluation, 2025; Appendix C).

- The PM's "Inspiring Australia Programme" is not separately identified in the recovered budget collection, and is not included as an additional item in the Agency operating-measure subtotal.
    - This is a boundary of the evidence collection, not proof that an activity has no government funding.
    - The established "Inspiring Australia Programme", the Prime Minister's Prizes for Science, and astronaut outreach must be distinguished in budgets and added into the modelling.
    - Full costing should cover the flight astronaut and any required backup, including training, certification, salaries, travel, accommodation and support costs. Identify costs already included in the flight price and separate past training from future expenditure (Appendix B).

- **Source audit qualification:**
    - The UK evaluation estimates £7.49 in direct benefits per £1 of public investment. After additional private R&D and capital costs are included, it estimates £6.42 in

direct productivity gains per £1 of social cost. Both are portfolio findings; neither establishes an Australian single-flight return (UK Space Agency, 2025a; Appendix G).

- The originating data, method and limits of independent replication, are recorded in Appendix G (UK Space Agency, 2025a).

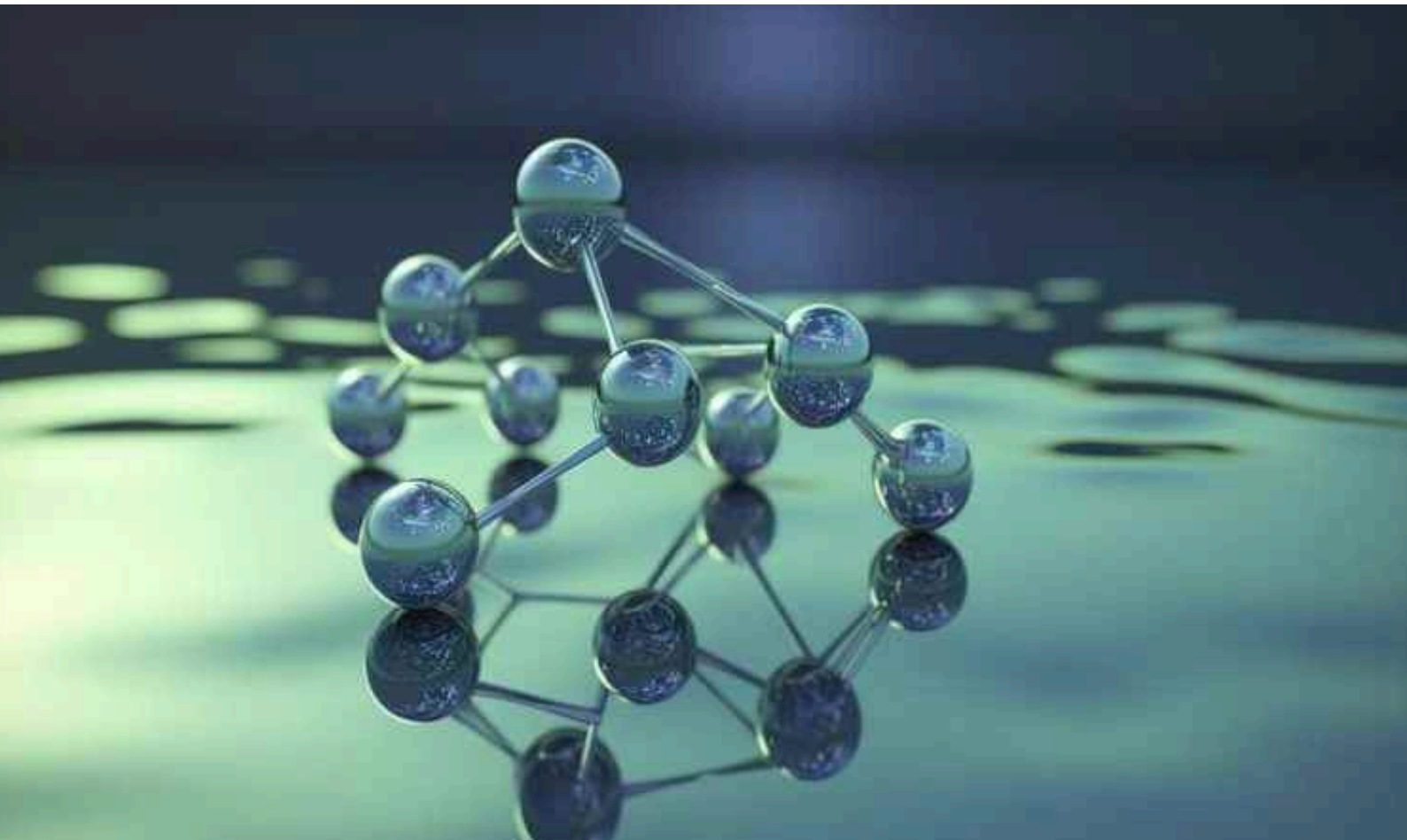
- **Earth-side industry comparison:**
  - Official surveys and company reports identify continuing manufacturing, exports and skilled employment in the countries reviewed (Section 14).
  - Sections 11 and 14 distinguish observed workforce changes from announced hiring, and test a domestic export-manufacturing alternative, against the same public-budget threshold.
  - Manufacturing needs a verified commercial pipeline and full cost account; foreign industry size does not demonstrate Australia's single-astronaut flight ROI. Source inconsistencies are disclosed in Appendix G.



Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AI	Artificial intelligence
ARP	Agencja Rozwoju Przemysłu; Polish Industrial Development Agency
ASA	Australian Space Agency
ATEM	Australian trade-and-environment model
ATSE	Australian Academy of Technological Sciences and Engineering
AU	Australia
AUD / A$	Australian dollar
BCR	Benefit–cost ratio
CAD / C$	Canadian dollar
CAPITA	Treasury tax-and-transfer microsimulation model named in the 2017 review
CBA	Cost–benefit analysis
CGE	Computable general equilibrium
CHF	Swiss franc
CM22	ESA Council meeting at ministerial level in 2022
CoPS	Centre of Policy Studies
CSA	Canadian Space Agency
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DOI	Digital object identifier
EBIT	Earnings before interest and tax
ECU	Edith Cowan University
EMMA	Treasury Macroeconometric Model of Australia
ESA	European Space Agency
ESA cooperation agreement	A negotiated arrangement with a non-member state; not membership
EU	European Union
EUR / €	Euro
FTE	Full-time equivalent
FX	Foreign exchange
FY	Financial year
GBP / £	Pound sterling
GDP	Gross domestic product
GEMPACK	General Equilibrium Modelling PACKage
GFS	Government Finance Statistics
GNP	Gross national product
GRC	Geographical-return coefficient
GSP	Gross state product
GST	Goods and services tax
GVA	Gross value added
INR / ₹	Indian rupee
IP	Intellectual property
ISI	International Space Investment programme
ISRO	Indian Space Research Organisation
ISS	International Space Station
JSON	JavaScript Object Notation; machine-readable model data
K1–K12	Calculation identifiers used in the model comparison matrices
KPI	Key performance indicator
L2	ABS general-government sector consolidation scope used in the debt series
MARIA	Treasury retirement-income microsimulation model named in the 2017 review
MARTIN	Macroeconomic Relationships for Targeting Inflation
MDA	MDA Space, a satellite and space-systems manufacturer
MONASH	Historical dynamic CGE model, predecessor to VU-National
MYEFO	Mid-Year Economic and Fiscal Outlook

NOK	Norwegian krone
NPV	Net present value
NSIL	NewSpace India Limited
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
ONS	Office for National Statistics, United Kingdom
ORANI / ORANI-G	Australian CGE model family and its generic implementation
PDF	Portable Document Format
PII	Publisher item identifier in the supplied literature links
PLN	Polish złoty
PM	Prime Minister
PRISMOD	Treasury price/incidence models named in the 2017 review
PV	Present value
Q1	First quarter
R&D	Research and development
RBA	Reserve Bank of Australia
RDP	Research Discussion Paper
ROI	Return on investment
SA	South Australia
SEK	Swedish krona
STEM	Science, technology, engineering and mathematics
TAFE	Technical and further education
TERM	The Enormous Regional Model
UK	United Kingdom
UKSA	UK Space Agency
URL	Uniform resource locator; a web address
US / USA	United States of America
USD / US$	United States dollar
VET	Vocational education and training
VU-National	Victoria University national CGE model
VURM	Victoria University Regional Model



Report Limitations

An assessment and financial modelling of Australian and European Space Agency mooted cooperative agreement, membership counterfactuals and a single-astronaut mission used the following evidence categories:

- OBSERVED = official reported fact;
- DERIVED = arithmetic from identified assumptions;
- SCENARIO = illustrative, not a quote or forecast;
- UNVERIFIED = insufficient source evidence.

1. This report is an independently assembled economic assessment, not an independently peer-reviewed publication.
2. This report uses publicly available data from comparable countries because a binding Australian quotation and the terms of a proposed ESA cooperation agreement were not publicly available for this assessment.
3. The report's scenario calculations are reproducible, but definitive national estimates require negotiated programme terms and audited data on beneficiaries. The scenarios draw on non-EU ESA cooperation arrangements and ESA members to illustrate possible cost structures and outcomes.
4. The author is not a trained economist, but has experience in economic modelling for commercial business applications.



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Declaration of interests

Dr Gabrielle M Caswell has contributed to the development of artificial-intelligence clinical tools and assistants. Dr Caswell is Founder and CEO of SpacePort Australia Pty Ltd www.spaceportaustralia.com.au, Science Space School Pty Ltd www.spacescienceschool.com, and curator of The Hamilton Project www.TheHamiltonProject.space

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Editorial note

The author is responsible for the sources, calculations, conclusions and final text. This discussion paper has not been independently peer reviewed.

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1.0 Introduction

October 2026 public reporting update: mission funding and attribution

As at 26 October 2026, the Australian Government has submitted a counteroffer to the European Space Agency for a proposed mission involving Katherine Bennell-Pegg. The financial terms of that offer have not been disclosed. ABC News (23 October 2026) reported an earlier mission-seat figure of approximately AUD$100 million, while an Australian newspaper report supplied for this review describes a proposed AUD$160 million astronaut plan (Mendes, 2026). These figures are attributed public reports, not verified quotations for an identical scope of services.

On 20 October 2026, ABC News reported that South Australia supported a contribution but that several other states and territories had declined direct funding. On 23 October, ABC News reported more than AUD$6 million in philanthropic cash commitments and a broader campaign total of approximately AUD$25 million encompassing cash, in-kind and indicative contributions. These categories overlap and must not be added together. Neither pledged support nor transfers between governments reduce the underlying resource cost of a mission; confirmed private cash may reduce the taxpayer-funded share.

For fiscal scrutiny, AUD$100 million, AUD$120 million and AUD$160 million are therefore additional nominal Australian-dollar cost cases. They are not interchangeable with the report's USD$100–120 million planning range, which depends on the exchange rate and contract inclusions. On a ten-year, 7% real annuity basis, a hypothetical AUD$160 million initial cost requires approximately AUD$22.78 million in additional annual net Australian social benefits to break even, assuming benefits begin in year 1. The corresponding thresholds are AUD$14.24 million for AUD$100 million and AUD$17.09 million for AUD$120 million. These are switching values, not predicted returns; consistent price-year treatment and ancillary costs remain necessary.

The assessment must separately identify the total economic cost, Commonwealth cash outlay, state and territory contributions, confirmed private funding, in-kind assistance, and any additional long-term operating commitments. It must then establish the incremental benefits retained by Australian households, firms, research institutions and communities relative to feasible alternative investments. The evidence reviewed does not yet support a mission-specific estimate of those benefits.

This final costing presentation adopts the estimated USD$100–120 million planning range for one Australian astronaut flight. Any items not included in any negotiated mission contract: selection, salary, training, wages and accommodation whilst training, medical screening, medical support, insurance, experiment development and qualification, travel and logistics, Australian mission management, post-flight analysis, opportunity cost and risk contingencies, are not included in this estimate. This cost of flight is based on previous commercial costs per mission per person with Space X. Whilst the Polish €65 million Ignis budget remains a separate historical comparator; it is not used to override this Australian planning range.

Updated cost basis: Single flight and Canadian comparator (US$)

Canada is the comparator for Australia, for the ESA participation contribution, not a legal precedent for Australian admission.

The Canadian Space Agency's programme evaluation reports 2022–23 transfers of C$12.050 million to ESA's General Budget and C$34.308 million to optional programmes, a total of C$46.358 million. The ESA cooperative agreement gives Canada a negotiated 50% contribution rate on the applicable general-budget scale (excluding the specified technological research activity); it does NOT provide a 50% discount on optional-programme subscriptions, on the total payment, or on an astronaut flight. Canada is a cooperating state, rather than an ESA member (Canadian Space Agency, 2023; Government of Canada & European Space Agency, 2019).

Currency convention: the Bank of Canada calendar-year 2023 annual average for Canadian to USD currency was C$1.3497 per USD$1. (Bank of Canada, n.d.)

The 2022–23 Canadian fiscal expenditure is divided by that calendar-year rate, solely to create a transparent approximate USD comparator; note this is not a transaction-date conversion, and the figures have not been adjusted for inflation to 2026.

1. The Canadian general-budget transfer in 2022–23 was C$12.050 million, approximately US$8.93 million at the stated annual-average exchange rate (Canadian Space Agency, 2023, table 1; Bank of Canada, n.d.).

2. Canadian optional-programme transfers in 2022–23 were C$34.308 million, approximately US$25.42 million at the stated rate (Canadian Space Agency, 2023, table 1; Bank of Canada, n.d.).

3. Together, these 2022–23 transfers totalled C$46.358 million, approximately US$34.35 million at the stated rate. Canadian domestic administration costs are additional (Canadian Space Agency, 2023, table 1; Bank of Canada, n.d.).

The Canadian evaluation reports that domestic programme-management costs represented approximately 1–2% of total programme investment. They are additional to the US$34.35 million transfer subtotal (Canadian Space Agency, 2023).



Counterfactual fee calculation

If the Canadian general-budget component were charged at 100% rather than its negotiated 50% rate, its implied general-budget amount would be 2 × C$12.050 million equaling C$24.100 million, or approximately USD$17.86 million, at the stated currency conversion rate.

Holding Canada's optional programme subscriptions constant at C$34.308 million, a purely mechanical no-discount comparator would be C$58.408 million, approximately USD$43.28 million, annually. It should be noted the total Canadian fee of USD$43.28 million is NOT an Australian ESA cooperative agreement fee. Australia's assessed scale, eligibility, accession terms, programme choices, industrial-return rights, and mandatory obligations have not been publicly established.

It should also be noted that the '50% rule' applies only to Canada's defined Basic Activities scale, with treaty exclusions, and may not be extended to Australia. To date, there has been no publicly discussed cooperative agreement fee amount for Australia.

Illustrative cash outlay, not economic return

This comparator represents annual payments under Canada's multi-year agreement and already includes optional programmes. These combinations are illustrative only: a stand-alone flight need not require ESA subscription, and ESA cooperative agreement status does not in itself guarantee a single astronaut flight. One assumed cost is that of USD$100–120 million per single astronaut flight, plus one Canadian-equivalent annual ESA cooperative agreement cost of USD$34.35 million, creating a total of USD$134.35–154.35 million, in a flight year. This calculation is BEFORE ancillary Australian costs (*a.k.a.* equivalent to Canadian administrative costs and any additional programme funding in Australia). Any different Australian programme subscriptions must be specified rather than added a second time to this combined comparator.

Using the mechanical, undiscounted general-budget comparator instead gives USD$143.28–163.28 million. A 10-year nominal constant-contribution illustration would be USD$343.5 million (Canadian-sized fee) or USD$432.8 million (mechanical no-discount comparison), excluding inflation, currency exchange-rate movements, optional programme changes,

domestic administration and the single flight. Neither sum is a negotiated Australian commitment, costs of a cooperative agreement or flight have not been publicly disclosed, the Canadian example is an illustrative comparator, not a prediction or quote for Australia.

Return threshold

For an illustrative US$100–120 million mission cost, a benefit–cost ratio of one requires US$100–120 million in additional discounted Australian net social benefits before allowing for other costs.

If the illustrative Canadian-sized fee is genuinely incremental, and required for the mission, the threshold rises to USD$134.35–154.35 million before ancillary costs are added. It should be noted that industrial contracts cannot be equated with net national benefits, as they include intermediate inputs, imported content, wages and costs of production (electricity, rent and other costs). A 'geographically' returned dollar of contract value, is not a dollar of fiscal recovery.

Sources for updated fee calculation

Several sources were accessed for Canadian fee calculation data.

These include:

1. **Canadian Space Agency. (2023). Evaluation of the European Space Agency Contribution Program of the Canadian Space Agency. https://www.asc-csa.gc.ca/eng/publications/er-2223-0201.asp;**
2. **Canadian Space Agency. (2019). Canada–European Space Agency Cooperation Agreement. https://www.asc-csa.gc.ca/eng/funding-programs/canada-esa/about-cooperation-agreement.asp;**
3. **Bank of Canada. (n.d.). Annual exchange rates. https://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/.**

2.0 Scope, definitions and institutional eligibility

"ESA membership", "ESA cooperative agreement" and "EU membership" are distinct. ESA reports 23 Member States, including non-EU countries. Canada is a 'cooperating country', and has a cooperative agreement with the ESA, it is not a Member State. The legal and financial conditions available to Australia are not established. Any Australian agreement may not mimic the Canadian agreement, which explicitly provides Canada a tailored general-budget contribution, and voting rights (*only for participating programmes*) (ESA, n.d.-a; CSA, 2019).

Appropriate Australian decision set

An appropriate Australian Decision set would include retention of fruitful arrangements that are already established, with consideration and further development of assets and benefits for the Australian people. These might include:

- Retain current bilateral/ground-station relationships;
- Negotiate a general cooperation framework, with manufacturing, aiming for micro- and macro-economic participation in Moon to Mars supply chains;
- Subscribe selectively to eligible ESA activities, if open to negotiation, and within Australia's space capability and development interest;
- Pursue a Canada-type arrangement, if legally and politically available, with consideration of fixed and transparent costs, with advantages to Australian researchers, students and companies;
- Examine full membership, after ROI and KPIs review, if offered, if Australia meets ESA eligibility with accession conditions confirmed and ongoing;
- Purchase each single-astronaut mission [space flight] with negotiated experiment access, as discrete contracts for transparency and budget clarity.

These are alternative negotiation pathways, and are not presented as a single automatic progression pathway(s). The relevant comparison is incremental to the status quo, and existing infrastructure (i.e. the New Norcia infrastructure), established research partnerships, or Australian industrial activity. It must not be claimed or presented as benefits, newly attributable to any later established ESA cooperative agreement.

3.0 Budgetary evidence sources

The budgetary evidence sources and their limitations are identified in Table 1. Benefit–cost ratios are not necessarily comparable across countries or programmes because their scope, methods, industrial participation and outcomes differ. The Canadian evaluation cautions that the information available does not permit a precise total-investment return calculation (Canadian Space Agency, 2023).

Table 1 summarises the evidence, observed findings and interpretive limitations. Comparable, independently verified ROI and KPI data and downstream-benefit estimates are not available for every country or programme reviewed.

Several factors may explain the gaps: budget data may not separately identify the relevant activities; outcomes may not be attributable to a country's ESA participation; and some benefits may appear only after a programme ends. Contract return, domestic employment and wider research benefits also require different measures. Missing information should not be interpreted as evidence that benefits are absent.



Table 1. Evidence base and interpretation

Evidence	Observed finding	Interpretive limitation
ESA official structure	The ESA has 23 'members' in total including the UK and Poland; Canada has a 'cooperative agreement', which is not membership status; EU and ESA are distinct entities.	Membership status does not imply identical programme access
Canada 2023 evaluation	C$213.390 million in ESA transfers for 2018–19 to 2022–23; C$2.494 million in programme management costs; C$215.884 million total programme resources (Canadian Space Agency, 2023, Table 1).	This is an historical Canadian-ESA arrangement; An Australian price for a cooperative agreement has not been publicly divulged, any KPIs and ROI requires finer calibration and tiered to the actual AU $ value of the mooted cooperative agreement
Canada return coefficient	Q1 2023, overall, the return coefficient was 0.95; And this reduces to 0.60 return coefficient for basic activities; And 1.14 for Earth observation activities.	These figures are 'Weighted Eligible Contracts', and not net economic return [on investment].
UK independent evaluation	£7.49 estimated direct UK economic benefit per £1 public ESA investment.	UK-specific attribution/model, not a transferable Australian multiplier due to the maturity of their manufacturing and supply chain access as well as their relatively close geographic location,
UK 2025–26 Space report	£601.732 million ESA subscription expense in 2025–26, including £12.796 million recognised hedging loss; final-quarter geographical-return coefficient 1.01 (UK Space Agency, 2026, financial accounts and performance analysis).	Published expense includes exchange-contract accounting and is not a single-flight cash price. Geographical return measures contracts relative to contribution shares, not social benefit–cost return.
Poland: Ignis	Government reported €65 million mission cost; Data for ROI or ongoing supply chain integration and subsequent manufacturing not reported.	Not necessarily full social opportunity cost [to Poland] and may be not be reflective of Australian price for ESA cooperative agreement participation.
ESA CM22 impact study	Economic footprint of ESA industrial contracts	ESA CM22 impact study explicitly excludes benefits from downstream use of developed space assets by the ESA if a sovereign asset of another nation/country, non-ESA member.

4. Canadian case study: Costs, access, industrial and manufacturing return

Canada's ESA programme is a particularly relevant comparison because it is outside Europe and not an ESA member. Its agreement requires an annual general-budget payment at 50% of the scale that would apply to a Member State (with specified exclusions), plus subscriptions to optional programmes. Canada may attend open Council meetings but does not vote on the general budget. Contract eligibility is tied to programmes it funds (CSA, 2019; CSA, 2026a).

For fiscal 2018–19 through 2022–23 the Canadian Space Agency reported C$55.696m for general-budget payments and C$157.694m for optional programmes, totaling C$213.390 million. C$2.494 million in programme management costs brought total resources to C$215.884 million. Administration was estimated at 1–2% of programme investment. The evaluation also suggested optional-programme overheads may be 20–30%, but stressed that these are rough estimates and do not support a precise net-return calculation (CSA, 2023).

Table 2. Canadian ESA payments and programme resources

Canadian payment component (C$ million)	Five-year observed amount (C$ million)	Percentage share of ESA fees
General budget	55.696	26.1%
Optional programmes	157.694	73.9%
Total ESA fees	213.390	100%
Programme resources (incl. domestic administration of cooperative agreement)	215.884	Not same denominator, domestic [Canadian] cost

Geographical-return coefficient

The overall geographical-return coefficient (GRC) moved from 1.10 in late 2015 to 0.95 in early 2023. (Canadian Space Agency, 2023, Figures 8–9) These figures are ratios of ‘weighted contract shares to contribution shares for eligible activity’.

Sector differences should be noted, i.e. Basic activities [0.60], Earth observation [1.14], Exploration [1.00] and Telecommunications [1.02]. A coefficient of 0.95 is not proof that 95 cents of every gross tax dollar returns as Canadian income, still less a 5% economic loss. In November 2025 Canada announced ESA commitments of €407.71 million (reported as approximately C$664.6 million) including new defence-industrial funding. This is a new commitment, not a one-year historical spending figure, and not an Australian membership benchmark. (CSA, 2026a)



5. Non-EU ESA members and European industrial geography

The United Kingdom, Norway and Switzerland show that ESA membership does not require EU membership. Their relevance to Australia is not legal status alone: they are geographically embedded in the European aerospace and scientific supply chains; they have established transport and technical relationships and participate in a mature procurement ecosystem. Britain also possesses major industrial primes, and has long-term ESA contracting history within its economy.

The UK's 2025–26 report records £601.7m in ESA subscriptions and a 1.01 contract-return coefficient. The evaluation reports £7.49 per £1 of public expenditure and £6.42 per £1 of modelled social cost. These are estimated productivity benefits, not Treasury receipts. The social-cost model includes induced R&D, capital and administration; it is not a reconciled account of all complementary national funding. Necessary extra support must be matched to its benefits without double counting (UK Space Agency, 2025a, 2025b). The UK's 2025 ministerial commitment of £1.7 billion over five years is a 'commitment profile', not an actual annual fee or spent budget (UK Space Agency, 2025, 2026).

Norway and Switzerland are relevant legal and geographic comparators, but this review has not obtained an audited matched panel of their annual contributions, industrial returns, jobs and incremental GDP on a common price-year basis.

Their precise benefit–cost ratios are therefore not estimated due to lack of data. A defensible expanded comparison requires ESA national contribution schedules, national audits, procurement records and consistent time windows to provide meaningful comparable data and estimates for the Australian situation. As this data for Australia is not available, meaningful comparative estimates cannot be made.

6. Geography: Distance, transport and supply-chain participation

Great-circle distance indicates geographical and logistical separation, not freight cost. The haversine formula calculates the shortest distance between two points on a sphere. The routes below use approximate city-centre coordinates; actual cargo routing, airport access, insurance, customs and transit times can differ substantially.

Table 3. Reference-route distances

Reference route	Approx. great-circle km
Sydney–Paris	16,960
Sydney–Cologne	16,570
Sydney–Bremen	16,370
Toronto–Paris	6,001
Oslo–Paris	1,342
Zurich–Paris	488
London–Paris	344

Table 3 compares approximate great-circle distances between Sydney and selected European airport or space-industry centres. Distance may increase freight, travel and coordination costs for some forms of participation, but these distances alone do not establish the size of any competitive disadvantage; actual costs and delivery requirements need to be measured.

The relevant economic channels are recurring personnel travel, on-site engineering integration, prototype shipping, hazardous-material restrictions, time-zone coordination, specialist certification, European test-facility access, export controls, repair cycles and qualification delays. For Australia these may reduce effective local contract margins or discourage small firms from bidding. They must be estimated by industry and task rather than multiplied mechanically by kilometres.

A distance-adjusted supply-chain model should compare landed costs and total delivered programme value. Inputs may include Australian labour and components, freight, customs, insurance, travel, carrying costs, rework, compliance and currency hedging. Software, remote operations, medical research, ground systems and digital services may be less sensitive to physical distance; the effect should be estimated for each activity.

7. Single-astronaut mission: observed benchmark and full cost account

Astronaut participation can support research, capability development, education and science communication. The public economic return of a proposed flight should be assessed against pre-established, measurable KPIs and a credible counterfactual rather than assumed from participation alone (European Space Agency, 2024).

Poland's Ministry of Economic Development and Technology stated that the Ignis mission cost Poland €65 million from the Polish budget. (Ministry of Economic Development and Technology, 2025; ESA, 2025) The Ignis mission flew in 2025, with ESA support, as part of Axiom Mission 4, with a SpaceX Dragon vehicle, and carried with it, Polish experiments. This is the strongest directly published mission-level national cost benchmark identified in this review; it should be noted, however, this mission cost is not an identified, universal astronaut seat price (Ministry of Economic Development and Technology, 2025; ESA, 2025).

Sweden's Marcus Wandt flew the Muninn mission on Axiom Mission 3, in 2024, through an ESA-supported project-astronaut arrangement. Public ESA mission descriptions establish the flight, but do not provide an audited 'all-in' Swedish net economic return figure.

Complete cost boundary

Outlined in Table 4 are cost items which need to be considered for ESA flight participation. In the column of 'Required Items' each item is listed once, to avoid double or mis-counting costs.

Standard matrices could be developed and maintained for mission components and their economic data. Consistent KPIs and ROI definitions would support comparisons across missions and experiments and more transparent government reporting.

Table 4. Full mission cost boundary

Cost centre	Required items
Flight purchase	Crew transport, spacecraft, launch, docking/ISS access, return and recovery
Training and mission support	Flight astronaut and any required backup: salary, training and medical certification; simulators, mission control and ground staff.
Research programme	Experiment selection, hardware, flight qualification, payload integration, samples, post-flight analysis
Insurance and risk	Liability, contingencies, legal obligations, medical/accident risk where priced
Travel and geography	Australia–Europe/US travel, freight, accommodation, specialist on-site integration
Public-sector cost	Procurement, oversight, diplomatic support, grants, outreach and communications
Opportunity cost	Alternative payload access, terrestrial research, industrial qualification, domestic manufacturing
Post-mission obligations	Data curation, publications, IP management, maintenance, follow-up research and evaluation



8. Scenario model: Single Australian astronaut flight

This scenario is deliberately illustrative, in EUR millions, with constant-price amounts and a 10-year horizon. It is NOT an Australian bid, an ESA offer, or a forecast. The €65 million base is Poland's observed mission budget. Additional Australian-specific preparation and downstream costs are sensitivity assumptions requiring quotations.

The principal planning case uses US$110m plus US$10m in ancillary costs, converted at US$0.65 per A$1, and 7% real discounting. This section retains the separate Polish euro benchmark and 4% illustration. These are different scenarios. Post-flight employment and outreach also require costing.

Table 5. Single-flight ancillary-cost scenarios

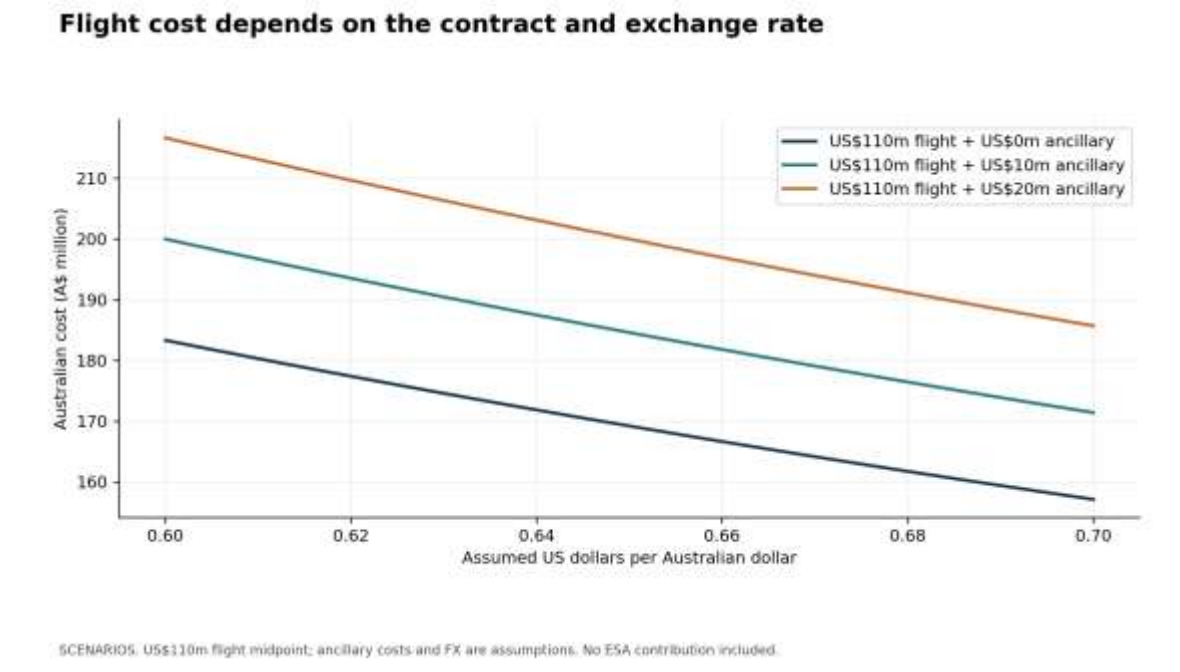
Scenario (EUR € million)	Mission base (EUR € million)	Additional national costs (EUR € million)	Total public cost (EUR € million)	Domestic incremental benefits needed for BCR=1 (EUR € million)
Lower ancillary cost	65	5	70	70
Central illustrative	*65*	*20*	*85*	*85*
Higher ancillary cost	65	40	105	105

Using the central €85 million case, an assumed €15 million in additional discounted Australian net social benefits leaves a €70 million shortfall. Gross domestic value added cannot be substituted for net social benefit. Break-even requires €85 million in additional discounted benefits, measured against consistent full resource costs. These are arithmetic tests, not estimated outcomes (Australian Centre for Evaluation, 2025).

At an illustrative 4% real discount rate, €10 million in additional benefits paid at the end of year 10 has present value €6.76 million. A stream of €10 million at each year-end for ten years has present value of approximately €81.1 million. Timing can materially change the economic case, even when undiscounted totals appear identical in the scenario.

The arithmetic conventions, discount factors and great-circle method used in this section are documented in Appendix A. The evidence gaps and documentary conditions for a final appraisal are listed in Appendix B.

Figure 1. Flight cost depends on the contract and exchange rate



SCENARIOS. USD$110m flight midpoint; ancillary costs and FX are assumptions. No ESA contribution included. Legend: navy, teal and orange lines add USD$0m, USD$10m and USD$20m ancillary costs respectively. Model: cost and exchange-rate sensitivity, C = (flight + ancillary)/USD per AUD; no benefit forecast. Method: Appendix C, Reproducible simulations; Section 18, K1.

9. ESA cooperative agreement versus membership: before-and-after counterfactual

The “before” case is not zero space expenditure: Australia already incurs costs and receives benefits from ground stations and other European relationships. The “after” case must be compared with what would occur without the proposed agreement. A cooperation agreement may increase access to contracts and facilities, but Australian terms and subscriptions remain subject to negotiation.

Table 6. ESA participation and flight counterfactuals

Case	Annual payment status	Contract entitlement	Incremental Australian analysis
A. Existing cooperation	Existing project-by-project costs; Not zero, no discrete budget reporting	Existing negotiated/project rights; Some facilities access	Baseline operations, contracts and research, some facility access
B. New general agreement	In negotiation; No publicly verified fee announced at time of report	In negotiation	May deliver additional access, but does not include administration and optional programme costs
C. Canada-style cooperative arrangement	Hypothetical; Canada has lobbied for and gain a special financial formula; Canada has the advantage of a proven long-term relationship with the ESA.	Canada’s cooperative agreement is programme-linked, and conditional.	Will require ESA written eligibility, contribution [scale] requirements, and ‘return’ terms, with agreed upon financial [programme] participation
D. Full ESA membership	At this stage there is no verified Australian accession/annual fee for this option	If Australia was successful, if admitted as an ESA member, they would gain member rights.	At this stage this can’t be costed, it is not a factual proposal and will require (currently) absent legal and financial terms
E. Single flight purchase	Mission-specific would attract a negotiated price	Crew/payload rights would be established in contract for flight.	This could be separately costed; Does not come with any form of, or automatic ESA membership

Illustrative annual subscription sensitivity (not a membership quote)

To demonstrate the arithmetic, consider annual subscriptions of €20 million, €50 million and €100 million with a 10-year programme, a 4% real discount rate, and 20–30% of programme payments absorbed by overhead, before execution of eligible contracts.

The 20–30% range is drawn from Canadian historical optional-programme discussion; its applicability to an Australian package is unknown, i.e. Australia may choose *not* to take part in any additional/optional programmes as part of its work with the ESA

Table 7. Annual contribution sensitivity at the legacy 4% rate

Illustrative annual payment scenario (€ million)	10-year undiscounted (€ million)	10-year PV at 4% (€ million)	Indicative eligible contract pool/year at 20–30% overhead, BEFORE Earth return (€ million)
20	200	162.2	14-16
50	500	405.5	35-40
100	1,000 (1 billion)	811.1	70-80

These are illustrative payment and contract-pool scenarios, not forecasts of awards. Domestic value added includes wages and operating surplus after intermediate inputs are deducted; it is not net social benefit. A welfare appraisal must separately account for additionality, displacement and resource opportunity costs. A high contract-return coefficient can coexist with negative national net benefit.



10. Economic modelling framework and decision rules

The appraisal uses incremental social cost–benefit analysis, supported by net present value, break-even switching values and sensitivity tests. Under the central Australian planning case, A$184.62 million in initial expenditure requires A$26.29 million in additional annual net Australian benefits over ten years at a 7% real discount rate. A three-year delay raises the annual threshold to A$32.20 million. These are calculated thresholds, not predicted economic returns. Full formulae, assumptions, discounting and calculation coverage are documented in the technical appendices.



11. Australian industry, employment and procurement test

Understanding GDP

An Australian firm winning a €1 million ESA contract does not necessarily add €1 million to Australian GDP. Firm gross value added is output less all intermediate inputs, including domestic and imported goods and services. Domestic suppliers' value added can be counted separately, once. To estimate the causal national increment, the appraisal must also consider work displaced and activity that would have occurred without the agreement. Wages, depreciation and operating surplus are components of value added, not automatically net social benefits (Australian Bureau of Statistics, 2026a; see Figure 2).

Figure 2. A contract dollar is not a dollar of national benefit

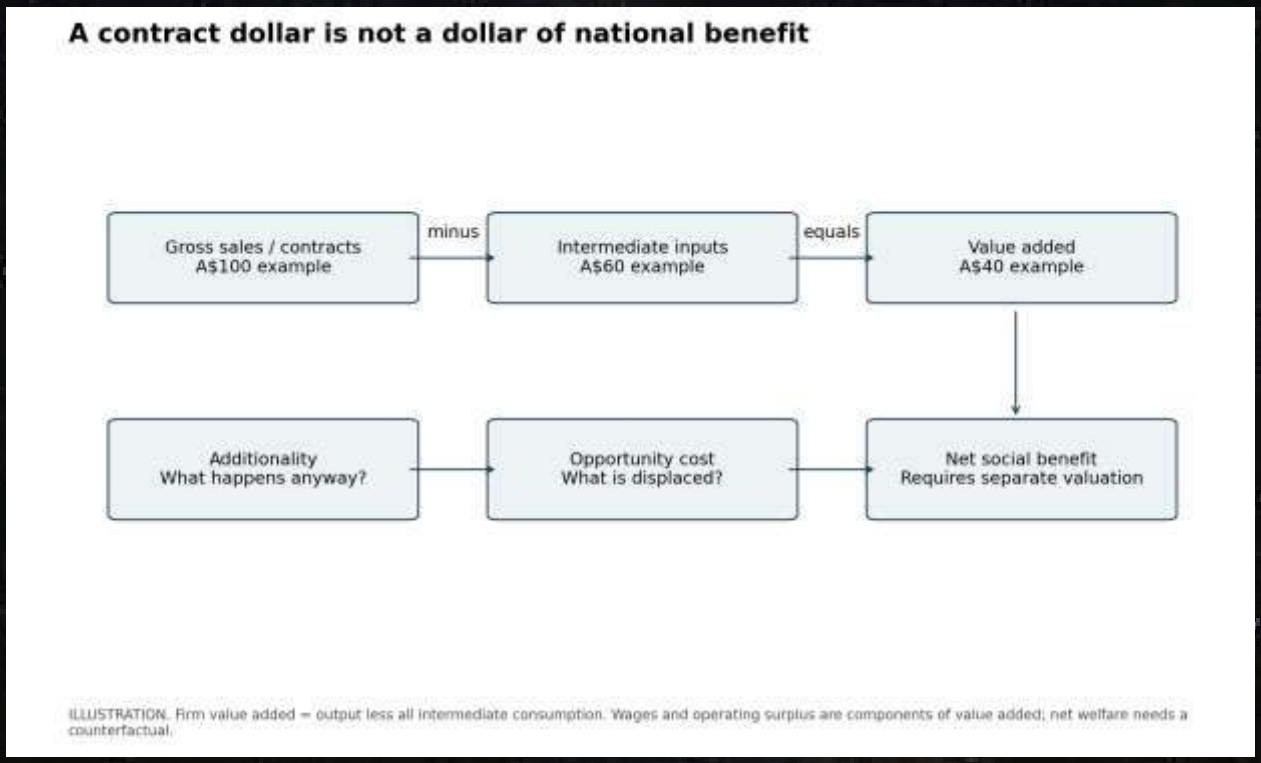
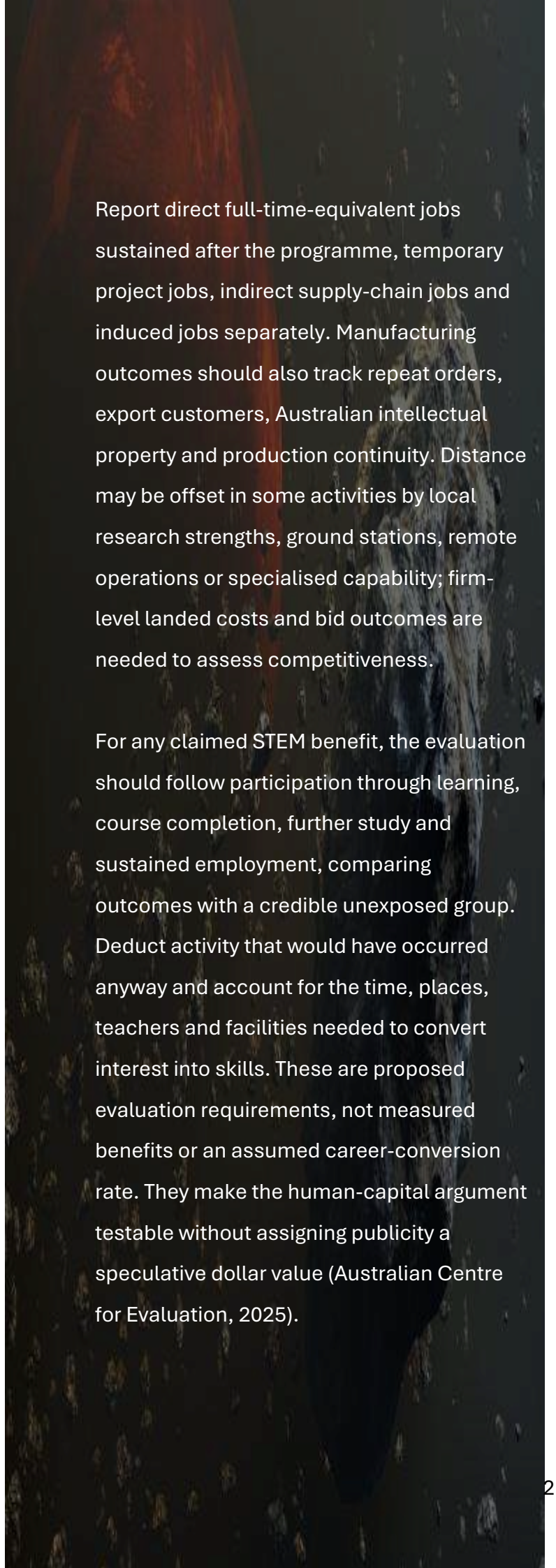


ILLUSTRATION. Firm value added = output less all intermediate consumption. Wages and operating surplus are components of value added; net welfare needs a counterfactual. Legend: upper boxes illustrate sales less intermediate inputs; lower boxes identify further welfare tests. Model: national-accounts decomposition and incremental social-CBA framework; the example is not estimated GDP or ROI. Explanation: Appendix C, Modern economic theory and its practical test; Section 11.



Report direct full-time-equivalent jobs sustained after the programme, temporary project jobs, indirect supply-chain jobs and induced jobs separately. Manufacturing outcomes should also track repeat orders, export customers, Australian intellectual property and production continuity. Distance may be offset in some activities by local research strengths, ground stations, remote operations or specialised capability; firm-level landed costs and bid outcomes are needed to assess competitiveness.

For any claimed STEM benefit, the evaluation should follow participation through learning, course completion, further study and sustained employment, comparing outcomes with a credible unexposed group. Deduct activity that would have occurred anyway and account for the time, places, teachers and facilities needed to convert interest into skills. These are proposed evaluation requirements, not measured benefits or an assumed career-conversion rate. They make the human-capital argument testable without assigning publicity a speculative dollar value (Australian Centre for Evaluation, 2025).

An export manufacturing alternative must also earn its cost

Foreign manufacturing activity shows that a continuing industrial business is possible; it does not establish the return from creating one in Australia. This test retains the A$184.62m public-budget comparator and asks how much additional export business would be required. It assumes no foreign country multiplier and claims no forecast of Australian contracts. Net annual national benefit equals export sales R × additional-sales share q × net-benefit fraction s. The net fraction is after imports, labour and capital opportunity costs, incremental private investment costs, foreign profit leakage and externalities; the initial public outlay is charged once at year 0. Gross sales, payroll, GVA and tax receipts must not be added together as benefits.

At 7% real discounting, ten annual payments and 75% additional sales, a tested net-benefit fraction of 20% requires A$175.23m annual exports to recover the public outlay; a three-year delay raises this to A$214.67m. A$100m annual sales under those assumptions yields A$15m annual net benefit and NPV −A$79.26m. This is a switching-value calculation, not evidence

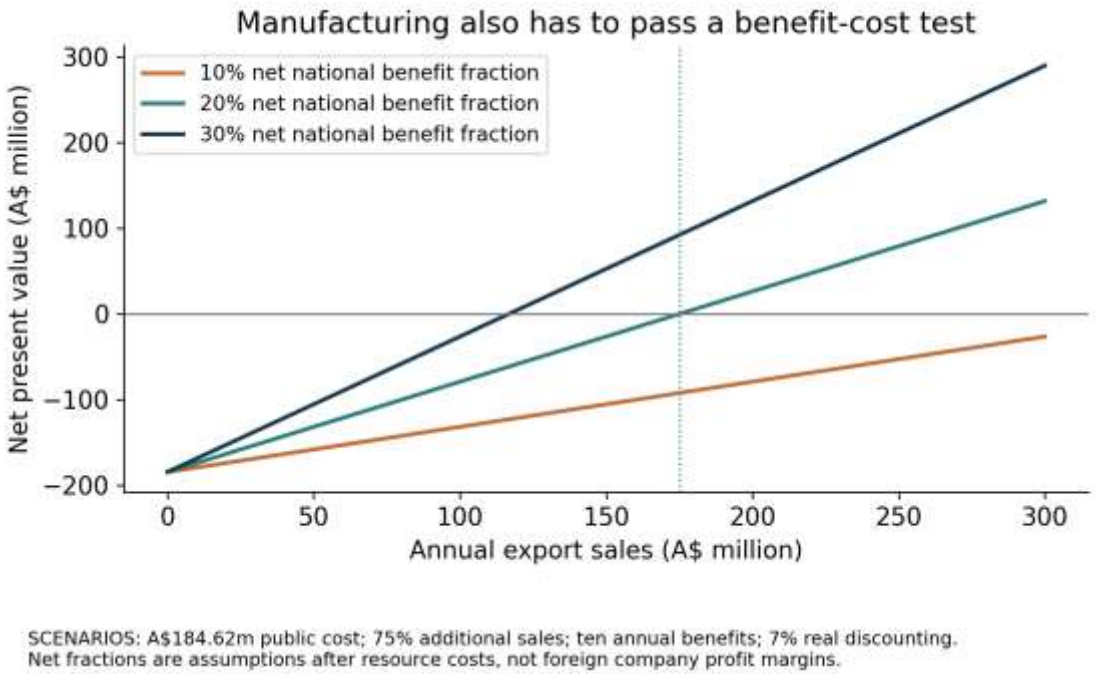
that manufacturing is uneconomic: the commercial pipeline, net fraction and timing remain unverified. The same evidence standard applies to flight and domestic alternatives (Australian Centre for Evaluation, 2025).

Table 8. Australian manufacturing export sensitivity at the central assumptions

Annual exports A$m	Annual net benefit A$m	NPV A$m	BCR
25	3.75	-158.28	0.143
50	7.5	-131.94	0.285
75	11.25	-105.6	0.428
100	15.0	-79.26	0.571

The separate export model executes 216 deterministic cases: four sales levels, three additional-sales shares, three tested net fractions, two delays and three discount rates. An operating-workforce illustration tests 36 combinations of sales, payroll share and loaded employee cost. For example, AUD$50m annual sales with 30% allocated to payroll at AUD$200,000 per FTE-year supports 75 operating FTE; AUD$100m supports 150. These are sales-funded capacity scenarios after operations begin, not net new national jobs, forecasts or additional welfare. The 46.15 FTE in the earlier five-year facilities portfolio is a different, finite public staffing budget; do not add the two measures.

Figure 3. Manufacturing also has to pass a benefit–cost test



SCENARIOS. Public outlay A$184.62m; 75% additional sales; ten annual benefits; 7% real discounting. Tested net national benefit fractions are assumptions after resource costs, not observed foreign profit margins. Legend: orange, teal and navy lines test net national benefit fractions of 10%, 20% and 30%; the horizontal zero line marks NPV break-even. Model: discounted export-benefit sensitivity, with 75% additional sales. Method: Appendix C, Manufacturing export and operating workforce calculations; Appendix H, manufacturing calculation audit.

12. Sensitivities, risk and public disclosure

Risks include non-eligibility for full membership or competitive cooperative agreement and post-flight expectations not met due to procurement concentration in incumbents, contract under-return for investment, uncompetitive foreign exchange changes, manufacturing inclusion dependence on European primes, underfunded Australian qualification facilities, science benefits that are real but are likely to be non-monetisable, and the trap of post-flight 'publicity', that is incorrectly counted as durable industrial growth.

Table 9. Decision parameters and disclosure requirements

Parameter	Low/central/high test	Data needed for definitive result
Australian ESA annual payment	€20/50/100 million illustrations	Requires ESA written offer and programme schedule to create budget.
Eligible-contract share	70–80% illustrative	Requires ESA programme-specific cost and overhead contribution rules to be clarified and costed post currency exchange.
Domestic value-added share	Must be measured and calculated; No unsupported data estimates to be used, requires actuals or similar industry comparison(s).	Firm accounts and import content required for modelling, with calculated net profit or loss to be included in predictive model.
Real discount rate	2%, 4%, 7%	Applicable Australian government appraisal guidance required.
Mission ancillary cost	€5/20/40 million illustration	Australia requires a binding launch, crew costs, as well as research inclusion costs and insurance quotations.
Distance penalty	Distance from Australia to business partners in EU; This is be influenced by sector and will be contract-specific.	Actual freight, travel, qualification and lead times are calculable.
Benefit lag	An estimated benefit lag of between 0–10+ years, depending on industry, technology and market place (novel or mature).	Could be defined by contract award, product sales, and customer milestones; Science and research indicators will use different KPIs that need to be established before contract or flight undertaken.
Exchange rates	Currency exchange fluctuations; Limited ability to predict forward/stress paths; It should be appreciated that a minimum of 3-4 currencies would be involved in this programme (€, £, AUD $, USA$), currency instability and fluctuating conversion rates could greatly hamper profitability.	Somewhat stabilised with Treasury-approved scenario exchange rates; Non-government and non-government associated enterprises, i.e. independent businesses, may be more exposed with currency fluctuations.

13. Findings and recommended evidence threshold

A single-astronaut flight and ESA institutional participation should be evaluated as distinct cost items, with overlapping costs counted only once. The reviewed evidence did not identify an audited causal return for one national astronaut mission. Poland's €65 million Ignis budget is an observed benchmark, but it does not establish Australia's all-in cost or return (Ministry of Economic Development and Technology, 2025).

Canada provides a non-European example of an ESA cooperation agreement. Its payment mix, programme overheads and industrial-return data are useful comparators, but they do not provide a binding Australian agreement or flight quotation. Canada's evaluation cautions against calculating a precise aggregate return from the available information (Canadian Space Agency, 2023).

Third, the United Kingdom demonstrates that large benefits may accrue to an established European industrial participant, whilst its 1.01 geo-return and £7.49 economic-benefit estimate are distinct measures. Australia must test whether comparable contract access and domestic absorption capacity would exist from its greater geographical distance.

Before public commitment, the incumbent government should publish and discuss:

(a) ESA legal/access terms and cost schedule;

(b) an Australian industry capacity and bid-readiness audit;

(c) a mission-specific all-in astronaut quotation;

(d) a 10–15-year incremental social cost–benefit model;

(e) a contract-level Australian value-added and employment model; and

(f) independently reviewed sensitivity analysis.

Without these data and a complete cost account, neither an Australian agreement fee nor national ROI can be established from international experience alone.

Additional assessment: evidence of community benefit and alternative expenditure

The appropriate fiscal question is whether the proposed astronaut flight produces additional benefits for Australians that exceed its full incremental costs and the benefits forgone from the best feasible alternative. A contract awarded to an Australian business, an announcement of jobs, and the gross output of the space sector are not interchangeable with net Australian social benefits (Australian Centre for Evaluation, 2025; OECD, 2022).

In the existing central scenario, a US$110 million flight plus US$10 million in additional costs at US$0.65 per Australian dollar requires AUD$184.62 million in initial expenditure. At a 7% real discount rate, ten equal annual benefits of approximately AUD$26.29 million would be needed to reach a net present value of zero; a three-year delay increases the required annual benefit to approximately AUD$32.20 million. These are switching values, not predicted economic returns. The relevant model is the incremental discounted social cost–benefit analysis; the detailed arithmetic remains in Appendix C.

The community-benefit pathway should be established for every material claim: public payment → Australian recipient or service → additional activity relative to the counterfactual → verified net value added, research or public benefit → geographical and social distribution → timing and persistence. Imported equipment, foreign subcontracting, displacement of existing work, and benefits already expected under current programmes must be separated from new Australian gains. STEM inspiration should be assessed using incremental educational participation and subsequent outcomes, not audience reach alone.

The OECD handbook discusses data, comparability and attribution challenges in measuring the space economy (Organisation for Economic Co-operation and Development, 2022). A UK review combined 68 published return estimates, all positive, and noted possible publication bias; many estimates were inferred from other reported figures. These observations warrant caution about unqualified universal multipliers but do not establish that an Australian flight would have negative net value (UK Space Agency, 2022).

Clark et al. (2014) discuss the difficulty of comprehensively assessing the economic and social effects of public space investment. Corrado et al. (2023) estimate smaller recent macroeconomic spillovers than those associated with earlier US space activity within their

model. Neither study measures the net benefit of a proposed Australian flight; their relevance is to the limits of transferring historical sector-wide estimates to one contemporary mission.

The alternative-use comparison should therefore include domestic astronaut training and analogue facilities, research and payload qualification, mission-control capacity, industrial certification, space medicine, and other science investments. These are alternative investment options, not automatically proven superior projects: each requires its own incremental costs, achievable outcomes and procurement evidence. The appropriate finding is that the presently published evidence does not establish that the single flight is the best use of the proposed Australian public expenditure.

National Spaceflight Foundation: publicly verifiable mission-specific cost–benefit modelling has not been identified in this review. Its potential evidence should be assessed under the same rules as all other advocates' and critics' material.

No financial return has been attributed to the foundation without an accessible model, underlying assumptions and a source that identifies the claim. The evidence-checking requirements are recorded in the technical appendix.



14. Cross-country evidence and what can be inferred

The non-EU-member comparison requires some care. The United Kingdom, Norway and Switzerland are full ESA members but are not EU Member States. Canada is a non-European cooperating (agreement) country established for some period of time, whilst Poland, Hungary and Sweden are ESA members and supply useful national astronaut case studies.

Table 10. Cross-country evidence and causal interpretation

Country	Status	Public Financial Evidence	Causal inference
United Kingdom	Non-EU ESA member	£601.732m ESA subscription expense in 2025–26, including £12.796m recognised hedging loss; geographical-return coefficient 1.01 (UK Space Agency, 2026).	£7.49/£1 direct GVA estimate from quasi-experimental evaluation; Strongest measured UK-specific productivity effect, not a transferable Australian coefficient
Norway	Non-EU ESA member	ESA publishes country contributions and programme accounts; no matched audited national BCR established here	Proximity and mature industrial integration differ from Australia
Switzerland	Non-EU ESA member	ESA country contribution schedules available; no matched audited national BCR established here	No numerical ROI should be inferred.
Canada	Non-European cooperating country	C$213.390m ESA transfers in five fiscal years	0.95 geographical-return coefficient in 2023 Contracts and social benefits require separate accounting.
Poland	EU/ESA member	Government states €65m for Ignis mission	Flight programme cost, not a demonstrated monetary return.
Hungary	EU/ESA member	HUNOR and Ax-4 documented; complete comparable audited cost not established	No defensible mission ROI from programme publicity.
Sweden	EU/ESA member	Muninn flight documented; complete matched national cost/benefit not established	No defensible mission ROI.
India	Non-ESA country |	Official ISRO documents confirm Ax-4 and seven experiments; Reported ₹548 crore spending requires reconciliation with primary budget records	Illustrates access without ESA membership, not equivalent national objectives.
Australia	ESA partner, cooperative agreement negotiations announced 2025	No public binding accession quote or national astronaut mission quote	Counterfactual must start from existing ESA-linked assets.

India is not an ESA member but supplies a separate commercially arranged ISS flight comparison. These groups allow answers for different questions including: the value of European industrial membership, non-European (EU) programme access, and the marginal economics of flying a single astronaut.

Figure 4. National space activity is not attributable to one flight

National space activity is not attributable to one flight

Country / scope	Documented cost or indicator	Flight outputs / industry link	Single flight causal ROI
Poland / Ignis	€65m national mission budget	13 experiments: materials, biotech, medicine, electronics	Not established
India / Ax-4	No reconciled primary cost in this review	7 Indian microgravity experiments; learning for Gaganyaan	Not established
Sweden / Muninn	Flight documented; matched all-in cost not established	Research and operational experience	Not established
Canada / ESA program	C$213.390m transfers, 5 years; 0.95 geo-return in Q1 2023	Access to funded ESA procurement; not a one-astronaut programme	Not a flight ROI
UK / ESA portfolio	£7.49 / public £1; £6.42 / social-cost £1 (2025)	Measured beneficiary productivity; whole ESA portfolio	Not a flight ROI

SOURCES: Polish ministry 2025; ISRO 2025; ESA Muninn 2024; CSA evaluation 2023; UK Space Agency evaluation 2025. Missing ROI means unknown, not zero. Legend: each row separates country, programme scope, outputs and the status of single-flight attribution. Method: structured comparison of evidence; no common return coefficient is fitted. Explanation: Appendix C, International evidence and single flight attribution; Appendix H, foreign-source audit.

Earth-side manufacturing employment and commercial outcomes

Industry surveys and company accounts provide a better test of sustained Earth-side activity than astronaut publicity. The table retains original currencies and reference years. Manufacturing definitions differ: the UK category includes research and engineering;

Canada separates spacecraft and ground-system production; several national surveys also include services. These figures establish the scale of existing activity, not a public-investment ROI or a return caused by a flight.

Table 11. Earth-side industry evidence for the reviewed countries

Country and period	Manufacturing or commercial evidence	Employment evidence	Boundary and source
UK, 2022/23	Manufacturing income £2,467m; direct manufacturing GVA £1,159m, in 2022/23 prices.	Manufacturing FTE 12,489, up 1,903 from 2021/22.	Broad category includes R&D and engineering. Survey estimates, not a flight effect (UK Space Agency, 2025c).
Canada, 2024	C$903m spacecraft and C$151m ground-system manufacturing; combined C$1,054m. Whole-sector exports C$2,177m.	Headline workforce includes government and universities. Manufacturing-only job creation not identified.	Annual survey, 212 respondents. Workforce reconciliation issues recorded below (Canadian Space Agency, 2026b).
Poland, 2022–24	ARP publishes company and supplier evidence; no matched national manufacturing GVA account verified.	Reported 21-firm panel: 970 to 1,268 people (+298).	Not a manufacturing-only FTE census; source year-on-year arithmetic and panel scope need qualification (Agencja Rozwoju Przemysłu, n.d.).
Sweden, 2024	Agency reports SEK4.9bn space-related turnover; SEK20.3bn is the same companies' whole-business turnover.	No comparable manufacturing-only job-creation series verified.	188 identified firms; 60 survey respondents. Do not label all company sales as space sales (Swedish National Space Agency, 2026b).
Norway, 2021	Commercial turnover about NOK11bn; exports about NOK8.9bn.	About 2,700 sector jobs; stock, not new jobs.	Downstream activity dominates. Updated 2025 survey pending, so not a 2026 manufacturing result (Norwegian Space Agency, 2023, n.d.).
Switzerland, 2024 company case	RUAG International: CHF494.9m group sales; reported operating free cash flow excluding divestments −CHF16.4m.	No reconciled national manufacturing job-creation series verified.	Multinational group with foreign production; neither Swiss-only GVA nor national ROI (RUAG International, 2025).
India, FY2024/25 company case	NSIL operating turnover ₹2,761.56 crore; exports ₹452.44 crore; profit after tax about ₹822.20 crore.	Commercial company accounts do not give an industry manufacturing employment series.	Profit is company accounting, not welfare return on Indian space spending. 1 crore = 10 million rupees (NewSpace India Limited, 2025).
Hungary	No matched annual national manufacturing revenue/GVA series verified in this review.	No comparable manufacturing job-creation series verified.	Strategy and mission participation do not fill the statistical gap. No numerical return assigned.

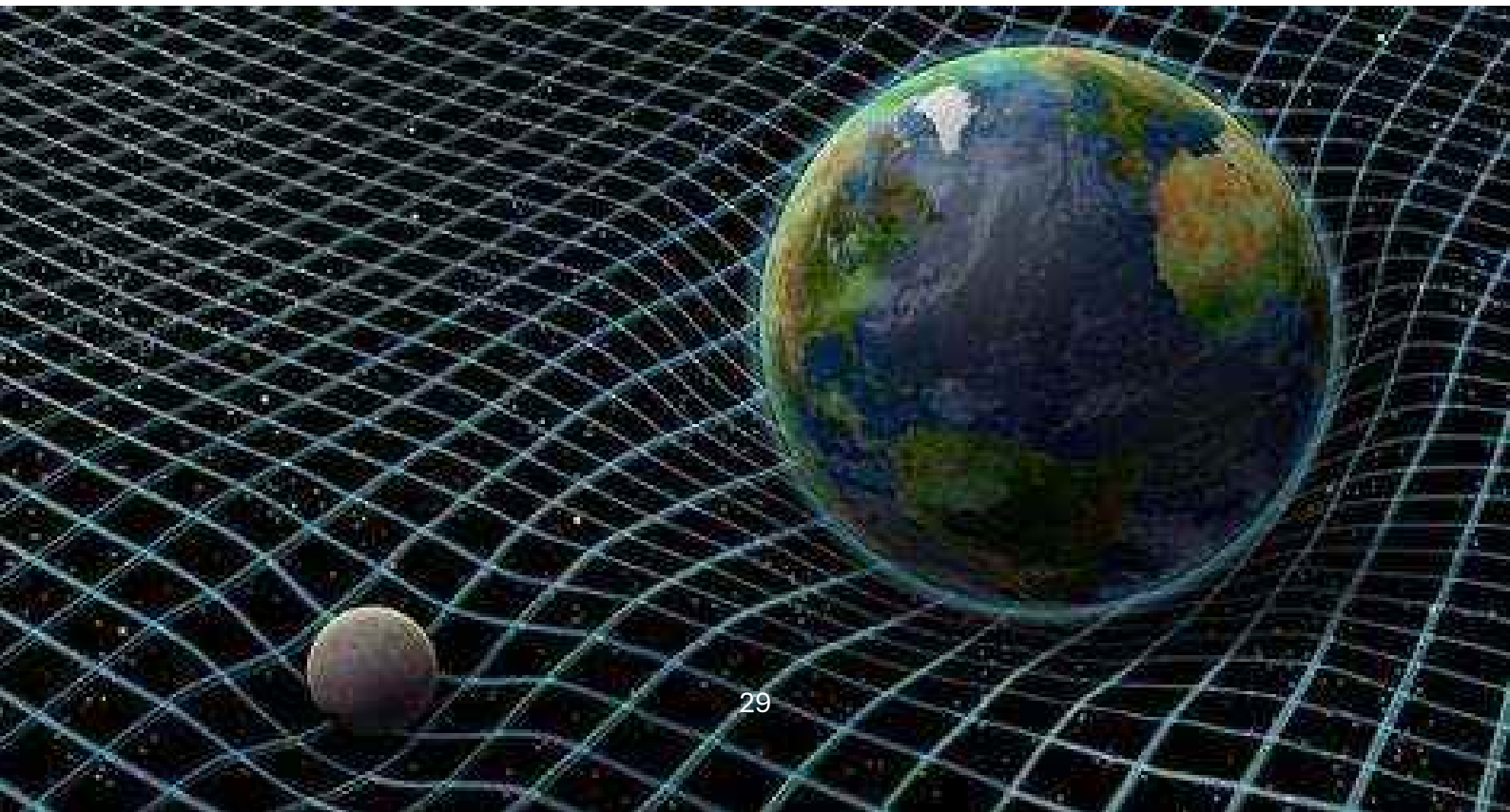
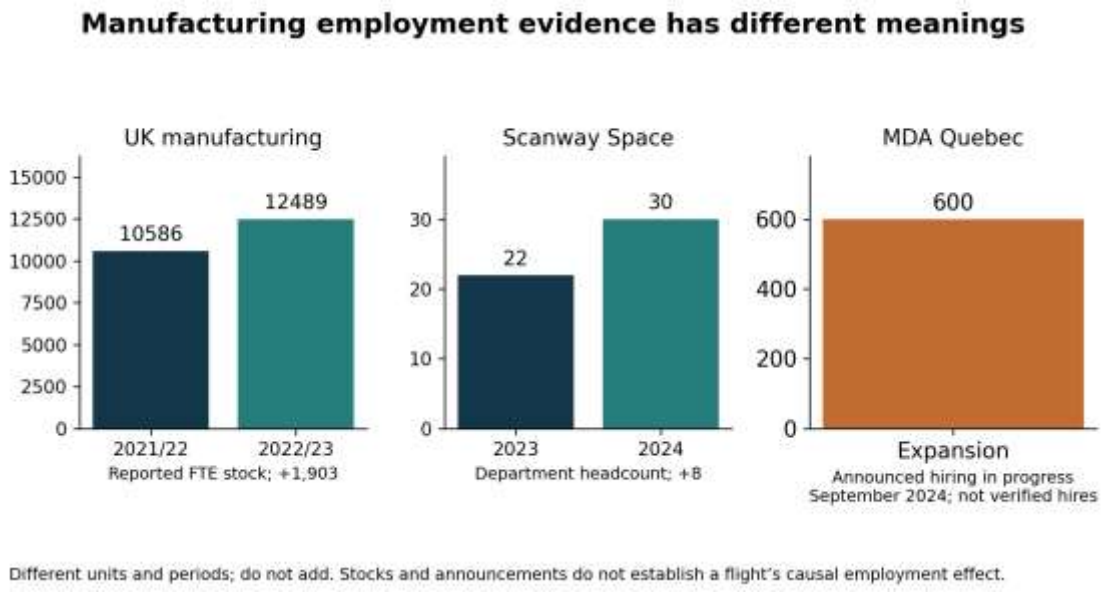


Table 12. Specific manufacturing employment and capacity examples

Example	Specific observed or announced change	Industrial link	What may be inferred
UK manufacturing	10,586 to 12,489 FTE; +1,903 (+18.0%), 2021/22–2022/23.	Satellites, instruments, components, ground equipment and research.	Reported employment growth; manufacturing real income fell 9% in the same comparison. Jobs alone do not prove profit or net welfare (UK Space Agency, 2025c).
Scanway Poland	Space department: 22 to 30 staff in 2024; +8. Whole company 59 to 68.	Satellite optical instruments and cameras; company also serves non-space industry.	Primary management report, section 6. Department growth may include transfers, not eight verified hires. These 2024 data predate the 2025 Ignis flight (Scanway, 2025).
MDA Quebec	Company announced 600 additional high-skill jobs in progress, September 2024.	Factory expansion linked to an initial 198-satellite Telesat order.	Demand-linked manufacturing pipeline, not verified realised hires or astronaut-induced jobs (MDA Space, 2024).
Beyond Gravity	New facilities in Decatur and Linköping opened in 2024; no reconciled local hiring count used.	Launch structures and satellite separation/dispenser systems.	Production capability is identifiable, but group revenue and jobs cannot all be attributed to Switzerland (RUAG International, 2025).

The employment comparison distinguishes payroll stocks, changes in reported stocks, funded operating capacity, announced recruitment and causal net job creation. A defensible Australian job claim requires location-specific hiring and separation records, FTE definitions, project funding duration, displacement and a matched counterfactual. Manufacturing orders and facilities are observable intermediate outcomes; continued contracts, margins, skills retention and national net benefits still require follow-up.

Figure 5. Manufacturing employment measures must be kept distinct



UK: reported manufacturing FTE stocks. Scanway: Space-department staff stocks. MDA: September 2024 hiring announcement in progress. Different periods and units; do not add or attribute to a single astronaut flight. Legend: left = UK manufacturing FTE stocks; centre = Scanway Space-department headcounts; right = MDA's announced hiring in progress. Method: descriptive employment comparison, not estimated causal job creation. Explanation: Appendix C, Manufacturing export and operating workforce calculations; Appendix G, company and survey audit; Section 14.

15. Membership price: an explicit non-quote

ESA mandatory funding is based on Member States' gross national product, whilst optional subscriptions are negotiated programme by programme with the ESA (ESA, n.d.). This does not yield a legally valid Australian accession bill. A purely arithmetic GDP-scale approximation would still omit the negotiated mandatory scale, optional subscriptions, accession terms, contribution ceilings, geographic-return transition, administrative overhead and any programme-specific commitments. Therefore, there is no numerical "presumed membership fee", in this report, presented as an official estimate. The €20m/€50m/€100m annual cases are bounded policy stress tests, not membership prices.

Before-and-after membership cannot be estimated by treating pre-membership European contracts as zero: Australia already provides ground infrastructure and conducts international research with European partners. For each option, the incremental net fiscal cost equals new ESA contributions *plus* Australian administration, travel, testing and compliance, less savings on activities replaced. Incremental benefits must exclude contracts and research that would have occurred anyway.



16. Employment, fiscal effects and distribution

The model should disclose five employment measures separately:

(1) Australian direct FTE-years on funded contracts;

(2) enduring FTE positions two and five years after the contract;

(3) indirect supply-chain FTE-years, with Australian import coefficients;

(4) induced jobs, only if supported by an explicit input–output or general-equilibrium model; and

(5) displaced jobs elsewhere in the economy. “Jobs supported” is not the same as net new continuing employment.

Fiscal return requires additional [Australian] Commonwealth and state and territory tax receipts, changes in payments, public service costs and foregone revenue and should not be confused with GDP uplift.

A public investment can have a positive social NPV, while returning less than its cost in taxes; equally, a contract programme may create revenue without a positive social NPV. These dichotomies should be remembered, and appreciated when viewing modelling outcomes, and illustrate why it is important to have pre-defined KPIs and ROI before space flight or ESA cooperative agreement(s) are executed.



17. Audit standard and independent review

A definitive evaluation requires ESA's written Australian eligibility/fee proposal, programme-level eligible procurement schedules, bidder-level Australian cost and import-content data, a binding astronaut procurement quote, and an independent evaluator with access to both unsuccessful bidders and comparison firms. Difference-in-differences needs credible parallel trends, treatment timing, overlap and tests for selection. One astronaut and a national programme are unlikely to support a simple country-level causal estimate, firm/payload-level evaluation is preferable. The preferred design is a pre-registered difference-in-differences or matched-firm study for industrial productivity, supplemented by audited social cost–benefit analysis, a sensitivity-tested supply-chain model and a qualitative scientific-value assessment. The reviewer(s) should publish data definitions, discounting convention, price base year, currency assumptions, treatment of existing activity, displacement and selection effects, contract weighting, confidence intervals and material conflicts of interest. Claims that cannot be independently checked must be reported as scenario results or unquantified potential benefits, not as actual facts. Appendix A supplies the reproducible calculation conventions. Appendix B distinguishes established observations from missing evidence. Appendix C expands the economic appraisal; Appendix D recovers the earlier Australian budget evidence; Appendix E records departmental model access and the limits of execution.

Additional source notes

The following sources provide further institutional and modelling context:

- European Space Agency. (n.d.). ESA facts. https://www.esa.int/About_Us/Corporate_news/ESA_facts
- European Space Agency. (n.d.). Funding. https://www.esa.int/About_Us/Corporate_news/Funding
- European Space Agency. (n.d.). ESA, an intergovernmental customer. https://www.esa.int/About_Us/Business_with_ESA/Business_Opportunities/ESA_an_intergovernmental_customer
- Canadian Space Agency. (2024). Supplementary information tables: 2023–24 departmental results report. https://www.asc-csa.gc.ca/eng/publications/drr-2023-2024-tables.asp
- Indian Space Research Organisation. (2025, July 15). Axiom-4 mission: A saga of approximately 12 million kilometres and 282 orbits aboard the ISS. https://www.isro.gov.in/ISRO_EN/Axiom04_mission_successfully_concluded_return_ISRO_Gaganyatri_ShubhanshuShukla.html
- Australian Space Agency. (n.d.). International partnerships. https://www.space.gov.au/international-partnerships

18. Departmental economic models and calculation comparison

The numerical results in this review are local arithmetic and scenario calculations. Departmental macroeconomic and general-equilibrium models are discussed to explain their possible uses and data requirements; no mission-specific run of those models was performed. Section 18 and Appendices E and H distinguish completed calculations from unexecuted specialist models. No forecast from an unexecuted model is attributed to Treasury.

Table 13. Common calculation register

ID	Calculation and convention	Result
K1	(US$110m + US$10m)/0.65, year 0	184.6154; planning assumption
K2	C$46.358m / 1.3497	US$34.346892m; historical nominal comparator
K3	Σ years 1–10 of (1.07)^−t	7.023582 annuity factor
K4	A$20m × K3	140.4716 PV benefits; tested, not forecast
K5	K4 − K1	−44.1437 NPV under the A$20m benefit test
K6	K4 / K1	0.7609 BCR under that test
K7	K1 / K3	26.2851 annual break-even benefit
K8	K7 × (1.07)^3	32.2004 annual break-even benefit, years 4–13
K9	(US$34.346892m/0.65) × K3	371.1357 PV of ten annual comparator contributions
K10	0.60×K1 + 0.08×K1×Σ years 1–5 of (1.07)^−t	171.3260 portfolio PV cost under the stated schedule
K11	0.25×K1/(5×A$0.2m per FTE-year)	46.1538 funded FTE for five years; not net jobs
K12	Incremental GDP, net jobs and tax recovery	Not estimated: contracts, imports, counterfactuals and microdata missing

Table 14. Calculation coverage in CBA, EMMA and MARTIN

Calculation	Project CBA	Treasury EMMA	RBA MARTIN
K1–K2 Cost and currency	L	I	I
K3–K8 Discounting NPV BCR and thresholds	L	I / post-process	I / post-process
K9 Subscription cost schedule	L	I	I
K10 Domestic portfolio cost schedule	L	I	I
K11 Funded staff capacity	L / budget identity	I, not net jobs	I, not net jobs
K12 GDP net jobs taxes	M; external estimates needed	M; not run	M; not run

Key: L = calculated locally; I = potential input or post-processing identity, without a model run here; M = required [illegible] model, not run; N = outside the model's principal purpose. These codes are not zero-valued results. See Appendix E for [illegible] status.



Table 15. Calculation coverage in CGE climate and fiscal frameworks

Calculation	ORANI / VU-National / regional CGE	ATEM climate model	Fiscal and distribution accounts
K1–K2 Cost and currency	I; classify by commodity and import origin	I if relevant to a defined climate scenario	L for gross budget outlay
K3–K8 Discounting NPV BCR thresholds	I / welfare post-processing; no project run	N for a flight CBA	L for stated fiscal flows; separate from welfare
K9 Subscription cost schedule	I; distinguish foreign transfer and purchased services	N	L for scenario cost; no negotiated fee established
K10 Portfolio cost schedule	I; capital and recurrent demand must be separated	I only if an energy/emissions question is defined	L for scheduled outlay
K11 Funded staff capacity	I; CGE net employment needs labour-market closure	N	L as funded capacity; household effects not estimated
K12 GDP net jobs taxes	M; zero-shock demo only, no mission result	N for mission ROI; climate extension would need data	M; no tax or beneficiary-microdata model run

Key: L = calculated locally; I = potential input or post-processing identity, without a model run here; M = requires a calibrated mission-specific model, not run; N = outside the model's principal purpose. These codes are not zero-valued results. See Appendix E for access and execution status.

19. Economic literature and evaluation of ROI

The literature review examined how studies define the space sector and measure economic outcomes. Henderson et al. (2012) use night-light data to measure economic activity; Garretsen and Martin (2010) examine geographical history and agglomeration; Wilson (2011) discusses terrestrial economic geography. Appendix F records the policy and literature sources screened.

This literature is broad in scope, but does not provide a single-astronaut-flight ROI estimate. It cannot establish that flight spending produces a specified gain or loss.

Biddington (2021) identifies geography and national security as persistent drivers of Australian space policy and cautions against treating the creation of an institution as a complete policy settlement. This supports a purpose-specific investment case but does not estimate the return on the proposed single-astronaut flight.

Macauley (1995) distinguishes tangible and intangible space benefits and illustrates valuation questions. Its historical discussion is not a current estimate that all space investment lacks productivity gains, particularly in light of the later UK portfolio evaluation. The verified abstract of Bongers et al. (2026) frames market failures, regulation and public economics; the accessible summaries of Peeters (2024), Sandhu (2023) and Mirek (2025) address commercial structures, disclosure and sustainability. These support careful appraisal and reporting, but provide no verified Australian single-flight multiplier. Appendix G records access limits and excludes unresolved links from numerical claims.

Appendix D recovers the earlier Australian budget collection, and separates programme authorities, award offers and actual R&D expenditure. ABS evidence also shows why “all science jobs lost” is not an acceptable aggregate: government R&D effort was 16,338 person-years in 2024–25 compared with 15,889 in 2022–23, while real expenditure fell. This does not erase the documented CSIRO reductions; it demonstrates that sector coverage and measurement units must be explicit (Australian Bureau of Statistics, 2026c).

The 2026 Statement on Space describes a durable domestic space economy delivering essential services, greater Australian participation in the value chain, spillovers to other sectors

and access to international markets. It also identifies mission support, ground operations, testing and a microgravity ecosystem.

The DCCEEW Science Strategic Statement emphasises evidence-based decisions, outcomes, scientific skills and retention. It supports an opportunity-cost and capability assessment; it does not determine whether this mission should proceed. Regional access, First Nations participation and disability inclusion require explicit design and measurement (Department of Climate Change, Energy, the Environment and Water, 2026).

The federal education toolkit and Queensland's STEM guidance support skills and learning, but do not supply a monetary return coefficient for astronaut inspiration (Department of Industry, Science and Resources, 2026; Department of Education, n.d.; Queensland Department of Education, n.d.). The STEM Equity Monitor provides a national pathway baseline from school through tertiary study, graduation and employment, including women and other underrepresented groups.

A space-flight outreach programme should report learning, enrolment, completion and employment changes against that baseline, not equate audience reach with additional STEM workers.

Continuing funding obligations and alternative support for the space sector

A single astronaut flight and a continuing programme subscription are different fiscal decisions. The relevant Australian comparison should therefore report (a) the full one-off mission cost, (b) any additional recurring or multi-year ESA payments, (c) domestic programme administration and complementary funding, and (d) the public value that could be obtained from established Australian industry, research and training instruments. Existing spending and benefits must remain in the baseline rather than being attributed to a new agreement.

The European Space Agency reported €22.3 billion in commitments at its November 2025 ministerial meeting. The United Kingdom announced £1.7 billion in new five-year ESA subscriptions, while its 2025–26 accounts recorded £601.7 million in ESA subscription

expenditure and obligations extending into 2035. These amounts describe different time periods and accounting concepts and must not be added together. They illustrate the significance of future commitments and the importance of annual cash-flow schedules, rather than providing an Australian price (ESA, 2025; UK Space Agency, 2026).

Canada announced €407.71 million (approximately C$664.6 million) in ESA programme commitments in November 2025. Its cooperation agreement extends to January 2030, with programme participation and payments determined by negotiated terms. The Canadian 2025–26 departmental plan had separately reported C$31.432 million in planned annual contributions for that financial year. The later multi-year commitment must not be mistaken for an annual fee or added to overlapping appropriations (Canadian Space Agency, 2025, 2026).

Australia already supports its space sector through domestic programmes. The Moon to Mars initiative was allocated AUD$150 million over five years (2021–2026); the 2024–25 departmental annual report describes AUD$42 million for the Australian lunar rover consortium and AUD$3.6 million in supply-chain capability grants. These programmes support manufacturing, technology qualification and research independently of purchasing a single astronaut flight. They are not necessarily interchangeable with crewed-flight objectives, and their incremental social returns also require evaluation (Austrade, n.d.; Department of Industry, Science and Resources, 2025).

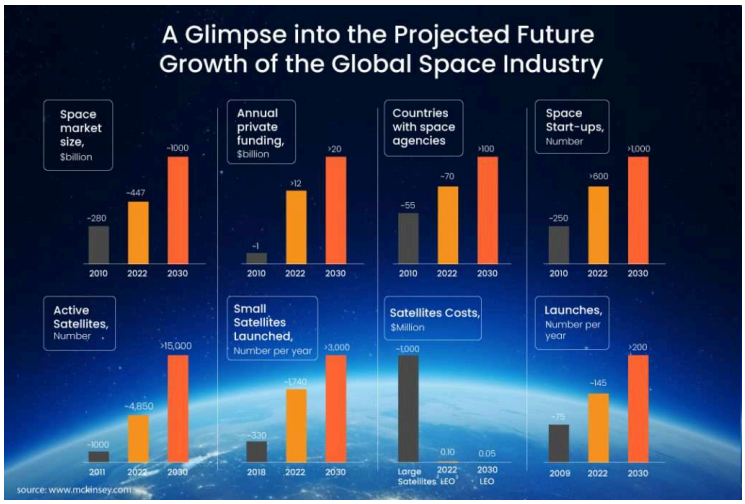
The Australian department's 2024–25 performance report records AUD$3.997662 million in Moon to Mars supply-chain grants associated with AUD$2.316864 million in business contributions, and a AUD$42 million lunar-rover grant associated with AUD$11.755804 million in business contributions. These are reported co-investment commitments, not proof of realised economic benefits. The distinction matters equally for claims made on behalf of astronaut missions (Department of Industry, Science and Resources, 2025).

The comparison should trace benefits beyond contract announcements: Australian value added net of imported inputs; durable local employment and wages; subsequent commercial sales attributable to the intervention; taxation net of subsidies; retained intellectual property; regional and educational access; and spillovers not otherwise achievable.

Where evidence is unavailable, record the result as unquantified rather than zero or realised return. Include the ongoing costs of facilities, technical staff, grants and training after initial appropriations expire.

These figures describe obligations and measurable outcomes, not the superiority of a flight or domestic programme. A like-for-like assessment requires common costs, timing and benefit attribution. Appendix G records the source audit; Appendix H explains the appraisal methods.

Indian Space Agency Projected Future Growth of Global Space Industry



NT News, October 2026

PM's $160m astronaut plan faces fierce backlash

LIAM MENDES

The Albanese government has written to state and territory leaders asking them to help with a $160m mission to send Australian of the Year Katherine Bennell-Pegg to the International Space Station.

In a letter obtained by The Australian, Science Minister Tim Ayres and Assistant Science Minister Andrew Charlton wrote to the leaders asking them to "partner" with the commonwealth in Australia's first official astronaut mission to take place in the first quarter of 2028.

However, the Northern Territory government has hit back at the mission, labelling it "reckless" at a time when people are struggling with the cost-of-living crisis, and calling on the federal government to "come back down to earth".

"It's reckless and shows the PM's priorities are way out of touch with Australians," Acting Chief Minister Gerard Maley said.

A spokesman for the NSW government also said it was not something they were considering supporting at this time.

While Mr Maley congratulated Ms Bennell-Pegg – Australia's first qualified astronaut – and said she was an "extraordinary" Australian, he said the expenditure could not be justified.

"The question for Anthony Albanese is simple: is a $160m space mission really the priority right now?" Mr Maley asked.

"The federal government cannot tell Australians there isn't enough money for the things they need on the ground, then spend $160m going to the moon.

"The PM doesn't understand Australians are doing it tough right here on Earth. The Albanese government needs to focus on everyday Aussies and young families doing it tough before sending someone into space."

> "The question for Anthony Albanese is simple: is a $160m space mission really the priority right now?"
>
> GERARD MALEY
> NORTHERN TERRITORY ACTING CHIEF MINISTER

In the letter penned by Mr Ayres and Dr Charlton and sent at the start of August, they wrote that Australia had been invited by the European Space Agency to take part, and that commitment was required by mid-October.

The letter describes the mission as "more than a seat for Ms Bennell-Pegg" on the International Space Station, saying it would be a "complete Australian mission that includes locally developed experiments and technology".

They wrote that the federal government had received offers of support from a broad range of stakeholders, including state and territory governments, industry and philanthropic organisations.

Businessman Dick Smith in April pledged $1m, saying the endeavour would encourage thousands of schoolchildren to pursue careers in engineering, science and technology.

In an April 7 letter to Mr Albanese, the entrepreneur urged the Prime Minister to personally support an Australian partnership with the European Space Agency.

"This is not simply about sending one Australian into space," Mr Smith wrote.

"It is about whether Australia chooses to seize a rare strategic opportunity that may not come again for decades."

The revelation comes a day after the Reserve Bank lifted the cash rate to 4.6 per cent, its highest level in 15 years.

Australian Bureau of Statistics figures released on Wednesday showed headline inflation had jumped to 4 per cent in the year to August, up from 3.5 per cent in July, driven largely by increases in housing and fuel costs – and well above the Reserve Bank's target band of 2-3 per cent.

A spokesman for the SA government said: "South Australia stands ready to partner with the federal government in what should be a national endeavour."

Alternative space-industry investment and the Australian public-benefit test

Global market growth is not a project-specific return

The World Economic Forum and McKinsey (2024) forecast that the global space economy could expand from US$630 billion in 2023 to US$1.8 trillion in 2035. The forecast includes both direct space-sector activity and downstream space-enabled applications; it is not an estimate of net Australian welfare, and cannot be multiplied by an assumed Australian market share to justify a single astronaut mission. The OECD (2026) likewise identifies downstream satellite data and services as a major source of economic value. These forecasts should be treated as scenarios with definitional and attribution limitations, not guaranteed receipts.

Australia already has an industry platform

The Australian Space Agency's 2025 sector fact sheet reports approximately A$4.6 billion in annual sector turnover, 17,000 full-time-equivalent positions and approximately 620 organisations. Its narrower 2022 specialised-space-business series reports AUD$1.1 billion turnover, AUD$330 million GDP contribution and 3,600 employees. These measures cover different populations and dates and must not be summed. The fact sheet also cites annual satellite-enabled benefits of approximately AUD$1.5 billion in agriculture and AUD$115 million in mining; these are estimates of benefits associated with services, not marginal benefits from the proposed astronaut flight.

The Space Industry Association of Australia (SIAA) Member Capability Matrix 2025 offers a complementary industry-supplied inventory of participating organisations and their stated technical capabilities. It helps identify existing and potential Australian suppliers across space-related activities, and may guide further investigation of domestic procurement, capability gaps and investment alternatives. Its coverage is association-member based and should not be interpreted as a complete census of Australian space businesses. Crucially, the matrix documents reported capabilities; it does not independently verify commercial readiness, contract performance, additional employment, Australian value added, or economic returns from public expenditure (SIAA, 2025).

Accordingly, SIAA capability entries are leads for verification rather than evidence of realised benefits. Any proposed funding pathway should be tested against independent procurement records, audited financial or employment data where available, Australian content and import shares, subsequent sales, counterfactual outcomes, and the opportunity cost of public funds.

Neither the existence of these capabilities nor the projected expansion of the global space economy demonstrates that a dedicated astronaut flight is necessary to develop them.

Potential domestic investment pathways and measurable outcomes

Agriculture and food systems — fund Earth-observation analytics, positioning services, regional connectivity and producer adoption trials. Test changes in input costs, yield variability, water efficiency and independently measured farm margins against an untreated or matched comparison group.

Transport, freight and logistics — invest in positioning, navigation and timing resilience, tracking, communications and interoperable data services. Test avoidable delay, fuel use, supply-chain losses, service reliability and net Australian supplier revenue.

Communications and regional communities — test satellite broadband access, remote-service continuity and locally maintained ground infrastructure. Measure incremental connectivity, business uptime, education and health-service access, with operating and subscription costs included.

Emergency management — develop Australian fire, flood, drought and coastal monitoring applications, alert integration and decision-support procurement. Evaluate response time, avoided damage and service reliability without claiming every avoided loss is caused by the intervention.

Australian manufacturing and research infrastructure — competitively support flight-qualified components, sensors, robotics, ground systems, testing facilities and research-to-industry partnerships. Measure contracts won, export value added, Australian intellectual property, durable skilled employment and additional private co-investment, net of displacement.

Other public-interest alternatives — apply the same appraisal to health research, regional infrastructure, advanced manufacturing and education. Space-sector investment is not automatically preferable to these non-space uses of scarce public funds.

The 2018 Review of Australia's Space Industry Capability explicitly identifies satellite communications, ground stations, space situational awareness, positioning, Earth observation and research as Australian strengths. The Bureau of Infrastructure and Transport Research Economics (2024) identifies potential regional agricultural and mining benefits from low-Earth-orbit connectivity. These sources establish plausible investment channels, not an unconditional case for subsidy.

Apply one consistent appraisal standard to every option

Each option, including an astronaut mission, should disclose the full Commonwealth, state and other public costs; capital and recurrent obligations; an explicit counterfactual; Australian value added rather than gross turnover; additionality and displacement; distribution across households, regions and firms; evidence of enduring capability; and discounted net social benefit under common price-year and discount-rate assumptions. Procurement, research and industrial benefits attributable to a mission should be credited where demonstrable, but existing space-industry growth must not be attributed to that flight merely because it occurs in the same sector.

The proposition that Australia can participate meaningfully in the space economy without purchasing a dedicated astronaut seat is therefore a credible policy counterfactual, not a proven conclusion that crewed missions have no scientific, diplomatic, educational or industrial value. The public decision is whether the mission's incremental benefits exceed its incremental costs and outperform feasible alternatives. "Vanity flight" is a political description. Economic appraisal can test costs and benefits, but cannot establish that label as fact.

Policy inference — The above evidence supports testing a credible non-flight route to Australian space-industry participation. It does not demonstrate that every domestic programme is beneficial, that all flight expenditure is wasteful, or that a specific alternative has already passed cost–benefit appraisal. Selection requires comparative NPV, fiscal affordability, risk, distribution and transparent Australian benefit attribution.

Calculation D — Ten-year 7% level annuity factor = [1 − (1.07)^−10]/0.07 = 7.0235815.

Break-even annual amount = initial cost/7.0235815. Worked examples: AUD$100m→AUD$14.238m; AUD$120m→A$17.085m; AUD$160m→A$22.780m.

Hypothetical additionality illustration: AUD$30m×0.60=AUD$18m annually; AUD$18m×7.0235815=AUD$126.424m PV.

All amounts are illustrative A$ real unless otherwise specified; the source for discount-rate choice and the assumed cost base must be retained in the principal model section.

Source A — Space Industry Association of Australia (2025), SIAA capability matrix 2025: self-reported member capabilities, not measured returns. https://www.spaceindustry.com.au/siaa-capability-matrix-2025/

Source B — Agora High-Tech (2024), Where the Australian Space Sector is heading in the next decade?, pp. 1–2: attributed Space Foundation global estimates, Australian programme examples and industry commentary. Status: sector commentary; underlying third-party figures require primary verification. https://agora-hightech.com.au/wp-content/uploads/2024/11/Where-the-Australian-Space-Sector-is-heading-in-the-next-decade-Nov-2024.pdf

Source C — NSW Space Research Network (2026), Australia's Space Research and Development Landscape: White Paper, executive summary, pp. 1–8: scope, investment barriers, sector dependencies, claimed AUD$1–1.2bn annual spending and research priorities. Status: author synthesis; no independent budget reconciliation undertaken here. https://www.spaceresearchnetwork.org.au/wp-content/uploads/2026/08/Executive-Summary.pdf

Source and calculation audit trail

International growth forecasts are contextual market scenarios, not project appraisals. The World Economic Forum–McKinsey 2035 space-economy projection and the Space Foundation 2023 estimate quoted in Agora use different scope, years and methodology; neither measures marginal Australian national welfare. Likewise, the UK space-R&D direct-value and spillover ratios cited by the NSW white paper are not transferable benefit–cost ratios for Australia or for a single astronaut flight. Their primary methodology must be checked before any numerical use in the appraisal (NSW Space Research Network, 2026, p. 2; Agora High-Tech, 2024, p. 1).

Earth observation/agriculture: baseline producer outcomes, uptake, independent agronomic trials, cost of imagery and software, net savings and distribution across regional producers. Communications/transport: verified outage avoidance, time savings, resilience valuation,

customer adoption and foreign service dependence. Emergency management: counterfactual incident outcomes, avoided loss net of response and capital costs, and attribution of satellite information. Manufacturing/testing: Australian contract awards, imported content, value added, plant utilisation, exports, additional job-years and productivity. Life sciences/analogues: validated research outputs, technology readiness, translation agreements, Australian IP ownership and domestic health/agriculture application. Astronaut flight: independently specified experiments and payloads, flight-dependent results, Australian-owned IP, contracts, incremental STEM outcomes, opportunity costs and all mission-associated public funding. None of these pathways receives an assumed positive multiplier.

Evidence-to-outcome register for competing investments

To illustrate benefit attribution rather than invent project returns: if a domestic satellite-data programme produced independently measured gross annual Australian user savings of AUD$30 million, but only 60% were additional after counterfactual and displacement adjustments, its attributable annual benefit would be AUD$18 million before programme operating costs. The 60% and AUD$30 million values are hypothetical sensitivity inputs, not source-derived estimates. At a 7% discount rate over ten years, AUD$18 million annually has a present value of approximately AUD$126.4 million before costs. This would not justify AUD$160 million of initial expenditure on its own. An identical additionality and cost test applies to astronaut research, education, commercial contracts and diplomatic benefits.

For an initial outlay of AUD$160 million, a ten-year benefit horizon and 7% real discount rate, the level annual incremental net Australian benefit required for NPV = 0 is AUD$160m × 0.07/[1 − (1.07)^−10] = approximately AUD$22.78 million per year. For AUD$100 million and AUD$120 million the corresponding thresholds are approximately AUD$14.24 million and AUD$17.09 million. These scenarios exclude any additional recurrent cost and are deliberately NOT forecasts of realised flight benefits. If benefits begin later, costs recur, or Australian capture is lower, the required gross benefit increases. The same formula and horizon must be applied to alternative investments.

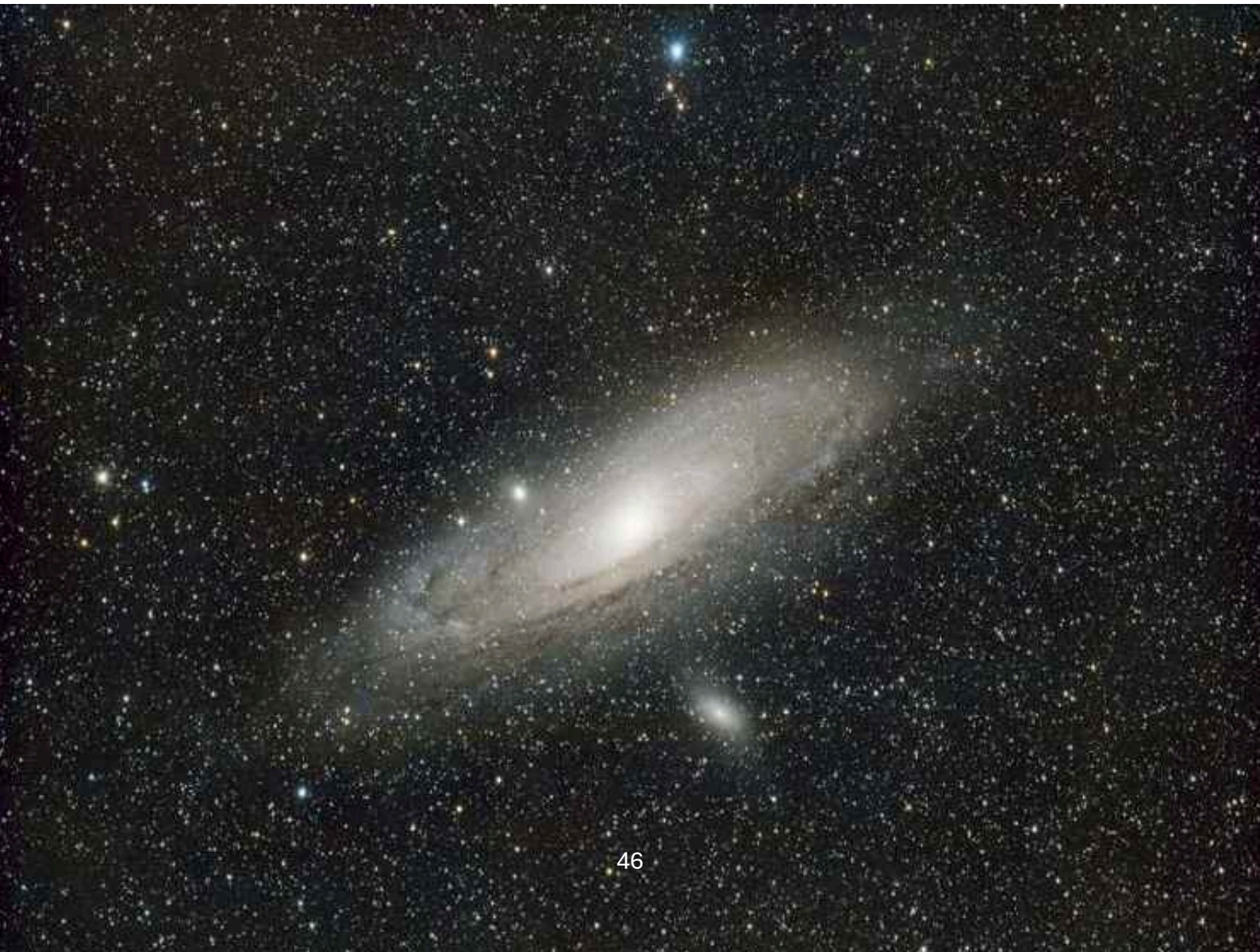
Illustrative threshold model (not predicted economic returns)

For every option J, the decision metric is incremental Australian net present value:

$$NPV(j) = -C0(j) + \Sigma[t=1...T] \{B_AU(j,t) - C_AU(j,t)\} / (1+r)^t.$$

C0 is initial Australian economic resource cost;

- B_AU is additional Australian benefit relative to a specified no-project counterfactual;
- C_AU is continuing Australian resource cost; r is the real discount rate; and
- T is the appraisal horizon. Government transfers and gross contract receipts are not automatically net national benefits. Imported inputs, displacement, deadweight, risk, administrative costs and residual value require separate treatment. Commonwealth and state payments must be consolidated to avoid double counting. This is the proposed decision framework, not a finding that any option has positive NPV.



Australian space research evidence and investment counterfactual

Sources for this additional assessment

- Australian Space Agency. (2018). Review of Australia's space industry capability. https://www.space.gov.au/about-agency/publications/review-australias-space-industry-capability
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- World Economic Forum & McKinsey & Company. (2024). Space: The $1.8 trillion opportunity for global economic growth. https://www.weforum.org/publications/space-the-1-8-trillion-opportunity-for-global-economic-growth



A comparable appraisal of flight and non-flight investments

The SIAA 2025 capability matrix is an industry member inventory: entries indicate capabilities reported by participating organisations. They do not independently establish technical readiness, realised Australian contracts, value added, additional employment, net economic returns or national coverage. Neither the matrix nor advocacy submissions should be used as a substitute for audited financial, procurement and outcome evidence (Space Industry Association of Australia, 2025).

The November 2024 Agora High-Tech commentary reports Space Foundation global-sector estimates and describes Australian industry growth and funding discontinuity. Its approximately 700 organisations and 16,000 direct employees are attributed industry commentary estimates with potentially different definitions and years from the Australian Space Agency 2025 figures; they are not combined, averaged or used as a time series. Its SmartSat project and researcher counts are leads for verification against programme administrative records (Agora High-Tech, 2024, pp. 1–2).

The NSW Space Research Network (2026) summary identifies fragmented coordination, episodic funding, restricted testing and qualification access, weak commercialisation pathways and reliance on foreign Earth-observation data. Its priorities include space situational awareness, secure communications, positioning and navigation, Earth observation, resource utilisation, life sciences, manufacturing and ground infrastructure. These are potential investment channels, not independently established benefit–cost ratios (pp. 3–8).

The NSW Space Research Network (2026) white-paper executive summary is a multidisciplinary research-and-stakeholder synthesis, not an independently audited national expenditure

account or an ex-post evaluation of alternative programmes. It reports estimated combined civil and defence public space expenditure of AUD$1–1.2 billion per year, mostly for acquiring foreign capabilities; this figure is attributed to its authors and must not be added to agency budget totals without reconciling coverage, year, defence classification and intergovernmental transfers (NSW Space Research Network, 2026, pp. 2–3).

Evidence and modelling status: the reference list and source registers identify the public material used for the report. Scenario assumptions, equations and worked examples are recorded in Sections 8, 10 and 18 and Appendices A, C and H. The sensitivity calculations are illustrative and are not forecasts, audited outcomes or a substitute for a mission-specific business case.

Additional comparative sources identified in October 2026 include the OECD's Space Economy at a Glance 2026, Engineers Australia's Space Policy Advice Paper (2024), the Australian parliamentary review of the US technology safeguards agreement (2024), and Ambani and Bek's (2025) economic assessment framework.

The OECD distinguishes gross space-industry activity from value added; the parliamentary review reports conditional launch-market forecasts rather than realised national benefits. None supplies a demonstrated Australian net-benefit estimate for the proposed single astronaut mission. These publications are included for further comparison, not as proof of the superiority of any alternative.

2026 Australian Government Statement on Space

The Australian Government's Statement on Space, released in July 2026 and published by the Australian Space Agency in September 2026, provides the current policy framework. Its priorities encompass trusted space services, a spaceflight ecosystem, space platforms, a microgravity ecosystem and exploration technologies. These priorities are broader than purchasing a dedicated astronaut seat (Australian Space Agency, 2026b; Ayres & Charlton, 2026).

The Government also reported National Reconstruction Fund investment approaching AUD$200 million across six space companies in July 2026. The Australian Space Agency subsequently reported that space-sector investments supported by the fund had passed AUD$200 million in September. These are dated government announcements about investment

activity, not an independently measured social benefit–cost ratio or a net return attributable to a proposed astronaut flight (Ayres & Charlton, 2026; Australian Space Agency, 2026b).

For economic appraisal, the Statement on Space establishes policy alignment but does not remove the need to compare each proposed expenditure against realistic alternatives, including support for small businesses, industrial infrastructure, downstream satellite services, research translation and other public programmes. The historic 2018–19 sector-revenue baseline must remain labelled as historic; a new policy statement does not retrospectively update that measurement.



Recommendations

Before public commitment to a single-astronaut space flight, the incumbent government should publish and discuss:

(a) ESA legal/access terms and cost schedule;

(b) an Australian industry capacity and bid-readiness audit;

(c) a mission-specific all-in astronaut quotation;

(d) a 10–15-year incremental social cost–benefit model;

(e) a contract-level Australian value-added and employment model; and

(f) independently reviewed sensitivity analysis.

- Once actual flight and cooperation-agreement costs are available, an independent analysis should pair them with defined KPIs and test the same financial commitment against credible alternatives, including blue-sky research, commercially focused research, manufacturing and education support.

- A decision on an ESA agreement should be made through a transparent, independent process that manages conflicts of interest and assesses evidence against defined, traceable KPIs and economic criteria.

Evidence-to-conclusion assessment

Review standard. The findings below are graded according to what the cited evidence and transparent calculations establish. A lack of demonstrated positive net benefit is not proof of a negative net benefit. Industry forecasts, capability inventories and policy roadmaps cannot be treated as realised Australian welfare gains.

Finding 1 The global space economy is expanding (supported as a forecast, not a realised return). The World Economic Forum–McKinsey 2024 projection of USD$630 billion in 2023 to USD$1.8 trillion in 2035 is an international market scenario. It does not quantify the incremental Australian benefits of a particular mission or domestic programme.

Finding 2 Australia possesses relevant space-industry and research capabilities (supported as reported activity, not independently verified incremental returns). The Australian Space Agency

sector indicators, SIAA 2025 member-reported capability matrix, Agora High-Tech 2024 commentary and the NSW Space Research Network 2026 executive summary identify existing capabilities and barriers. Their populations, measurement years and definitions differ; estimates must not be summed or silently reconciled. The SIAA matrix documents reported capabilities, not independently verified commercial readiness, additional employment or economic returns.

Finding 3 Multiple plausible alternatives to a dedicated astronaut flight exist (supported as policy options, not ranked net-benefit outcomes). Satellite data applications, communications and navigation, Australian manufacturing, testing and qualification, robotics, ground infrastructure, research translation, analogue science and life sciences are identifiable pathways in the Australian Space Agency, CSIRO, MITRE, SIAA and research-network literature. The sources do not establish that any one pathway necessarily outperforms the flight.

Finding 4 A single publicly funded flight has not yet demonstrated superior Australian value (supported as an evidence sufficiency finding). The available public material does not provide a fully costed, independently validated mission business case with attributable Australian contracts, research outputs, enduring jobs, domestic value added and follow-on liabilities. It is therefore not possible to establish a positive mission net present value or superiority over alternative uses of funds. This finding must not be expressed as a quantified loss or a proven negative return.

Finding 5 Break-even figures are arithmetic thresholds, not forecasts. At a 7% real discount rate over ten years with equal year-end annual benefits, an AUD$160 million initial outlay requires approximately AUD$22.78 million of incremental annual net Australian benefit (160 × 0.07/[1 − (1.07)^−10]). The corresponding thresholds for AUD$100 million and AUD$120 million are approximately AUD$14.24 million and AUD$17.09 million. These calculations exclude unquantified follow-on costs and depend on a consistent real price base, benefit timing and the assumed discount rate. Reported AUD$160 million and US$100–120 million estimates are different planning scenarios, not interchangeable verified contract prices.

Finding 6 Opportunity cost and distribution are material (supported as appraisal requirements; magnitudes unproven). Each candidate investment should be assessed on incremental Australian welfare, net domestic value added, regional and household incidence, skilled job-years, import leakage, environmental and operational costs, uncertainty and funding

obligations. Gross turnover, private co-funding pledges, contract announcements, employment stocks and foreign programme returns are not substitutes for these measures.

Finding 7 The preferred policy decision remains conditional. Before committing substantial public funds to the flight, government should disclose a consolidated Commonwealth–state–other funding account, mission-specific deliverables, attribution methodology, uncertainty intervals and a comparable appraisal of realistic domestic alternatives. The assessment should be revised if new evidence changes these findings.

Source and calculation trace.

International forecast: World Economic Forum and McKinsey (2024).

Australian sector baseline: Australian Space Agency (2025).

Capability inventory: SIAA (2025).

Industry perspective: Agora High-Tech (2024).

Research barriers and opportunities: NSW Space Research Network (2026).

Strategic pathways: MITRE (Dailey et al., 2024) and CSIRO Space Roadmap.

Discount factor: the 7% ten-year level-annuity formula shown above.

Secondary estimates retain the scope, definitions and limitations of their originating sources.

Conclusion

On the evidence currently available, a dedicated Australian astronaut flight has no demonstrated incremental net economic gain over an equivalent public investment in Australian small businesses, research commercialisation, enabling infrastructure or other public services.

A decision to fund the mission should be supported by a published, independently scrutinised appraisal of its full Australian costs, attributable benefits, displacement effects and opportunity costs. The absence of a substantiated comparative return does not prove that the flight would deliver no scientific, diplomatic or educational benefit; those benefits and their attribution remain to be assessed.

The economic literature, model documentation, government and industry material and Australian Space Agency policy documents reviewed did not establish the incremental Australian return on a single astronaut flight. The available frameworks can support such an appraisal if the required mission-specific evidence becomes available.

Alternatives include negotiating a stand-alone commercial flight directly with a provider. Whether that is feasible, provides equivalent experiment access or costs less requires a verified offer and a like-for-like appraisal; an ESA cooperation agreement may have costs and benefits independent of a flight.

The numerical results in this report are local arithmetic and sensitivity calculations, informed by published Canadian and Polish examples. The specialist departmental models discussed in Section 18 were not run. The UK evaluation estimates portfolio-level returns using distinct public-cost and social-cost denominators; those estimates cannot establish a return from one Australian flight (Canadian Space Agency, 2023; Ministry of Economic Development and Technology, 2025; UK Space Agency, 2025a).

Public funding should be assessed across potential space programmes, education and workforce development. STEM outreach is one possible benefit, but durable career outcomes require evidence about training, employment pathways, participation and the counterfactual. The figures throughout this report illustrate budget scales and alternative scenarios, not forecasts of those outcomes.

A programme combining facilities, research and exchange with international partners could support Australian manufacturing and scientific participation. A domestic alternative must also

be costed and assessed against a credible counterfactual; its commercial demand, feasibility and net benefits cannot be assumed. Consistent definitions and transparent data collection would allow future programmes to be compared.

This report examines potential KPIs, costs and benefits to the Australian public of a single-astronaut flight. The calculations identify the additional benefits needed to break even; they do not measure the benefits that would actually occur. The assessment supports continued space exploration and industry development while seeking evidence on how limited public funding can best contribute to Australian capability over time.

On the evidence presently available, the case for publicly funding the proposed single Australian astronaut flight has not demonstrated a positive national return, a superior outcome to alternative investment in Australian capability, or a measurable benefit for the average Australian.

The proposal's stated ambitions overlap with science and STEM policy, but the necessary workforce, facilities, access and follow-on commitments have not been demonstrated in a public, costed delivery plan. The expenditure should therefore not be justified by transferring returns from established foreign space programmes or by assuming that visibility creates enduring industry.

A commitment should await an independently examined business case that establishes additional Australian benefits against transparent full costs and credible alternatives.

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Appendix A. Reproducible calculations

Calculation of Canadian optional-programme share

These sums refer to fiscal 2018–19 through 2022–23 (CSA, 2023).

Canada: C$55.696m + C$157.694m = C$213.390m ESA payments; general-budget share = 55.696/213.390 = 26.1%; optional share = 73.9%.

Calculation of great Circle distances

Coordinates are approximate urban centres, not ESA site-to-factory shipping routes.

Great-circle distances use d = 2R

asin(sqrt($\sin^2$(Δlatitude/2)+cos(latitude1)cos(latitude2)$\sin^2$(Δlongitude/2))), R = 6,371 km.

Ten-year payment present-value factor at the legacy 4% rate

Ten-year level-payment PV factor at 4% real = [1 − (1.04)^−10]/0.04 = 8.1109.

Thus €50m annually has PV €405.54m. A single €10m benefit at year 10 has PV €6.76m.

Contract pool illustration

This is not an ESA guaranteed return or a GDP calculation.

Contract pool illustration:

Annual contribution × (1 − assumed overhead share); €50m × 0.70–0.80 = €35–40m.

Appendix B. Audit trail and missing data

For audit purposes, an account of missing data and required evidence is provided:

Table 16. Audit trail and missing evidence

Required evidence	Publicly established?	Consequence
Canada historic payments and return ratios	Yes, 2023 official evaluation	Usable comparator
Canada agreement general-budget formula	Yes, official treaty text	Not automatically applicable to Australia
Australia negotiated ESA accession fee	No verified public offer	Cannot report as fact
Australia ESA eligibility for full membership	Not established in reviewed sources	Legal prerequisite unresolved, cannot report as fact
Australian single-astronaut binding price	No	Use scenarios only, based on other countries experience and cost
Poland Ignis €65m stated national mission cost	Yes, ministry statement	Can be used for benchmarking only, current cost of living crisis and associated increased costs appear to be global, increased costs expected
UK £7.49 economic benefit ratio	Yes, published independent evaluation	UK-specific; Cannot be transferred to Australia's situation and expected ROI do not transfer
Sweden Muninn all-in social ROI	Not identified	No defensible ratio, ROI can be deduced
Matched Norway/Switzerland ROI panel	Not obtained	No defensible ratio can be deduced
C$0.82 per C$1 claim	Not verified, no publicly stated by Canadian official reporting	Exclude as observed result, not actual as not tendered for evidence by government minister

Appendix C Economic modelling and evidence review 24 October 2026

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Disclaimer

This policy appraisal uses public sources and explicitly identified scenarios. It is not an audited business case or procurement quotation and has not been independently peer reviewed. Currency, construction, benefit and operating assumptions are used to test sensitivity; they are not forecasts. Missing evidence is distinguished from evidence of no effect.

Conclusions concern the public investment proposal and its demonstrated national benefits, not the competence or merits of the astronaut. No claim is made that this document has passed Treasury assessment or parliamentary scrutiny. Independent review of the full business case and underlying contracts remains necessary.

Decision finding

The publicly available evidence reviewed does not establish that purchasing the proposed Australian astronaut flight would yield positive incremental net benefits for Australia, outperform feasible domestic capability investments, or deliver a demonstrable benefit to the average Australian. The economic justification is not established at this stage. It would be premature to describe the proposal as self-financing, to transfer the UK's ESA-wide return to one Australian flight, or to claim an established conflict with every science policy. A flight could support research and STEM objectives, but those links need funded delivery plans and measurable outcomes. Without those commitments, prioritising a flight over the workforce and facilities required to absorb its benefits creates a material policy-delivery tension.

Current proposal and budget status

The estimated USD$100–120 million is retained as an estimate for single-astronaut space flight cost, this is not a verified quotation as one has not been made publicly available but the federal government.

ABC reporting dated 20 October 2026 and updated 21 October records an ESA offer and unresolved government funding, with South Australia supportive and several jurisdictions declining direct contributions. The current proposal's binding price, scope and cost-sharing need confirmation (Agius, 2026).

The 2026–27 Budget was delivered on 12 May 2026. Australian Government Solicitor records that Appropriation Bills No. 1 and No. 2 received assent between 26 June and 3 July 2026. The description "current unpassed budget" is therefore not used as a verified fact. Individual tax measures or a future mission appropriation may have a different status and must be identified separately (Australian Government Solicitor, 2026).

Budget Paper No. 2 provides AUD$21.7 million over two years from 2026–27 for the Australian Space Agency's core regulatory and policy functions. This is not identified as an astronaut flight allocation. A search of that paper found no "astronaut" entry; this alone cannot rule out a provision elsewhere, a confidential reserve or a later decision. No specific publicly identified appropriation or offset for this flight was established in this review (Australian Government, 2026b).

Potential financing routes are a new Commonwealth appropriation, lawful use or reprioritisation of an existing appropriation, state contributions and private funding. Government must disclose the actual route. General revenue is pooled: the report cannot say a particular school, hospital or research grant pays for the flight without an identified offset. If additional spending is not offset, it worsens the fiscal balance relative to the counterfactual; debt issuance finances the overall cash requirement. Public borrowing, financing costs and social resource costs are related but distinct accounts.

The economic framework

Social cost–benefit analysis asks whether Australians gain more value than the resources they give up. The fiscal account asks what government pays and receives. The industrial account measures sales, exports and value added. The distributional account asks who receives the

gains and who bears the costs. Keeping these four accounts separate prevents a contractor's revenue from being mistaken for a taxpayer return (Australian Centre for Evaluation, 2025).

For option j against the same baseline: NPVj = Σt[(Bj,t − Cj,t)/(1+r)^t] + residual valueT/(1+r)^T. BCRj = PV(Bj)/PV(Cj). In a mutually exclusive choice the preferred option is not automatically the one with the highest BCR; incremental NPV and the budget constraint determine the comparison. Fiscal NPV is calculated separately using additional tax receipts and savings less government cash outlays. Taxes and grants within Australia are normally transfers in the social account; administering them uses real resources.

Use real costs and benefits with a real discount rate; use nominal cash flows only with a consistent nominal rate. Currency conversion does not restate prices for inflation. The Canadian 2023 conversion remains a historical nominal comparator. A future negotiated fee requires its own inflation and exchange-rate schedule. The new central scenarios use hypothetical constant 2026 planning dollars, not an assertion that historical mission costs have been rebased.

The Treasury guide reports the Office of Impact Analysis convention of 7% real discounting with 3% and 10% sensitivity. These rates are used here; 4% is also shown only to bridge the source manuscript's calculations. The appropriate rate for a final proposal must follow the appraisal authority's applicable guidance. Financing interest is not added mechanically to a social CBA already charging opportunity cost through its discount convention.

Modern economic theory and its practical test

Table 17. Economic theory and the evidence required

Framework	Relevance to the choice	Evidence needed
Public goods and knowledge spillovers	Research can benefit people beyond the purchaser, justifying public support. A private sales account misses such gains.	Open data use, replicated findings, avoided costs and a credible attribution method; do not assume every experiment produces a commercial product.
Endogenous growth and absorptive capacity	Knowledge creates value when firms and workers can use it. Training, laboratories and repeat procurement can complement a flight.	Australian technical staff, IP rights, qualification capacity and funded follow-on work. Romer (1990); Cohen and Levinthal (1990).
Economic geography	Supplier clusters lower coordination costs and accumulate pecialized skills. Distance affects physical and digital activities differently.	Delivered quotes, quality, integration time and repeat-order margins. Kilometres alone cannot price a penalty. Krugman (1991).
Human capital	Skills and learning-by-doing may raise productivity, but attendance or inspiration is an intermediate output.	Course completion, competency gains, employment and earnings relative to comparison participants; retention in Australia.
Real options	A small reversible pilot can buy information before a large irreversible purchase.	A pilot cost, a defined learning question, a go/no-go gate, exercise cost and demand evidence. Do not attach an invented option value.
CGE and input–output	Input–output traces supply-chain activity; CGE can represent labour constraints, prices and displacement.	ABS coefficients or a calibrated CGE model with disclosed closure rules. Neither has been estimated here; the simulations are partial-equilibrium appraisal tests.
Distribution and opportunity cost	A positive aggregate return can still be concentrated; local spending can displace existing skilled work.	Australian households, regions, ownership, taxes and services affected. Report beneficiaries separately and test alternative public uses.

GDP is not the welfare test. A firm's value added is output less all intermediate consumption, including purchases from other Australian firms. Economy-wide value added includes those suppliers' contributions once. Wages and operating surplus are parts of value added; they are not automatically additional social benefits because workers and capital have alternative uses. International payments are not automatically waste: they purchase services whose Australian value must be assessed. Domestic expenditure is not automatically beneficial either. Figure 2 illustrates these distinctions.

Reproducible simulations

The threshold calculations use procurement outlay as a provisional proxy for national economic cost. They do not replace a final resource-cost account: domestic GST and transfers, labour and capital opportunity costs, any externalities and contract scope require reconciliation.

Annual benefit inputs mean additional benefits after downstream operating and resource costs, excluding the initial cost already charged at year 0. This convention prevents subtracting the same cost twice.

The model executes 648 deterministic combinations: three flight prices (USD$100m, USD$110m, US$120m), three incremental ancillary amounts (USD$0m, USD$10m, USD$20m), three assumed exchange rates (USD$0.60, USD$0.65, USD$0.70 per A$1), three real discount rates (3%, 7%, 10%), two benefit delays (0 or 3 years), and four annual net-benefit tests (AUD$10m, AUD$20m, AUD$30m, AUD$40m). These values bracket uncertainty; they are not statistically estimated distributions. No probability of success or confidence interval is reported from this grid.

Reproduction check: each case uses cost C = (flight price + ancillary cost) / exchange rate; the present value of ten equal annual benefits is B × Σ(t = 1 to 10) (1 + r)^−t / (1 + r)^L, where L is the additional delay in years. NPV is that present value less C. The 648 cases produce initial costs from A$142.86 million to A$233.33 million and NPVs from approximately −A$187.17 million to A$198.35 million. These extrema belong to different input combinations and are not confidence limits. The common inputs and results are cross-referenced in Table 13 (Australian Centre for Evaluation, 2025).

Cost at year 0 is (flight price + non-overlapping ancillary cost)/USD-per-AUD. The central cost is (110+10)/0.65 = AUD$184.6154m. The full tested cost range is AUD$142.8571m to AUD$233.3333m. Ancillary cost is an addition only where contract scope excludes it; zero is included to avoid assuming double counting. No ESA subscription is included in the stand-alone flight test. Figures 1–3 show the consequences.

Table 18. Break-even benefit by discount rate and delay

Real rate	Annual benefit years 1–10 A$m	Annual benefit years 4–13 A$m
3%	21.64	23.65
4%	22.76	25.60
7%	26.29	32.20
10%	30.05	39.99

At 7%, the ten-year annuity factor is 7.023582. The central flight needs A$26.29m in additional net Australian benefits at each year-end for ten years to break even. Delaying the same ten payments by three years raises the requirement to A$32.20m annually. If a claimed benefit is shared with other missions or would arise anyway, only its attributable increment belongs in this numerator.

Table 19. Net-benefit sensitivity for the central flight

Annual net benefit A$m	PV benefit at 7% A$m	NPV A$m	BCR
10	70.24	-114.38	0.380
20	140.47	-44.14	0.761
30	210.71	26.09	1.141
40	280.94	96.33	1.522

The numbers show conditional failure below the switching threshold and conditional success above it. They do not estimate which benefit stream the mission will deliver. If a verified monetised-benefit account is below cost, the shortfall is the minimum additional value required from unpriced science, education, diplomatic or other public benefits. Report that switching value openly rather than assigning publicity an arbitrary dollar value.

Manufacturing export and operating workforce calculations

Figures 3 and 5 and the new material in Sections 11 and 14 use two different kinds of evidence: published employment observations and a hypothetical Australian export-business appraisal. An observed rise in staff, an announced recruitment programme and a modelled staffing capacity are not interchangeable. Foreign company and survey data are not fitted as Australian job multipliers; their source limitations are recorded in Appendix H.

The export model is NPV = R × q × s × AF(r,10)/(1+r)^L − C, where AF(r,10) = Σ years 1–10 of (1+r)^−t. C is initial public outlay in A$ million; R is annual export sales in AUD$ million; q is the share of sales additional to the counterfactual; s is the tested net Australian benefit fraction after resource costs, private capital costs, imports and foreign profit leakage; L is the delay

before the first of ten benefit payments; and r is the real discount rate. Annual costs exclude C because it is already charged once at year 0. The net fraction is not a gross-value-added ratio or an observed corporate profit margin.

The 216 export cases combine R = AUD$25m, AUD$50m, AUD$75m or AUD$100m; q = 50%, 75% or 100%; s = 10%, 20% or 30%; L = 0 or 3 years; and r = 3%, 7% or 10%. Break-even annual exports equal C × (1+r)^L / [q × s × AF(r,10)]. With C = AUD$184.6154m, q = 75%, s = 20% and r = 7%, the threshold is AUD$175.23m a year without delay or AUD$214.67m with a three-year delay. These are conditional switching values, not forecasts.

Operating workforce capacity is J = R × 1,000,000 × w / k, where w is the payroll share of sales and k is loaded annual cost per FTE. The 36 cases combine the same four sales levels with w = 20%, 30% or 40% and k = AUD$150,000, AUD$200,000 or AUD$250,000. For example, AUD$50m sales × 30% / AUD$200,000 supports 75 operating FTE. This is gross operating capacity; a national net-job claim requires displacement, recruitment and retention evidence. Payroll must not be added again as an independent welfare benefit. The stated inputs and equation are sufficient to reproduce all 36 combinations.

ESA participation remains a separate decision

The 2022–23 Canadian transfer comparator is C$46.358m / 1.3497 = USD$34.346892m. At the assumed 0.65 conversion it corresponds mechanically to A$52.84m annually, before Australian-specific adjustments. It already includes optional programmes. Ten annual payments would have PV AUD$371.14m at 7%; combining that with the central flight gives AUD$555.75m.

This is a scenario, not Australia’s fee or an inflation-restated 2026 cost. Include such contributions only if the proposed contract makes them incremental, and include the benefits of the entire subscribed portfolio in the matching account.

What the same cash budget could support in Australia

The domestic alternative is a design-to-budget portfolio, not a quantity-surveyor estimate or a procurement promise. It assumes access to existing land, buildings, hospitals, universities, TAFEs and industry partners; a staged fit-out; and shared use of facilities. It does not purchase an orbital launch system, human-rated spacecraft, full astronaut certification, a complete neutral-buoyancy laboratory, a centrifuge or a replica of the ISS. Those are different projects. Figures 6 and 7 show the allocation and staff sensitivity.

For a lower AUD$120m cash envelope, the same shares provide AUD$48m capital, AUD$30m staff, AUD$18m nonstaff operations, AUD$18m reserve and AUD$6m design/evaluation. That supports 30 staff FTE for five years at AUD$200,000 per FTE-year. AUD$160m supports 40 on the same assumptions. The framework therefore remains usable if the eventual Australian-dollar quote is lower than the manuscript's US-dollar planning range.

A capacity illustration is six technical cohorts of 20 participants per year over five years: 600 course participations, or 480 completions at an assumed 80% completion rate. Four clinical simulation cohorts of 15 per year yield 300 participations. These may overlap and are not unique people, trained astronauts or qualified flight surgeons. Demand, trainer-to-student ratios, accreditation and operating costs must be tested before these targets enter a business case. A capacity count alone cannot establish economic return.

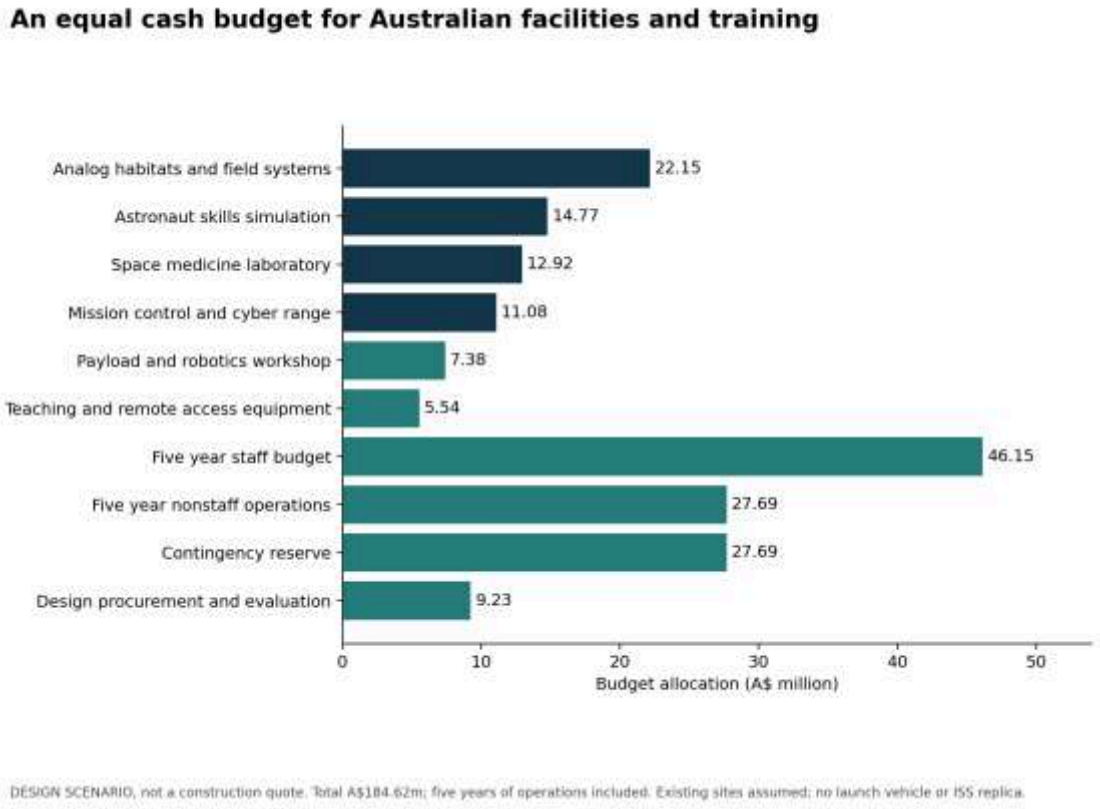
A real Australian precedent is the Commonwealth's 2019 announcement of AUD$6m for an Adelaide Mission Control Centre and AUD$6m for a Space Discovery Centre. This demonstrates that bounded facilities have been funded at a smaller scale; it is not a 2026 construction quotation, an all-in operating cost or evidence that six identical centres are needed. Procurement must first map existing infrastructure and buy access where that is cheaper than duplication (Minister for Industry, Science and Technology, 2019).

Table 20. Equal-budget Australian facilities and training portfolio

Component	Share	Central A$m	Deliverable and scope
Analogue habitats and field systems	12%	22.15	Modular isolation habitat, field logistics, environmental monitoring and research fit-out at an existing site.
Astronaut skills simulation	8%	14.77	Reconfigurable procedural, robotics, crew coordination and emergency simulators; not agency astronaut certification.
Space medicine laboratory	7%	12.92	Human-performance, telemedicine and clinical simulation equipment with hospital partners; no assumed clinical accreditation.
Mission control and cyber range	6%	11.08	Training consoles, communications emulation, fault injection and operational software; use existing ground assets where possible.
Payload and robotics workshop	4%	7.38	Payload electronics, small robotics, integration benches and access to external qualification facilities.
Teaching and remote access equipment	3%	5.54	School and TAFE access, remote participation hardware and accessible teaching equipment.
Five year staff budget	25%	46.15	Five-year staff envelope, including salary and assumed employer on-costs, excluding separately budgeted nonstaff operations.
Five year nonstaff operations	15%	27.69	Utilities, consumables, maintenance, training delivery, access charges and insurance for five years.
Contingency reserve	15%	27.69	Risk allowance, not a prediction that every dollar is spent; release only against approved needs.
Design procurement and evaluation	5%	9.23	Design and procurement support, independent evaluation, governance and an auditable baseline.

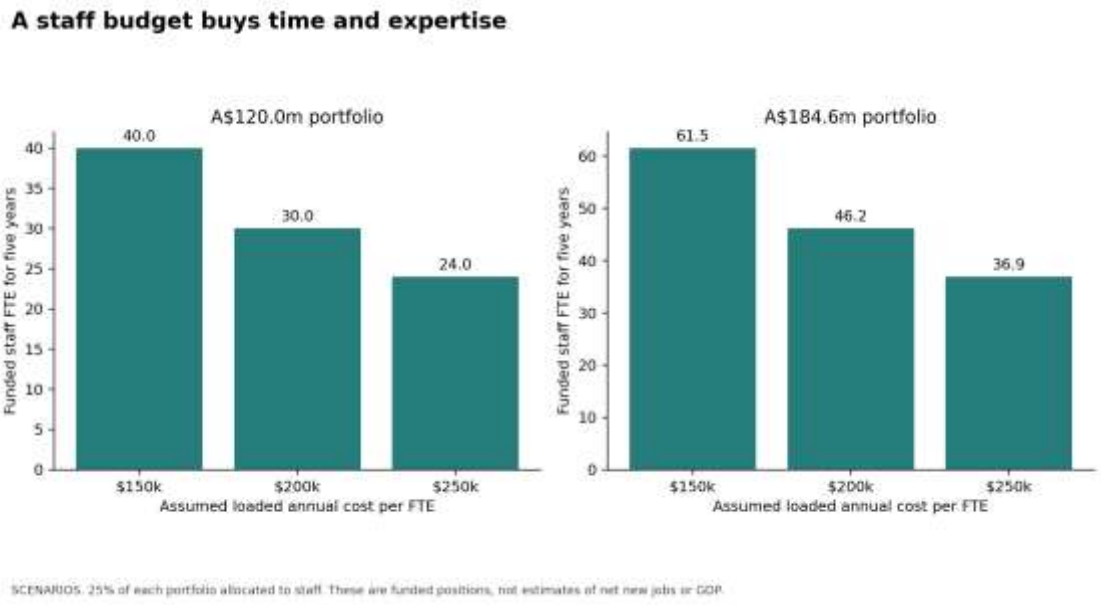
The capital allowance is 40% or A$73.85m. Staff receive 25% or A$46.15m over five years. At an assumed loaded cost of A$200,000 per FTE-year, this funds 46.15 staff FTE for five years, or 230.77 FTE-years. A$150,000–250,000 per FTE-year changes the staff capacity to 36.92–61.54 FTE. These are expenditure-funded roles, not net additional employment estimates. Construction jobs and induced employment are not added.

Figure 6. An equal cash budget for Australian facilities and training



DESIGN SCENARIO, not a construction quote. Total A$184.62m; five years of operations included. Existing sites assumed; no launch vehicle or ISS replica. Legend: each labelled bar gives one portfolio allocation in A$ million. Model: equal-cash-budget allocation scenario; allocations are design assumptions, not market quotations or a benefit forecast. Method: Appendix C, What the same cash budget could support in Australia and Equal cash is not equal present value; Section 18, K10.

Figure 7. A staff budget buys time and expertise



SCENARIOS. 25% of each portfolio allocated to staff. These are funded positions, not estimates of net new jobs or GDP. Legend: panels compare A$120m and A$184.62m portfolios; bars vary loaded cost per FTE-year. Model: five-year staffing capacity = 25% of portfolio / (five years × annual loaded cost). These are funded roles, not net national jobs. Method: Appendix C, domestic portfolio discussion; Section 18, K11.

Equal cash is not equal present value

For illustration, place capital, the full reserve and design/evaluation at year 0 (60% of the portfolio), and staff plus nonstaff operations equally at years 1–5 (8% annually). With no residual value or post-year-five cost assumed, portfolio PV cost at 7% is AUD$171.33m, below the flight's assumed AUD$184.62m immediate cost. The ten-year annual benefit threshold is AUD$24.39m. This timing advantage is conditional on the assumed schedule; an actual flight payment schedule may also be staged. Spending the full reserve up front is conservative for this timing illustration.

A fair full appraisal must give both options the same horizon, terminal asset-value treatment, cost inflation, demand tests and treatment of tax and displacement. Continued facility operation after year five is not free. Either include its additional cost and benefits, close the facility, or value a properly evidenced disposal or residual asset. No positive domestic BCR is claimed because the portfolio's use and social benefits have not been independently valued. The immediate policy advantage is a testable and divisible set of domestic deliverables, not a proven welfare multiplier.

International evidence and single flight attribution

Figure 4 compares the scope of evidence. Poland's ministry reports €65m for Ignis and thirteen Polish scientific and technological experiments, including work relevant to materials, biotechnology, medicine and radiation-resistant electronics. These are identifiable mission outputs. The ministry's existing sector employment and cumulative ESA contract totals cannot be attributed to that one flight. Subsequent commercial sales, costs, patents, licensing and firm survival need independent follow-up (Ministry of Economic Development and Technology, 2025).

ISRO's 2025 portfolio identifies seven Indian microgravity experiments. The associated human-spaceflight learning has a domestic Gaganyaan programme in which to be used. That complementary programme matters to the comparison: Australia should specify where equivalent learning would be retained and applied. Reported rupee flight figures have not been reconciled here with a primary all-in cost account, so no Indian monetary BCR is calculated (ISRO, 2025).

Sweden's Muninn mission establishes research and operational participation but no matched national net-benefit estimate was verified in this review. Hungary's flight likewise cannot supply a causal Australian ROI without a reconciled cost and benefit account. Norway and Switzerland are useful institutional and industrial comparators, but missing matched data are left as gaps. No country is assigned a zero return merely because its complete data were unavailable.

Canada's five-year C$213.390m transfer programme and geographical-return measure concern broad ESA participation. Its C$2.494m management cost is a separate, much smaller item. Canada's 50% formula applies to the defined general-budget scale; optional subscriptions are not universally halved. These facts do not price an Australian flight or provide an Australian fee entitlement (Canadian Space Agency, 2023).

The UK's 2025 RAND Europe and Ipsos evaluation is material counter-evidence to a blanket claim that ESA investment does not work. It estimates £7.49 in direct UK benefit per £1 public ESA investment using beneficiary productivity evidence. It concerns a long-standing portfolio and a mature industrial base, not the marginal return from a single astronaut. Australia cannot import the coefficient, but should use the study's evaluation approach and disclose comparable firm-level evidence (UK Space Agency, 2025a).

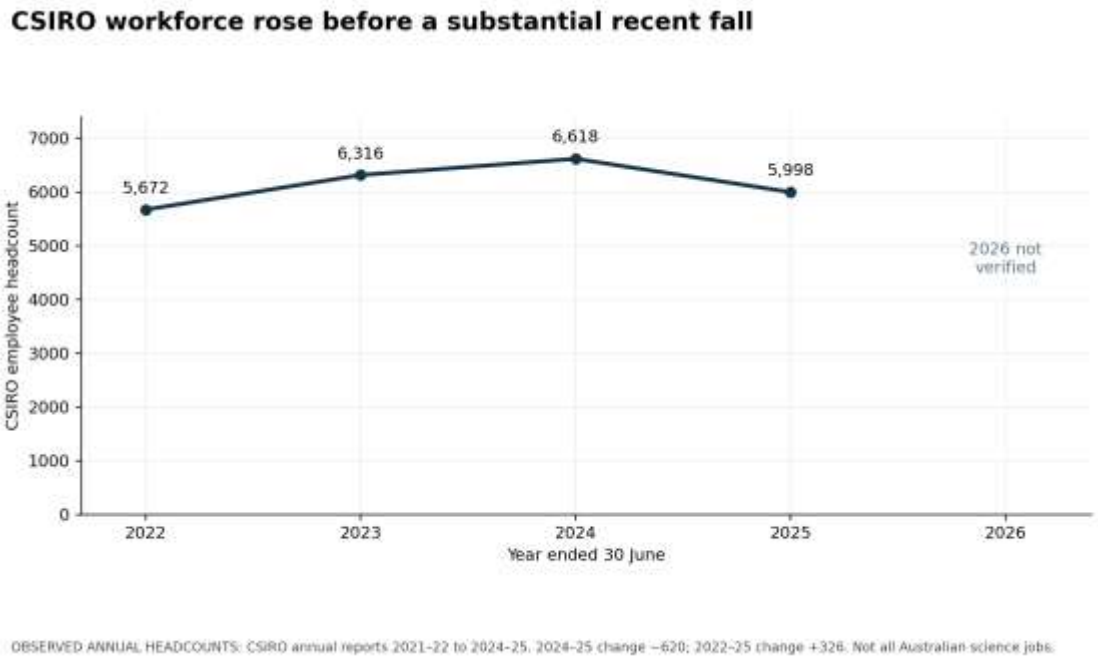
Science employment and the value of lost capability

A verified census of all Australian science jobs lost during October 2022–October 2026 was not established. Announced redundancies, expired contracts, employee headcounts, FTE and net employment changes measure different things; overlapping announcements must not be summed. Figure 8 therefore shows the verified CSIRO annual headcounts for 2022–2025 and explicitly leaves 2026 unverified. Headcount fell from 6,618 to 5,998 in 2024–25, a decline of 620, while remaining 326 above 2022. This does not negate losses in particular scientific fields; it prevents an inaccurate four-year aggregate claim (CSIRO, 2022, 2023, 2024, 2025).

ATSE's January 2026 submission reports more than 800 prior CSIRO job losses and a further announced 300–350 reduction. CSIRO's May 2026 statement confirms planned reductions of 300–350 FTE despite additional budget funding. They are separate dated evidence items, not a reconciled nationwide jobs register. Figure 9 labels their differing status and does not add subsequent unit-level announcements that may belong to the same rounds (ATSE, 2026; CSIRO, 2026).

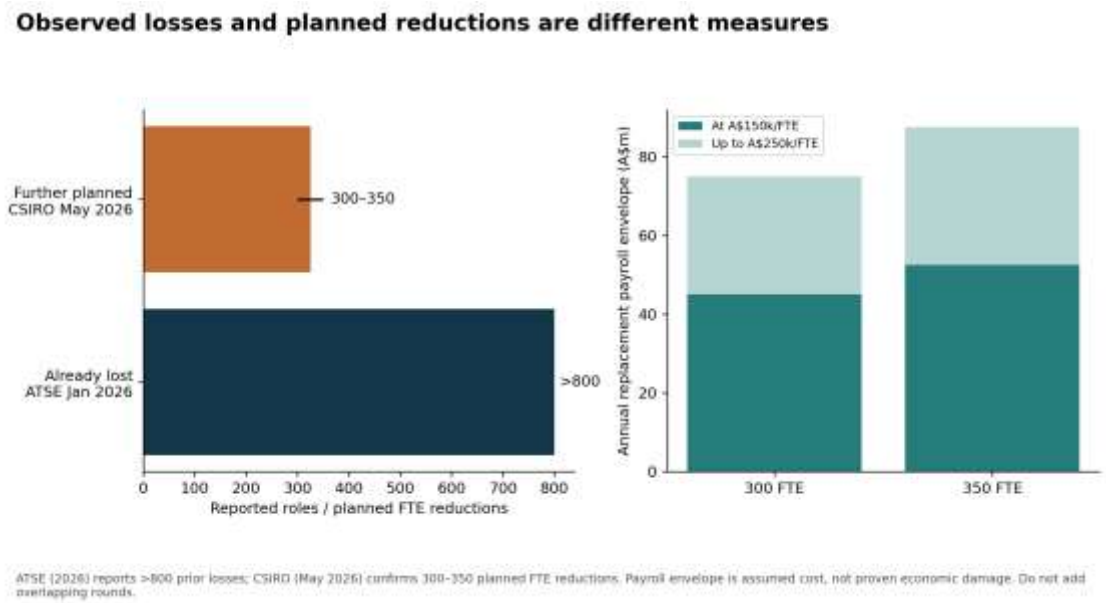
The monetary value of scientific capability lost is not proven by multiplying job reductions by salary or by a national R&D multiplier. For 300–350 FTE and assumed annual loaded costs of AUD$150,000–250,000, the replacement payroll envelope is AUD$45.0–87.5m per year. This is a scenario for funding scale, not measured lost GDP, fiscal savings or social damage. Proven loss would require project-specific cancelled work, re-employment and redeployment outcomes, avoided costs, IP and knowledge effects, replacement expense and a counterfactual. No “proven dollar loss” is asserted without these data.

Figure 8. CSIRO workforce rose before a substantial recent fall



OBSERVED ANNUAL HEADCOUNTS: CSIRO annual reports 2021–22 to 2024–25. 2024–25 change −620; 2022–25 change +326. Not all Australian science jobs. Legend: the line shows annual CSIRO employee headcount; 2026 is explicitly unverified. Method: descriptive time series; no national employment-loss or economic-damage model is applied. Explanation: Appendix C, Science employment and the value of lost capability; Appendix H, workforce-source audit.

Figure 9. Observed losses and planned reductions are different measures



ATSE (2026) reports >800 prior losses; CSIRO (May 2026) confirms 300–350 planned FTE reductions. Payroll envelope is assumed cost, not proven economic damage. Do not add overlapping rounds. Legend: left panel distinguishes reported prior losses and planned reductions; right panel brackets replacement payroll at A$150,000–250,000 per FTE-year. Model: payroll-cost sensitivity alongside observed/announced workforce measures, not lost GDP or social damage. Method: Appendix C, Science employment and the value of lost capability; Appendix H.

Science and STEM policy comparison

Table 21. Science and STEM policy comparison

Policy or report	Relevant test	Implication for the proposal
National Science Statement 2024	National capability, benefit, workforce and collaboration.	Require funded Australian delivery and retention. International participation can align; unsupported benefit claims do not demonstrate delivery.
National Science and Research Priorities 2024	Health, environment, transition, knowledge and resilient communities.	Score individual payloads and capability outcomes against relevant priorities; an astronaut's nationality is not a substitute for outcomes.
Australian Science Australia's Future Science 2035 (2025)	Projected gaps in agriculture, AI, biotech, climate, data, epidemiology, geoscience and materials.	Test whether payloads and follow-on investment close identified gaps or draw scarce resources away from them.
Pathway to Diversity in STEM government statement (2025)	Access, inclusive careers and skills pathways, including VET.	Require regional and underrepresented participation, teacher/TAFE delivery and measured progression; visibility alone is insufficient.
Academy 2026–27 Budget analysis	Underinvestment, workforce, infrastructure and research translation.	Compare the flight with protecting research capacity and operating infrastructure; include new funding as well as reductions.
ATSE submission to CSIRO inquiry (2026)	Stable publicly funded research agencies and infrastructure operations.	A one-off mission needs a credible complement to continuing capability; do not claim that the Academy prohibits astronaut flight.
Australian Academy of Science decadal plan 2021–2030 (2022)	Integrated space education, STEM participation, workforce and career pathways.	Assess funded training, research and career outcomes; the plan is not a mission-specific ROI estimate.

The Academy's 2026 budget assessment records both additional CSIRO funding of A$387.4m over four years and reductions or redirection in other science programmes. It identifies A$1.8m in 2026–27 for its school STEM programmes. These different periods must not be presented as interchangeable annual totals. The policy argument is about marginal allocation and delivery, not the false proposition that every science budget item is being cut (Australian Academy of Science, 2026).

Figures and the requested fiscal comparisons

Figures 14 and 15 use GDP and clearly separate Commonwealth gross debt, Commonwealth net debt and ABS consolidated general-government L2 net debt. Debt is a stock; GDP is an annual flow, so debt/GDP is a conventional ratio, not a pie-chart share of national income. States' debt/GSP percentages cannot be added or placed in a pie as though they sum to 100%. An eight-jurisdiction debt/GSP comparison is omitted because a consistent numerator and denominator panel was not verified.

Figure 16 uses ABS Table 9 actual state health and education expenses for 2024–25. It shows the central flight scenario as a scale comparison, rather than pretending that the flight is an agreed charge to state services. The historical denominator is not inflation-restated and is not a 2026–27 budget estimate. The accompanying JSON records the exact values and extraction
Figure 17 uses A$1.7m as a separate illustrative scale comparison. This amount is not the proposed astronaut budget or a mission-cost estimate.

The large debt totals do not by themselves prove the mission uneconomic. At national scale a flight may be a small expenditure while still having a large opportunity cost within space or research budgets. The stronger argument is comparative value for money at the relevant margin, not that the flight is the cause of Australia's debt.

Evidence conditions before an irreversible commitment

The decision paper should disclose a binding price and cost boundary; appropriation and offsets; Australian IP, data and procurement rights; payload-specific technical questions and cheaper access alternatives; the staff and facilities funded to use the results; a 10–15-year incremental social CBA with switching values; distribution by region and household group; implementation and operating risks; and an independent evaluation plan registered before contracts are awarded. Existing astronaut training is a sunk cost for the forward decision: include only future costs and benefits that differ across options.

For beneficiary-firm evaluation, compare changes in productivity with eligible non-beneficiaries and examine pre-treatment trends, selection, spillovers and concurrent grants. For STEM activity, compare participation, learning and subsequent pathways with a credible comparison group. For research, use field-relevant milestones and subsequent adoption; publication counts are not dollars. Report diplomatic and national-prestige benefits separately where credible monetary valuation is unavailable.

Concluding assessment

On the evidence presently available, the case for publicly funding the proposed single Australian astronaut flight has not demonstrated a positive national return, a superior outcome to alternative investment in Australian capability, or a measurable benefit for the average Australian. The proposal's stated ambitions overlap with science and STEM policy, but the necessary workforce, facilities, access and follow-on commitments have not been demonstrated in a public, costed delivery plan. The expenditure should therefore not be justified by transferring returns from established foreign space programmes or by assuming that visibility creates enduring industry. A commitment should await an independently examined business case that establishes additional Australian benefits against transparent full costs and credible alternatives.

Appendix D Recovered Australian space and science budget evidence

This appendix recovers two earlier working papers: Australian Space Agency Budget Grants and Outcomes Review (evidence audit to 12 August 2026) and Australian STEM Data Tables and Sources (12 August 2026). They are prior research working papers, not independent government audits. The core figures below are identified by their original accounting category and dated source. Current official sources were checked where available; recipient-by-recipient payments and outcome acquittals have not been newly audited.

Agency operating measure ledger

Table 22. Agency operating measure ledger

Period	Measure	Published amount A$m	Accounting boundary
2018–19 to 2021–22	Establishment	26.0 over four years	Budget measure; not actual annual operating expense
2021–22 to 2024–25	Additional Agency funding	18.5	MYEFO payments 2.9, 5.6, 5.0, 5.0; recovered historical schedule
2023–24 to 2025–26	Core functions / regulation	34.2 over three years	Budget Paper 2; includes policy coordination
2026–27 to 2027–28	Core regulatory and policy functions	21.7 over two years	Continuation measure; not a flight appropriation
2018–19 onward	Adelaide headquarters	Not for publication	Excluded from numeric total

The four numeric measures sum to A$100.4m, but cover overlapping periods and omit unidentified baseline resources. This is a measure-authority subtotal, not audited cumulative cash expenditure, not an annual budget and not a grant pool. The separately announced A$15m International Space Investment programme is not included in this core-operations subtotal (Australian Government, 2018, 2021, 2023, 2026b).

The PM inspire label and the collection boundary

No separately identifiable budget line titled the PM's "inspire program" appears in the earlier budget collection recovered for this report. No additional amount under that label is included in the AUD$100.4 million Agency operating-measure subtotal or assigned to the AUD$21.7 million core-functions continuation measure. This absence from the collection does not establish that the activity is unfunded or outside every departmental appropriation.

The Department identifies the Prime Minister's Prizes for Science as part of Inspiring Australia – Science Engagement. The Agency also publishes astronaut outreach under an Inspiring Australia topic label. A topic label does not identify a separate appropriation, cost centre or cash allocation. The precise programme intended by the author's phrase requires documentary

matching before any amount is attributed; this report therefore records it as not separately reconciled (Department of Industry, Science and Resources, n.d.-d).

Agency linked and adjacent programme ledger

Table 23. Agency-linked and adjacent programme ledger

Programme	Recovered envelope or awards	Scope and status
International Space Investment	A$15.0m envelope; A$11m across ten projects described	Historical envelope and partial announcement; not a complete paid-out ledger
Space Infrastructure Fund	A$19.5m envelope; A$16.5m across five resolved facilities	A$3.0m difference requires reconciliation; not assumed unspent
Moon to Mars Supply Chain	A$23,035,282; 29 award lines	Recovered award offers, not payments or net benefits
Moon to Mars Demonstrator Mission	A$41,474,742; 11 award lines	Recovered register; do not add to a parent envelope
Demonstrator Feasibility	A$4.0m across 20 organisations	Aggregate; earlier complete recipient reconciliation unavailable
Trailblazer / Roo-ver	A$50m component of A$150m Moon to Mars	Nested component, not additional to its parent
ISI India	A$20.69m authority; A$18,010,962 in three offers	Authority versus awards; not a contradiction or proven saving
Space-specific Modern Manufacturing awards	A$113,471,232 across seven awards	Adjacent departmental programme; not Agency operating expenditure

The three recovered durable registers contain 29 + 11 + 3 = 43 award lines and A$82,520,986 in offers. Repeat awards are not unique firms; an award is not a completed project or a payment. The current official recipient pages were located, but the 43-line historical subtotal is retained as the dated 12 August collection rather than represented as a fresh all-programme audit. A$82.52m must not be added to parent envelopes or to A$100.4m to announce a single Agency spend total (Department of Industry, Science and Resources, n.d.-a, n.d.-b, n.d.-c).

Recovered science expenditure series

Table 24. Government R&D expenditure and research effort

Government R&D performed	2020–21 A$m	2022–23 A$m	2024–25 A$m
Commonwealth organisations	2337	2800	2782
State / territory organisations	1281	1544	1597
Total current prices	3618	4344	4379
Total chain volume, 2024–25 prices	4212	4577	4379
Research effort, person-years	15047	15889	16338

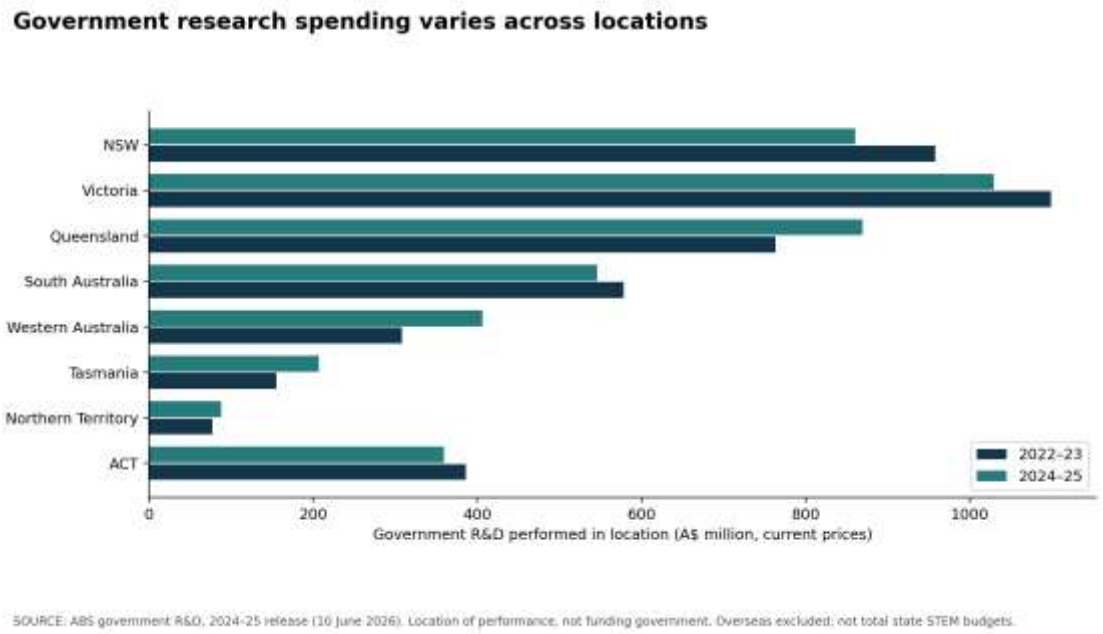
Source: Australian Bureau of Statistics (2026c). These are R&D performer measures, not a consolidated annual STEM budget. Current-price growth between 2022–23 and 2024–25 coexists with lower real expenditure and higher research effort. Unsurveyed intervening years are not interpolated.

Table 25. Government R&D by location

Location of R&D	2022–23 A$m	2024–25 A$m	Change A$m
NSW	958	860	-98
Victoria	1099	1029	-70
Queensland	763	869	106
South Australia	578	546	-32
Western Australia	308	406	98
Tasmania	155	207	52
Northern Territory	77	88	11
ACT	386	359	-27
Overseas	21	16	-5

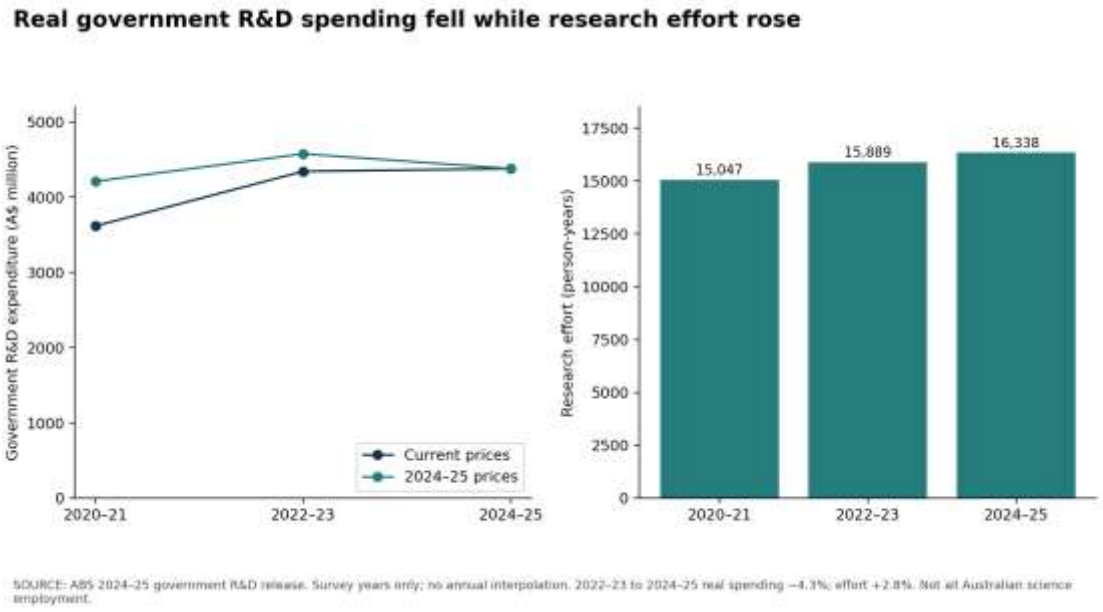
Location is where research was performed, not the funding government. The eight Australian rows sum to A$4,324m and A$4,364m; overseas activity and published rounding account for reconciliation with national totals. Earlier working-paper percentages used the Australian-location subtotal; they are not percentages of a state budget. Figures 10 and 11 display the recovered series.

Figure 10. Government research spending varies across locations



SOURCE: ABS government R&D, 2024–25 release (10 June 2026). Location of performance, not funding government. Overseas excluded; not total state STEM budgets. Legend: navy = 2022–23; teal = 2024–25. Bars show current-price government R&D performed in each location, in A$ million. Method: descriptive ABS survey comparison, not a state-budget or mission-return model. Explanation: Appendix D, Recovered science expenditure series; Appendix H, ABS-source audit.

Figure 11. Real government R&D spending fell while research effort rose



SOURCE: ABS 2024–25 government R&D release. Survey years only; no annual interpolation. 2022–23 to 2024–25 real spending −4.3%; effort +2.8%. Not all Australian science employment. Legend: left panel compares current-price expenditure (navy) with 2024–25-price chain-volume expenditure (teal); right panel shows research person-years. Method: published nominal/real series and effort comparison; no annual interpolation or causal model. Explanation: Appendix D, Recovered science expenditure series; Appendix H, ABS-source audit.

Budget source links and limitations

- 2018–19 regional budget statement: https://archive.budget.gov.au/2018-19/ministerial-statements/2018-19-regional-ministerial-budget-statement.pdf
- 2021–22 MYEFO: https://archive.budget.gov.au/2021-22/myefo/download/myefo-2021-22.pdf
- 2023–24 Budget Paper 2: https://archive.budget.gov.au/2023-24/bp2/download/bp2_2023-24.pdf
- 2026–27 Budget Paper 2: https://budget.gov.au/content/bp2/download/bp2_2026-27.pdf
- Official recipient and ABS URLs are in the reference list. Any final annual spend series needs departmental cost-centre actuals, grant payments and cancellations, acquittals, programme nesting and a fixed cut-off date. The recovered material documents what was collected; it does not remove those evidence requirements.

Appendix E Departmental modelling tools links and execution register

Access checked 24 October 2026. Documentation access, executable access and a calibrated project run are different states. “Not executed” does not mean zero impact. The public WebORANIG baseline is recorded only as an interface/solver check.

Table 26. Departmental model access and execution register

Owner / model	Public entry point	Access and execution for this report
Australian Treasury / modelling review	https://research.treasury.gov.au/sites/research.treasury.gov.au/files/2019-08/Review-of-Economic-Modelling-at-Treasury.pdf	Uploaded March 2017 review read. Historical institutional review; no executable.
Australian Treasury / EMMA	https://treasury.gov.au/sites/default/files/2021-09/p2021-203386.pdf	2021 model description accessed. No complete project-ready public executable established; no run.
Australian Treasury / appraisal guidance	https://evaluation.treasury.gov.au/sites/evaluation.treasury.gov.au/files/2025-07/guide-cost-benefit-analysis.pdf	Guidance applied to local NPV/BCR and switching-value calculations; not an official Treasury software run.
RBA / MARTIN	https://www.rba.gov.au/publications/rdp/2019/2019-07/read-me.html	Public package described; EViews 10 required; some data simulated. No EViews mission run.
RBA / historical small model	https://www.rba.gov.au/publications/rdp/2000/pdf/rdp2000-05.pdf	Historical documentation read; not called current MARTIN.
CoPS / ORANI-G	https://www.copsmodels.com/oranig.htm	Public documentation and models; GEMPACK knowledge/software needed for local variants.
CoPS / WebORANIG	https://www.gempack.com/webgem/weboranig/weboranig.html	Default short-run zero shocks executed. All displayed macro changes zero. No calibrated flight scenario or nonzero shock.
CoPS / VU-National VURM TERM	https://www.copsmodels.com/models.htm	Documentation accessed. Baseline database, software/access rights and project shock mapping not obtained; no run.
CSIRO / ATEM	https://research.csiro.au/ieem/australian-trade-and-environment-model-atem/	Official indexed description identifies climate/energy purpose. Full page access restricted in this review; no executable or mission run.
Treasury / climate modelling	https://treasury.gov.au/publication/p2025-700922	Net-zero modelling programme identified. Not an astronaut investment calculator; no flight application.
Treasury historical PRISMOD CAPITA MARIA / fiscal accounts	https://research.treasury.gov.au/sites/research.treasury.gov.au/files/2019-08/Review-of-Economic-Modelling-at-Treasury.pdf	Historical roles described by Murphy. No claim of current unchanged deployment or public runtime; no household tax or fiscal-payback run.
ABS / input-output methodology	https://www.abs.gov.au/methodologies/australian-national-accounts-input-output-tables-methodology/2023-24	Method and limitations checked. No unsupported expenditure multiplier applied.

Inputs needed for comparable specialist runs

Use one dated contract scope and cash profile for all options; split domestic purchases, imported crew services, capital, recurrent operations, grants and transfers; identify the fiscal funding source and offset; supply Australian commodity/industry mappings and regional locations; choose and justify wage, employment, capital, trade-balance and fiscal closure rules; document productivity and spillover mechanisms separately from demand; disclose baseline data, software version, solver accuracy and all exogenous shocks; then compare each result with the same no-new-mission baseline.

The named models are not independent replications when they use the same assumed benefits. GDP, consumption, equivalent variation, employment and government revenue should be reported separately. To add a model output to a CBA, first reconcile welfare, resource costs, time horizon and double counting. A multiplier or GDP response alone is not evidence of public cost recovery.

Local model execution record

Local sensitivity grid: 648 deterministic combinations, with no probability weights. Appendix C specifies the complete input ranges and benefit timing; Appendix H and Table 13 provide the calculation identities and worked values. These assumptions are not statistically calibrated and the grid is not a departmental macroeconomic forecast. An online zero-shock check does not validate the project assumptions.

Appendix F Supplied policy and literature screening register

The register records whether full text, an abstract or a bibliographic record was available and which claims it supports. Search pages and opaque redirects are excluded as substantive evidence. Unavailable full texts are not treated as reviewed.

Table 27. Supplied policy and literature screening register

Supplied item	Verified scope / access	Use in this report
STEM Equity Monitor	Official 2026 report and pathway pages	Baseline and distribution metrics, no inspiration-to-income coefficient.
Queensland STEM / federal education toolkit	Official policy guidance accessed	Learning and workforce pathway objectives; no flight ROI.
Academy homepage and advice-policy hub	Use identified Science 2035 and budget analysis from prior review	Specific dated reports cited, not the homepage as a numerical source.
Statement on Space	Official 2026 statement and PDF accessed	Vision and capability tests; does not prove that a flight cripples the sector.
OECD space-economy hub	Official thematic resource accessed	Sector measurement context; no transferable astronaut multiplier.
Biddington 2021, PII S0265964621000230	ECU author repository abstract and citation verified	Geography/security and policy coherence. No mission return estimate.
Bongers et al. 2026, PII S0265964626000202	Publisher abstract indexed; author institution metadata verified; full text unavailable	Market-failure framework at abstract level; no numeric coefficient imported.
PII S0265964626000172	Direct access blocked; identity/content not resolved	Not used for factual or numerical claims.
Macauley 1995	Resources for the Future article accessed	Tangible/intangible valuation; historical context.
Henderson Storeygard Weil 2012	AEA abstract, citation and replication link verified	Economic measurement from night lights; not returns to flight.
Garretsen Martin 2010	Author institution abstract/citation verified	Place, history and agglomeration; no kilometre-to-profit coefficient.
Wilson 2011, DOI 10.1080/13563467.2010.504299	Publisher abstract and citation verified	Terrestrial new economic geography, not orbital colonisation.
Auffhammer et al. 2013, DOI 10.1093/reep/ret016	Publisher abstract/citation verified	Weather/climate data pitfalls; not a space-spend benefit model.
PII S3050475926012893	Access blocked; identity/content unresolved	Not used in quantified modelling.
Sandhu 2023, DOI 10.1089/space.2022.0002	Publisher abstract and citation verified	Disclosure and space sustainability; no mission ROI.
Mirek 2025 chapter, DOI 10.1007/978-3-031-91227-6_36	Publisher abstract/citation verified; full text subscription-only	Sustainability review scope; no return coefficient.
Peeters 2024, DOI 10.1089/space.2023.0060	Publisher abstract/citation verified	Commercial models and growth conditions, not proof of a specific flight return.
Sandler Schulze 1981, JSTOR 24882431	Bibliographic record verified	Foundational space-economics lead; no unread substantive results used.
Hickman very large space projects PDF	Supplied ResearchGate file unavailable	Not used as a verified quantitative source.
Google Scholar searches / Google Books preview / Google goto URL	Search leads and incomplete or opaque targets	No citation to a search cache as evidence; book identity/page must be verified before substantive use.
DCCEEW 2026 Science Strategic Statement	Official policy page accessed	Evidence, outcomes and scientific capability/retention test.

Supplementary technical note — testing claims of economic and community return

A. Model comparability. Distinguish discounted social CBA, fiscal cash flows, input–output gross output, computable general equilibrium effects, ESA geographical return, and programme-level econometric impact evaluations. Their denominators, price years, geographical scopes and counterfactuals differ. A positive industry turnover multiplier does not itself establish a benefit–cost ratio greater than one.

B. Benefit attribution. For each asserted gain, record source; funding instrument; programme and beneficiary; Australian ownership and location; gross output; imported content; additional Australian value added; displacement; relevant tax receipts; monetised and non-monetised social benefits; distribution by community; timing; uncertainty; and independent verification. Deduct benefits already occurring under existing Australian–ESA relationships.

C. Comparator evidence. OECD (2022), Chapter 5, identifies methodological weaknesses in space impact evaluation and cautions against transplanting input–output multipliers between countries. The UK Space Agency (2021) review documents publication bias as a possible explanation for universally positive reported returns, and rates of return that are often reconstructed from heterogeneous studies. The peer-reviewed 2014 Space Policy article and the 2023 macroeconomic modelling article provide methodological and temporal qualifications rather than mission-specific Australian benefit estimates.

D. National Spaceflight Foundation Evidence Register. Website supplied for follow-up: https://nationalspaceflightfoundation.org.au/. At this revision, no foundation-authored, publicly reproducible mission-level national CBA was independently verified. Before inclusion of any specific return figure, obtain the original report, publication date, author, commissioning body, cash/in-kind funding split, counterfactual, beneficiary-level data, sensitivity tables and any independent review. Mark unavailable items “not verified”, not “zero”.

E. Alternative-spend decision rule. Apply a common real price year, a clearly disclosed discount-rate sensitivity, equal treatment of risk and delivery delays, a full resource-cost boundary, and explicit non-monetised benefits to both the astronaut option and domestic capability options. Equal nominal cash allocations are not necessarily equal present-value resource costs.

Additional source references

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- Corrado, L., Grassi, S., Paolillo, A., & Silgado-Gómez, E. (2023). The macroeconomic spillovers from space activity. Proceedings of the National Academy of Sciences, 120(43), e2221342120. https://doi.org/10.1073/pnas.2221342120

Appendix G Claim to source and underlying evidence audit

This audit checks material claims against the originating source and, where available, the source behind that source. Verification of a document or its arithmetic is distinct from independent reproduction of a statistical estimate. Restricted data, abstract-only access and incomplete reconciliations are recorded rather than concealed.

Table 28. Claim source and underlying-evidence audit

Claim	Originating evidence and underlying source	Audit result and limit
UK £7.49 per £1 public ESA expenditure	UK Space Agency 2025, sections 2.2 and 8; RAND Europe and Ipsos analysis links ESA contract records to ONS business data.	Published estimate verified; not replicated from confidential firm microdata. Applies to a portfolio, not one flight.
UK social rather than public-cost return	Same report, section 8.5: £6.42 per £1 social cost after private R&D and capital costs.	Denominator materially changes. Neither 7.49 nor 6.42 transfers automatically to Australia.
UK attribution methodology	Technical annex and cited Callaway–Sant'Anna staggered difference-in-differences method; awarded versus not-yet-awarded firms.	Method traced; assumptions include credible parallel trends and treatment timing. No independent re-estimation is claimed.
Canada annual payment	CSA Audit and Evaluation Directorate 2023, Table 1, based on programme financial records.	C$12.050m general plus C$34.308m optional = C$46.358m. Not an Australian fee.
Canada programme administration	CSA 2023 Table 1: C$2.494m over five years; total C$215.884m.	Report Table 2 has been corrected: administration is C$2.494m; C$215.884m is total programme resources. The earlier review comment is retained as an audit trail.
Canada negotiated 50% scale	2019 treaty, Article III.1–2, rather than a general promotional statement.	Applies to defined Basic Activities; optional subscriptions have separate arrangements. No Australian entitlement inferred.
Canada geographical return and ROI	CSA 2023 Figures 8–9 and efficiency findings; underlying ESA contract-return reporting.	Weighted contract-share coefficient, not welfare BCR; evaluation itself rejects precise total-investment return arithmetic.
2023 Canadian-dollar conversion	Bank of Canada annual-rate table, US-dollar row and 2023 column.	C$1.3497 per US$1 verified; fiscal-year cash converted approximately using a calendar-year rate.
Poland Ignis €65m	Polish ministry announcement of 24 July 2025.	Official stated mission cost and experiment outputs; not an independent full-cost audit or causal national ROI.
Australian Agency A$34.2m	2023–24 Budget Paper 2, Refocusing Support for the Australian Space Industry.	Three-year policy/core-functions measure verified. Net measure savings are not the same as its positive component.
Australian Agency A$21.7m	2026–27 Budget Paper 2, core regulatory and policy functions.	Two-year measure verified. No flight earmark established by that line.
Historical A$100.4m core subtotal	Recovered working-paper ledger, traced to four budget measures.	Arithmetic checked; not cumulative actual expenditure. Historical MYEFO details retained as dated evidence pending renewed primary reconciliation.

Claim	Originating evidence and underlying source	Audit result and limit
A$82.520986m grant offers	Recovered 43-line recipient ledger; official recipient registers are the originating sources.	Historical sum checked; payments, amendments and acquittals not re-audited. Offers and parent envelopes must not be added.
Government R&D amounts and effort	ABS 2024–25 government and private non-profit R&D release, survey tables and definitions.	Current and chain-volume amounts, location and person-year units distinguished. Not a whole STEM budget or a census of all science jobs.
CSIRO job reductions	Agency annual reports and its May 2026 statement; ATSE evidence as a separately identified stakeholder source.	Headcount, planned FTE cuts and stakeholder reported losses separated; no unsupported sum or proven nationwide dollar damage.
Treasury model use	Murphy March 2017 review and Bullen et al. September 2021 EMMA paper.	Historical review and later model description distinguished. No official project model execution implied.
Public MARTIN reproducibility	RBA supplementary read-me and model package description.	Some proprietary data replaced by simulated series; EViews requirements disclosed. Not the internal current forecasting system.
ORANI-G online availability	CoPS model documentation and live WebORANIG zero-shock run.	Access and zero baseline verified. No project calibration; does not validate a fiscal multiplier.
STEM inspiration / policy consistency	STEM Equity Monitor, Statement on Space, education guidance and specific Academy reports.	Objectives and baseline measures established; a causal inspiration-to-career return or policy breach is not established.
Own mission and domestic portfolio calculations	Explicit planning inputs and local model JSON / reproduction script.	Arithmetic and sensitivity-grid dimensions checked. No external quotation, empirical benefit forecast or official endorsement.
UK manufacturing outcomes	Size and Health 2024: voluntary survey, 218 responses; additional accounts and estimation.	Published manufacturing category includes research. Counts and income share have differing denominators; no causal funding or flight attribution.
Canadian workforce reconciliation	Headline 14,622 and +562; industry 9,655 to 9,627. Published 2024 institution rows sum to 14,322.	A 300-job discrepancy remains. Another total says 27,980 whereas direct plus indirect/induced rows sum to 28,171. No manufacturing employment multiplier is calibrated from these totals.
Polish panel and Scanway source check	ARP: 970, 1,013, 1,268 in 2022–24 but stated +205/+19.3% for the final year. Scanway primary report: 68 total, 30 Space staff in 2024.	1,268−1,013 = 255, not 205. ARP reports Scanway 69; primary report says 68. The 2022–24 +298 arithmetic is reproducible but panel scope changes, including Liftero, prevent treating it as a strict balanced sample.
Swedish space-related turnover	Agency company survey and public accounts; 60 responses from 188 identified firms.	SEK4.9bn is space activity; SEK20.3bn includes non-space business. Confidential responses and full survey not independently replicated.
Norwegian industry turnover	Agency 2021 survey with Oslo Economics; current agency notice says 2025 resurvey underway.	NOK11bn commercial turnover differs from NOK11.7bn total economic activity. No invented annual growth or manufacturing-only split.
MDA job announcement	Company release 13 September 2024 ties expansion to an initial 198-satellite order and 600 jobs being added.	Announcement in progress; realised payroll additions not independently verified. Do not equate order backlog, plant capacity and jobs delivered.
Company financial outcomes	RUAG International 2024 accounts/release and NSIL FY2024/25 statement of profit and loss.	Group and company boundaries retained; NSIL is NewSpace India Limited, not a similarly abbreviated unrelated firm. Accounting profit and divestment proceeds are not national social ROI.

Claim	Originating evidence and underlying source	Audit result and limit
Manufacturing sensitivity calculations	216 export-benefit and 36 operating-capacity cases, with explicit inputs and source observations in separate JSON.	Calculated locally. No EMMA/MARTIN run, foreign margin transfer or net national job forecast is implied.

Final source reconciliation: UK 2025–26 accounts report £588.936m in ESA subscriptions plus £12.796m in recognised exchange-contract loss, giving £601.732m total subscription expense. The performance section reports a final-quarter geographical-return coefficient of 1.01. These published figures are now verified; neither is a single- flight national return (UK Space Agency, 2026, sections 8, 12 and financial accounts).

Foreign return denominators and independent replication

The UK evaluation reports £27.802bn in estimated benefits against £3.714bn of public costs, or £4.331bn of modelled social costs. These yield approximately 7.49 and 6.42 respectively, not fiscal repayment ratios (UK Space Agency, 2025a, 2025b, Annex I). The social-cost base comprises induced R&D, capital and administration. It does not establish a reconciliation of all complementary national funding. Additional necessary support requires matched costs and attributable benefits, avoiding double counting. Confidential linked firm data and the full estimation environment were not accessed here.

The ONS Annual Business Survey methodology confirms the business-survey basis and confidentiality requirements. Public methodological documentation makes the provenance checkable, but does not give this report access to confidential unit records. Testing the published causal estimate would require the same linked data, treatment dates, code, sample exclusions and identification diagnostics. Reading a reference list alone does not reproduce an estimate (Office for National Statistics, 2024).

The Canadian legal formula was traced to Article III of the 2019 cooperation treaty. That treaty, rather than an assumed fee discount or a media account, is the primary source for the scope of the 50% rule. The historical amounts come from the separate CSA programme evaluation financial table. The legal rule, payments, contract shares and social benefits are therefore four separate evidence chains (Government of Canada & European Space Agency, 2019; Canadian Space Agency, 2023).

The UK technical annex also reports a statistically significant pre-treatment difference for GVA, warranting caution; turnover and productivity pass its reported pre-trend tests. Failure to reject a pre-trend is supporting evidence, not proof of causality. The confidential ONS microdata require accredited secure access (UK Space Agency, 2025b, technical annex, sections H.1.1–H.1.4).

Material source limitations retained

Canadian administration costs, optional-programme payments and UK subscription accounting are treated separately to avoid double counting.
Inaccessible papers are excluded from numerical validation. Historical working papers remain dated evidence; unresolved source limitations are disclosed in the audit.

Appendix H. Economic models, calculations and decision rules

This appendix explains the appraisal methods and calculation comparisons. The numerical examples are local calculations; the specialist departmental models were not run.

H.1 Economic modelling framework and decision rules

The appraisal compares incremental Australian social benefits and resource costs, rather than gross expenditure. Estimate each option against a common, credible no-new-mission baseline, then compare feasible alternatives on the same basis. Use consistent real prices and discounting, and test additionality, deadweight, displacement, leakage, distribution and uncertainty. NPV, BCR, fiscal return and industrial contract return answer different questions.

Calculation of Net Present Value (NPV)
Net present value (NPV) is calculated as the sum of incremental social benefits minus incremental social costs:

NPV = Σ[(incremental social benefits_t − incremental social costs_t)/(1+r)^t].

(Australian Centre for Evaluation, 2025)

Benefit-cost ratio (BCR)
Benefit–cost ratio (BCR) is calculated as the result of the incremental benefits divided by the incremental costs:

Benefit–cost ratio (BCR) = PV(incremental benefits)/PV(incremental costs).

(Australian Centre for Evaluation, 2025)

Fiscal return
Fiscal return is calculated as the additional taxes and savings minus government expenditure:

Fiscal return = discounted additional taxes and savings - government expenditure.

(Author's fiscal accounting identity; Australian Centre for Evaluation, 2025)

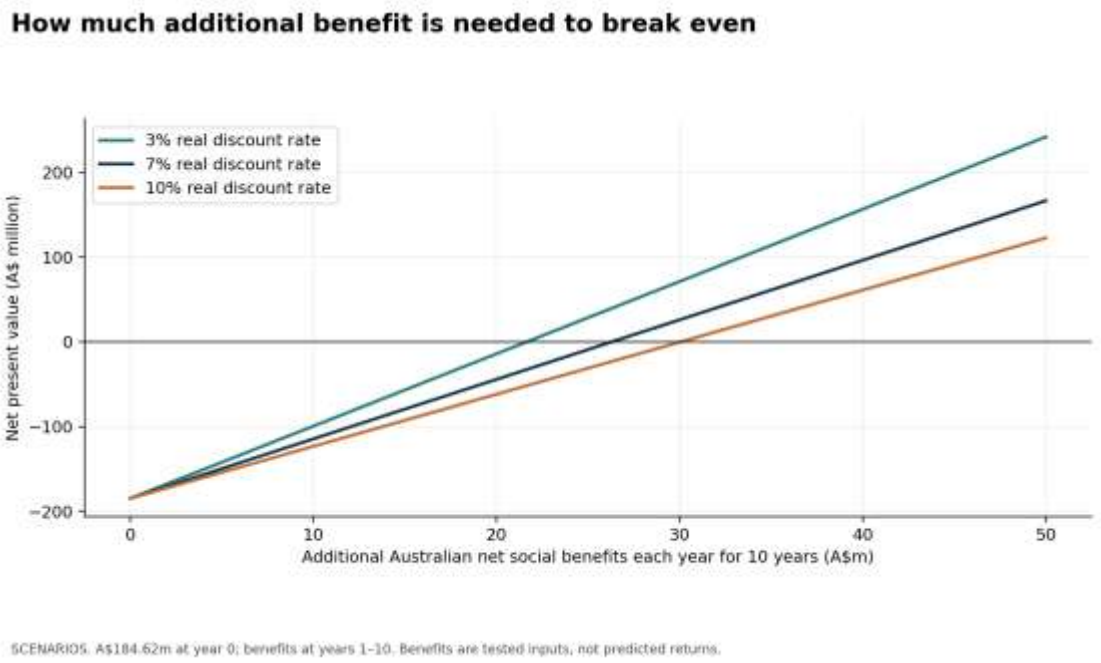
Industrial contract return
Industrial contract return is a measure of eligible weighted ESA contracts received by Australia (or Australian companies) relative to contribution shares (see Section 4).

Industrial contract return = eligible weighted ESA contracts relative to contribution share.

(European Space Agency, n.d.-b; Canadian Space Agency, 2023)

Input–output multipliers estimate inter-industry gross activity, using fixed-coefficient assumptions; they do not by themselves establish net welfare, fiscal payback or additionality. (Australian Bureau of Statistics, 2026a, Input–Output Tables methodology) Computable general equilibrium analysis can account for factor constraints, exchange-rate and displacement effects but requires transparent calibration. Real-options analysis can value staged investment and learning under uncertainty.

Figure 12. How much additional benefit is needed to break even

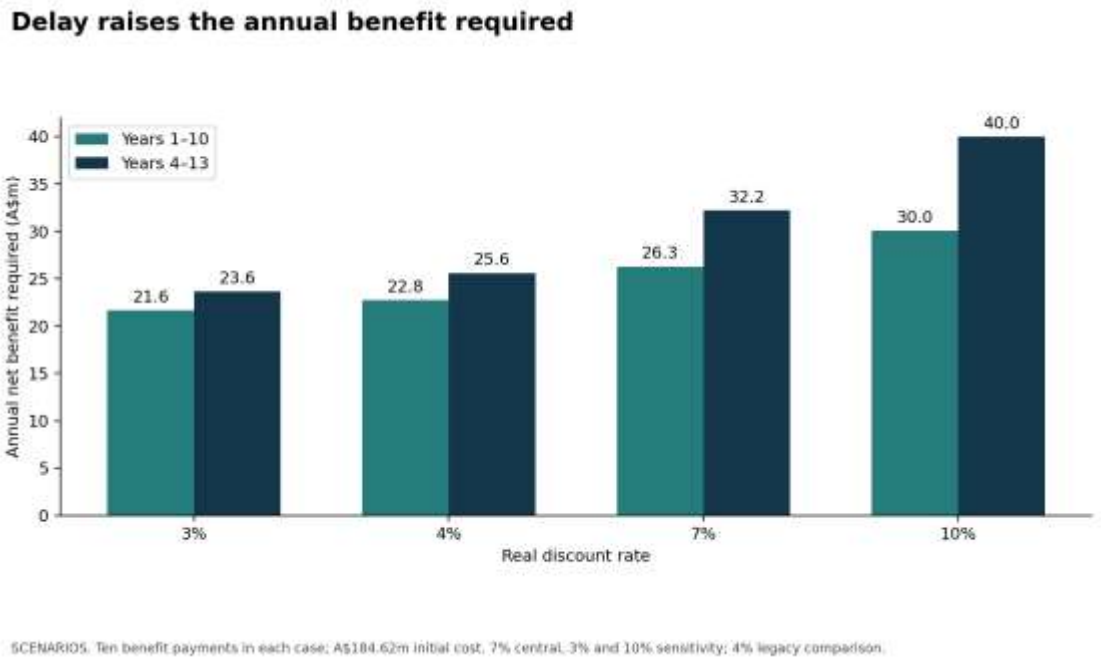


SCENARIOS. A$184.62m at year 0; benefits at years 1–10. Benefits are tested inputs, not predicted returns. Legend: teal = 3%, navy = 7%, orange = 10% real discounting; the zero line marks break-even. Model: incremental discounted social CBA, NPV = annual net benefit × annuity factor − initial cost. Method: Appendix C, Reproducible simulations; Section 18, K3–K7.

Economic-geography theory suggests agglomeration, supplier proximity and cumulative industrial learning may advantage firms already embedded, and near European primes (Leontief, 1986; Krugman, 1991; Boardman et al., 2018). For science and research benefits other measures are needed such as distinguish knowledge/publication outputs, IP options, increased technical workforce and unpriced public-good benefits from monetised commercial sales, whilst avoiding counting a grant-funded research salary as both a cost and an independent net benefit (to the recipient).

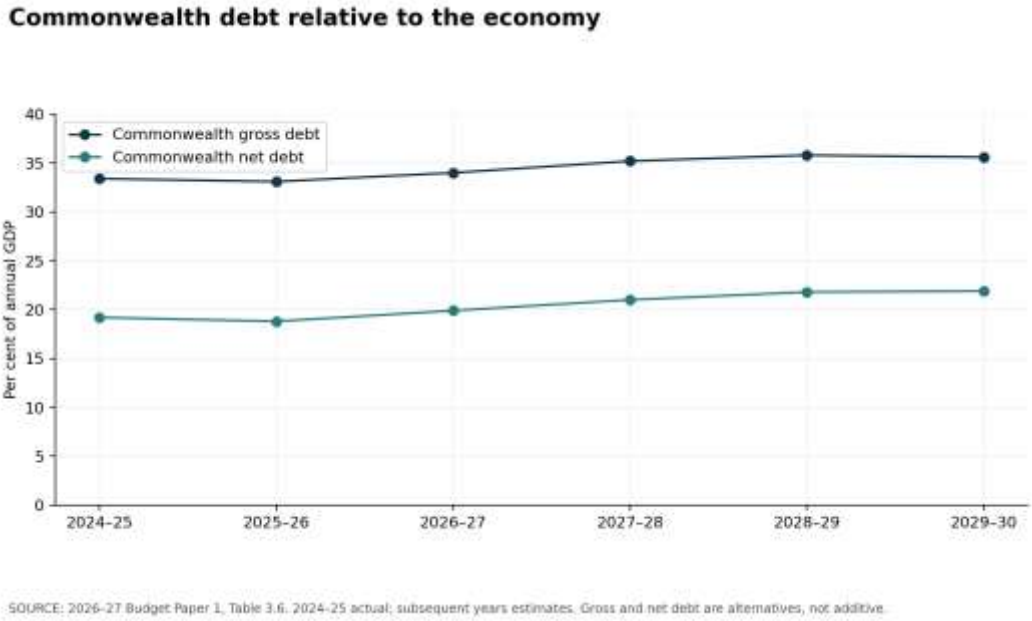
Budgetary delay raises the annual benefit, ROI, required to be returned to the Australian population. Comparisons demonstrated on the following graphics, illustrate the budgetary spend in different sectors of the Australian economy. Scenario data can be found in the legend and reproducible simulation data is noted in the accompanying appendix.

Figure 13. Delay raises the annual benefit required



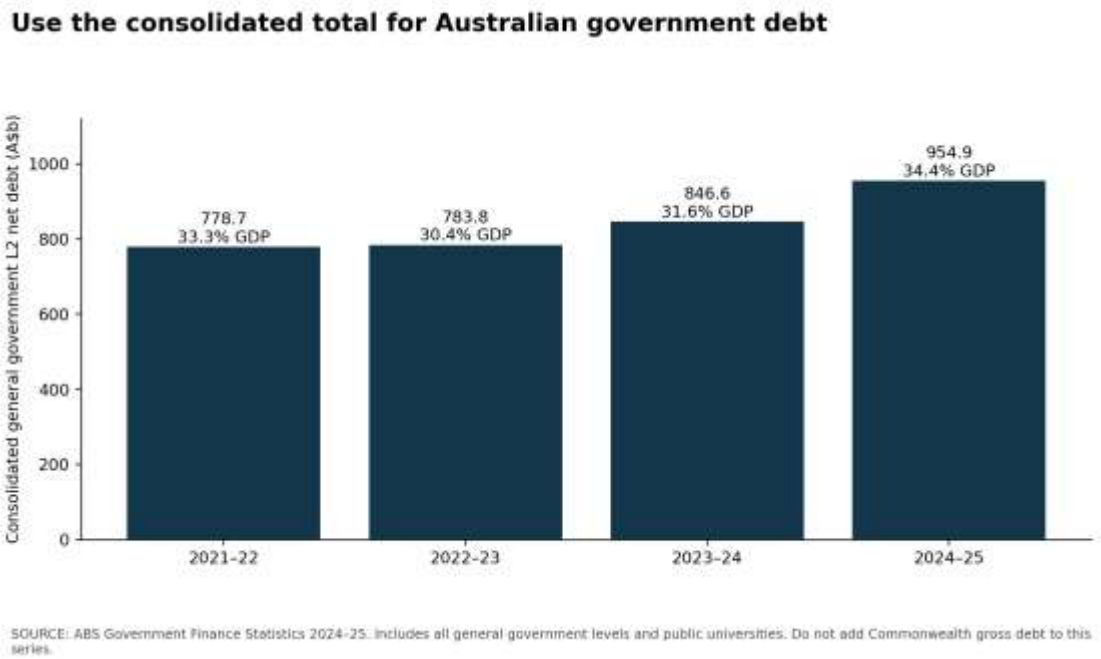
SCENARIOS. Ten benefit payments in each case; A$184.62m initial cost. 7% central, 3% and 10% sensitivity; 4% legacy comparison. Legend: teal bars = benefit payments in years 1–10; navy = years 4–13. Model: discounted switching-value analysis; the same ten payments are shifted by three years. Method: Appendix C, Reproducible simulations; Appendix A for the legacy 4% annuity comparison; Section 18, K7–K8.

Figure 14. Commonwealth debt relative to the economy



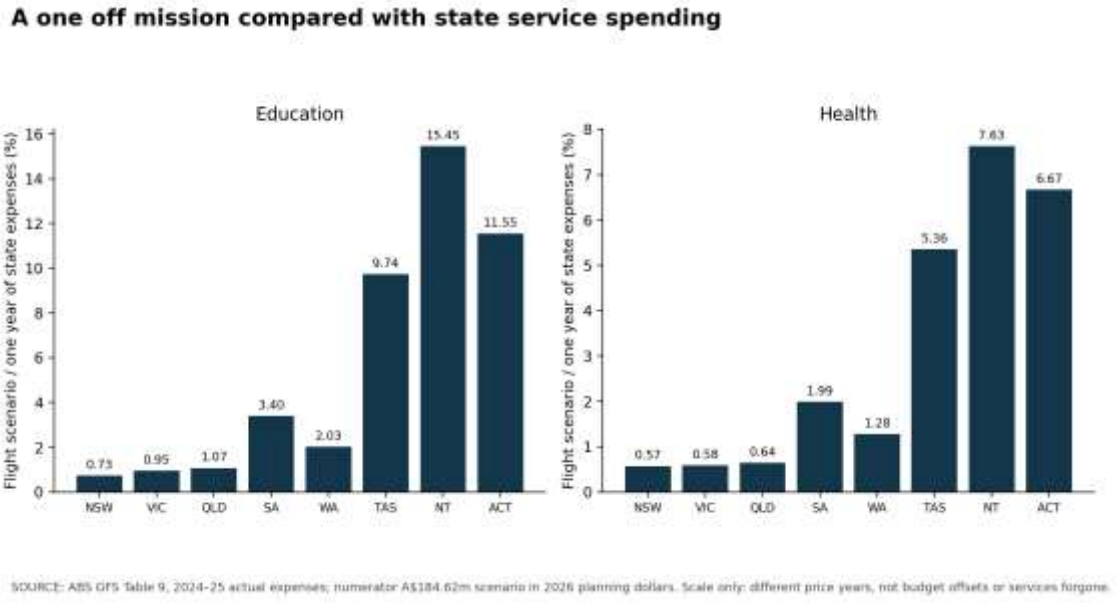
SOURCE: 2026–27 Budget Paper 1, Table 3.6. 2024–25 actual; subsequent years estimates. Gross and net debt are alternatives, not additive. Legend: navy = gross debt; teal = net debt, each as a percentage of annual GDP. Method: descriptive published fiscal series; no mission-impact model is applied. Explanation: Appendix C, Figures and the requested fiscal comparisons; Appendix H, source audit.

Figure 15. Use the consolidated total for Australian government debt



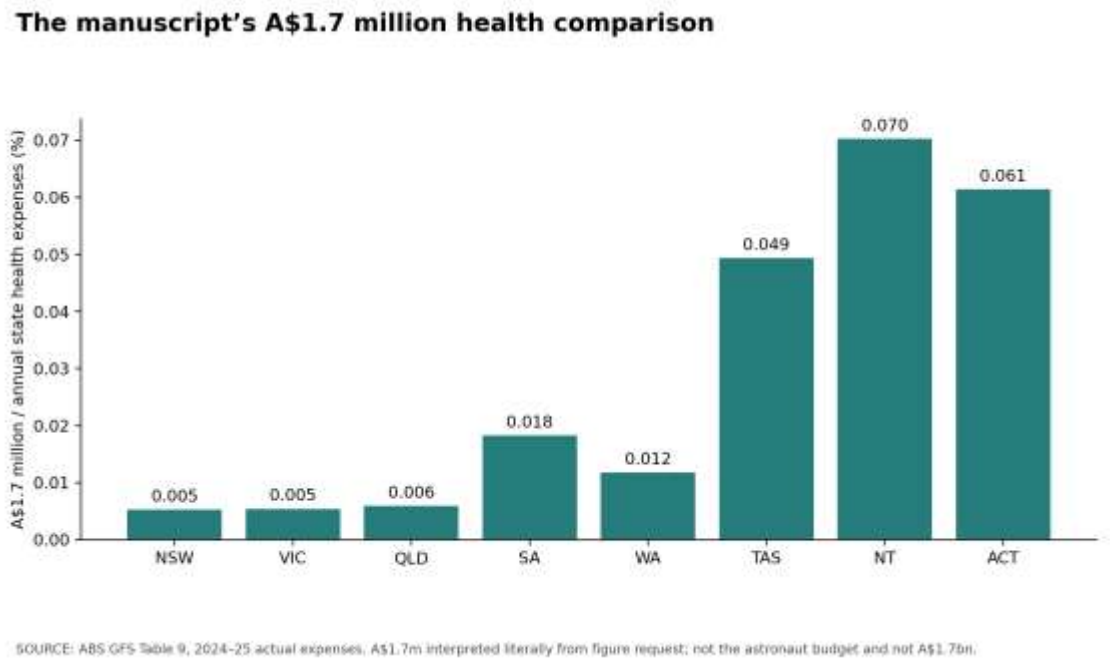
SOURCE: ABS Government Finance Statistics 2024–25. Includes all general government levels and public universities. Do not add Commonwealth gross debt to this series. Legend: bars = consolidated net debt in A$ billion; labels also give debt/GDP percentages. Method: descriptive ABS fiscal accounting; no mission-impact model is applied. Explanation: Appendix C, Figures and the requested fiscal comparisons; Appendix H, source audit.

Figure 16. A single-astronaut mission compared with Australian states and territories service spending



SOURCE: ABS GFS Table 9, 2024–25 actual expenses; numerator A$184.62m scenario in 2026 planning dollars. Scale only: different price years, not budget offsets or services forgone. Legend: left panel = education; right = health; each bar is the flight-cost scenario divided by one jurisdiction's annual expenses, in percent. Model: expenditure-scale ratio, not a welfare or budget-offset model. Method: Appendix C, Figures and the requested fiscal comparisons; Appendix H. ABS source locator: GFS Table 9.

Figure 17. A$1.7 million compared with state and territory health spending



Source: ABS GFS Table 9, 2024–25 actual expenses. A$1.7m is a separate illustrative amount, not the astronaut budget or A$1.7bn. Bars show this amount as a percentage of each jurisdiction's annual health expenses. This is a scale comparison, not a budget offset or benefit estimate.

H.2 Departmental modelling frameworks and calculation comparison

Murphy's March 2017 Treasury review is an institutional stocktake and roadmap, despite the later upload date in its URL. It documents modelling capabilities; it is not an online calculator or evidence that those models were run for this mission.

The 2021 EMMA paper is a later model description, and the 2000 RBA small-model paper is historical; the 2019 MARTIN paper and public package provide a more recent reference (Murphy, 2017; Bullen et al., 2021; Ballantyne et al., 2019).

A comparable appraisal requires common inputs, a local cost–benefit calculation and a separate account of what each specialist model can estimate. Passing an assumed expenditure through several models does not provide independent validation. Data, calibration, baseline and transmission assumptions must be disclosed for each run.

Models

EMMA supports Treasury macroeconomic forecasting and counterfactual analysis. MARTIN supports RBA macroeconomic forecasting and scenarios; the public release uses EViews and substitutes simulated series for some proprietary data. Neither was executed for this report. No

complete public EMMA runtime and calibrated mission scenario was established. A faithful MARTIN project run would require EViews, data-vintage control and a justified shock specification (see Table 14)

CoPS distinguishes historical ORANI models, generic ORANI-G materials, dynamic VU-National and regional models such as VURM and TERM. They are not interchangeable Treasury tools. The WebORANIG default short-run zero-shock baseline was checked on 24 October 2026. Its zero macroeconomic changes demonstrate access to the solver, not the effects of a flight (Centre of Policy Studies, n.d.).

The public interface includes government consumption, labour productivity, investment, wages, an exchange-rate numéraire and export demand. No mission spending classification, imported-service contract, labour displacement or research productivity effect was calibrated against a 2026 baseline. No nonzero shock was run, and no demonstration result was scaled into a mission return. A defensible project run requires a binding cost and scope, negotiated agreement terms and an explicit economic transmission mechanism.

Novel models

CSIRO describes ATEM as a trade-and-environment model for climate and energy policy. Treasury climate modelling must be assessed against its own technical documentation. No mission-specific emissions or energy question was specified here, so ATEM was not used to estimate astronaut ROI.

“Base plus growth” describes a forecasting or accounting approach, not a universal Treasury or RBA model. Forecasts may combine models, judgement and liaison evidence. Policy assumptions must be stated explicitly and must not be adjusted to produce a predetermined conclusion.

Common calculation register

All amounts below are A$ million unless another currency is explicitly stated. Benefit tests exclude the initial cost already charged at year 0, and include only additional Australian benefits, net of downstream resource costs (see Table 13).

Budget outlay is a provisional resource-cost proxy, as actual costs have not been publicly discussed, the full final CBA still requires tax/transfer and opportunity-cost reconciliation (see Table 13 and 14). Calculation IDs are shared with the model matrices and Appendix E.

Calculation coverage in each modelling framework

Table 29. Calculation coverage in CBA, EMMA and MARTIN

Calculation	Project CBA	Treasury EMMA	RBA MARTIN
K1–K2 Cost and currency	L	I	I
K3–K8 Discounting NPV BCR and thresholds	L	I / post-process	I / post-process
K9 Subscription cost schedule	L	I	I
K10 Domestic portfolio cost schedule	L	I	I
K11 Funded staff capacity	L / budget identity	I, not net jobs	I, not net jobs
K12 GDP net jobs taxes	M; external estimates needed	M; not run	M; not run

Table 30. Calculation coverage in CGE, climate and fiscal frameworks

Calculation	ORANI / VU-National / regional CGE	ATEM climate model	Fiscal and distribution accounts
K1–K2 Cost and currency	I; classify by commodity and import origin	I if relevant to a defined climate scenario	L for gross budget outlay
K3–K8 Discounting NPV BCR thresholds	I / welfare post-processing; no project run	N for a flight CBA	L for stated fiscal flows; separate from welfare
K9 Subscription cost schedule	I; distinguish foreign transfer and purchased services	N	L for scenario cost; no negotiated fee established
K10 Portfolio cost schedule	I; capital and recurrent demand must be separated	I only if an energy/emissions question is defined	L for scheduled outlay
K11 Funded staff capacity	I; CGE net employment needs labour-market closure	N	L as funded capacity; household effects not estimated
K12 GDP net jobs taxes	M; zero-shock demo only, no mission result	N for mission ROI; climate extension would need data	M; no tax or beneficiary-microdata model run

Key: L = calculated locally using the stated appraisal identity. I = can be an input or post-processing identity, but no model execution establishes it here. M = requires a calibrated model and mission specification; not run. N = outside the model's principal purpose. These codes are not zero-valued results. All six grouped rows cover calculation IDs K1–K12 in each framework. Numerical output is supplied only where a calculation has actually been performed. Missing model runs are not replaced by the local sensitivity model. Appendix E of the report records departmental and model-provider links, access requirements and execution status.

H. Continuing commitments: accounting and benefit transmission

For each option, record separately: commitment authority and announcement date; nominal total and currency; annual cash outlays; existing versus incremental expenditure; contract eligibility; Australian procurement share; administrative and co-funding requirements; contract and project life; future operating liabilities; real price base; discount rate; and terminal or residual value. The UK £1.7 billion new subscription and £601.7 million annual expenditure, for example, are not additive measures. The Canadian €407.71 million commitment and earlier planned annual contributions also occupy different reporting bases.

Community benefit bridge: public appropriation → eligible programme spending → contracts actually awarded → Australian-owned value added (less imports and displacement) → wages, profits and retained intellectual property → additional domestic taxation, productivity and knowledge spillovers → distribution by region and population. A geographical-return coefficient measures eligible contracts, not the final stages of this bridge. The same bridge must be applied to domestic grant programmes.

Comparator source register (additional primary documents)

- European Space Agency. (2025, November 27; updated December 2). ESA Member States commit to largest contributions at Ministerial. https://www.esa.int/About_Us/Corporate_news/ESA_Member_States_commit_to_largest_contributions_at_Ministerial
- UK Space Agency. (2026). UK Space Agency annual report and accounts 2025–2026. https://www.gov.uk/government/publications/uk-space-agency-annual-report-and-accounts-2025-2026/uk-space-agency-annual-report-2025-2026
- Canadian Space Agency. (2025, November 28). Canada confirms historic space investment at European Space Agency's Ministerial Council. https://www.canada.ca/en/space-agency/news/2025/11/canada-confirms-historic-space-investment-at-european-space-agencys-ministerial-council.html
- Canadian Space Agency. (2026). Departmental plan 2026–27: Supplementary information tables. https://www.asc-csa.gc.ca/eng/publications/dp-2026-2027-tables.asp
- Department of Industry, Science and Resources. (2025). Annual report 2024–25. https://www.industry.gov.au/sites/default/files/2025-10/disr-annual-report-2024-25.pdf
- Department of Industry, Science and Resources. (2025). Annual report 2024–25: Detailed results. https://www.transparency.gov.au/publications/industry-science-and-resources/department_of_industry__science_and_resources/department-of-industry-science-and-resources-annual-report-2024-25/chapter-2%3A-performance-statements/detailed-results
- Austrade. (n.d.). Space: Incentives, grants and support. https://international.austrade.gov.au/en/do-business-with-australia/sectors/space

Supplementary evidence review: MITRE (2024) and the Australian commercial-space counterfactual

Dailey, Groesbeck and Malekos Smith (2024) propose a strategic roadmap for Australian commercial space development built around launch geography, automated and robotic mining, satellite development, commercial diversification, space sustainability and international capacity-building. The paper is a strategic white paper, not an independently estimated Australian project-level cost–benefit analysis. Its assertions concerning future launch savings, industry growth and post-war economic analogies should be treated as hypotheses requiring independent validation, not measured Australian economic returns.

Policy implication: Australia can invest in the space economy through downstream satellite services, space-domain awareness, ground systems, robotics, research translation and domestic supply chains without making a single astronaut flight a necessary condition. The paper does not establish that an astronaut flight is economically inferior, nor does it estimate the incremental benefits of that mission. Both pathways must face the same appraisal standard.

Source-to-model transmission and validation register

M1 — Launch geography: source claim = potentially favourable delta-v/launch economics for particular trajectories. Validation = mission-specific latitude, inclination, azimuth, range safety, launch cadence, insurance, infrastructure, environmental and transport costs. Model input = independently estimated incremental Australian net value added, not gross launch revenue. Do not assume all orbits or Australian sites share the same advantage.

M2 — Robotics and automated mining: source claim = potential transfer of Australian terrestrial expertise to space applications. Validation = existing firms and technology-readiness levels, demonstrable contracts, IP ownership, co-investment, export demand and probability-adjusted commercialisation. Model input = additional Australian net benefits after public and private costs, displacement and import leakage.

M3 — Satellites, ground infrastructure and downstream services: source claim = possible commercial expansion. Validation = verified user demand and adoption in agriculture, transport, communications, disaster management and regional services. Model input = incremental productivity, avoided losses and consumer benefits attributable to the proposed intervention, net of implementation and operating costs.

M4 — Human spaceflight: the MITRE roadmap discusses exploration as a long-term strategic direction but does not demonstrate that purchasing one astronaut seat is prerequisite to M1–M3. Validation = signed Australian research payload agreements, domestic procurement, follow-on contracts, counterfactual access to microgravity facilities, workforce outcomes and demonstrable spillovers. Model input = probability-adjusted, attributable Australian benefits only; exclude publicity impressions and gross global-market growth as proxies for welfare.

Comparative appraisal: for each candidate investment, apply NPV = Σ[(incremental Australian social benefits − incremental Australian resource costs)/(1+r)^t], with consistent price base, horizon and real discount rate. Include option-specific implementation costs, continuing operating liabilities, timing, delivery risk, alternative delivery mechanisms, distributional outcomes and sensitivity bounds. The existing 7% ten-year break-even calculation is a scenario test, not evidence that any investment meets its threshold. Treasury's Industry Model (TIM) may inform wider sectoral effects when adequately specified; it does not substitute for a project-level counterfactual or establish causal benefits without suitable inputs (Carlton et al., 2023).

Evidence classification: MITRE (2024) = strategic/propositional source; CSIRO Space Roadmap = Australian strategic opportunity assessment; SIAA 2025 = member-reported capability inventory; independently documented contracts and programme evaluations = potential observed outcomes; Treasury/Finance appraisal guidance = methodological standard. No single source is sufficient to infer a positive Australian social NPV for either a mission or an industrial alternative.

Additional traceable references

- Dailey, N. D., Groesbeck, T., & Malekos Smith, Z. L. (2024, September). Australia's space epoch: Leveraging geolocational and technological advantages to forge a commercial space frontier (PR-23-03794-2). MITRE. https://www.mitre.org/sites/default/files/2024-10/PR-23-03794-2-Roadmap-Australia-Economic-Technological-Renaissance-Space-Age.pdf
- Carlton, F., Gustafsson, L., Hinson, M., Jaensch, J., Kouparitsas, M., Peat, N., Quach, K., Wende, S., & Womack, P. (2023, August 30). Modelling industry specific policy with TIM: Treasury's multi-sector dynamic general equilibrium model of the Australian economy. Australian Treasury. https://treasury.gov.au/publication/p2023-437296-tim
- CSIRO. (n.d.). Space roadmap. https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/future-industries/space-roadmap

Independent arithmetic and inference controls

All monetary switching values below use a ten-year annuity, a 7% real discount rate, benefits beginning at the end of year 1, and zero additional costs after the initial investment. They are scenario thresholds, not estimates of realised Australian benefits. Comparing nominal reported prices with these real-value thresholds requires a consistent price year and treatment of additional lifecycle costs.

- AUD$100.00 million initial expenditure: minimum constant annual incremental net Australian benefit AUD$14.24 million; annuity factor 7.023582.
- AUD$120.00 million initial expenditure: minimum constant annual incremental net Australian benefit AUD$17.09 million; annuity factor 7.023582.
- AUD$160.00 million initial expenditure: minimum constant annual incremental net Australian benefit AUD$22.78 million; annuity factor 7.023582.
- AUD$184.62 million initial expenditure: minimum constant annual incremental net Australian benefit AUD$26.29 million; annuity factor 7.023582.
- Central exchange-rate scenario: (USD$110 million mission assumption + USD$10 million ancillary assumption) / 0.65 USD per AUD = AUD$184.615 million. The USD$10 million assumption must be excluded if already included in a mission price; the reported AUD$160 million case is a separate scenario, not an additional charge.

For every alternative, use the same baseline, horizon, discount rate, price year, additionality test, displacement assumptions, Australian benefit capture, risk treatment and lifecycle costing. A positive global industry forecast, an industry capability inventory or an overseas programme multiplier is not itself an Australian project benefit.

Evidence-to-conclusion decision rule

Evidence supports the existence of Australian space-sector capabilities and plausible investment opportunities. It does not presently demonstrate that a dedicated astronaut flight is a necessary precondition for Australian participation, nor does it quantify the flight's incremental Australian net present value. Absence of a demonstrated positive return is not evidence of a negative return. Likewise, alternative investments must be appraised rather than presumed superior.

Evidence status: the source register identifies the public documents used and distinguishes reported observations, scenario inputs and unresolved evidence. Availability of a source does not by itself establish the validity or applicability of every claim within it. The proposed mission's contract terms, incremental costs and realised benefits remain unverified.

October 2026 reporting sources

- ABC News. (2026, October 20). SA still committed to Bennell-Pegg space mission, as other states decline funding request. https://www.abc.net.au/news/2026-10-20/sa-watch-on-astronaut-program/107286280
- ABC News. (2026, October 23). Federal government makes offer to send Australian of the Year to space. https://www.abc.net.au/news/2026-10-23/australia-makes-offer-to-send-australian-of-the-year-to-space/107300194
- InDaily. (2026, October 23). Multimillion-dollar promise to send Adelaide astronaut into space. https://www.indailysa.com.au/news/just-in/2026/10/23/multimillion-dollar-promise-to-send-adelaide-astronaut-into-space
- Mendes, L. (2026, October). PM's $160m astronaut plan faces fierce backlash. NT News.