Unpacking the Aerospace Systems subject report 2021

Internal assessment

220595

Image: *Ee Lah Roo — Long time ago* by Kargun Fogarty

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Presenter

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Learning goals

Learn how to use the QCAA Aerospace Systems subject report to inform teaching and assessment practice.

Success criteria

You will know you are successful if you can reflect purposefully on the information provided in the subject report to determine how you can improve your school's internal assessment in Aerospace Systems.

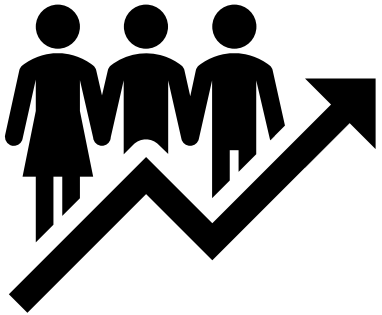
Finding subject reports

The purpose of the subject report

2021 summative assessment cycle key outcomes:

- Quality assurance: Endorsement and Confirmation
- External assessment results

- Effective practices and practices to strengthen
  - Internal assessment
    - Assessment design (validity, accessibility)
    - Assessment decisions (reliability)
  - External assessment
    - Teaching and learning



Structure of the webinar

CELEBRATE

UNPACK

REFLECT

STRENGTHEN

QUESTIONS

Subject data summary: Distribution of standards

Year	2020	2021
Students	157	140
A	18 (11.4%)	21 (15%)
B	52 (33.1%)	43 (30.7%)
C	75 (47.7%)	67 (47.8%)
D	10 (6.3%)	9 (6.4%)

Internal assessment

Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA2	IA3
Total number of instruments	13	13	12
Percentage endorsed in Application 1	38%	38%	92%

Number of samples reviewed and percentage agreement

IA	Number of schools	Number of samples requested	Number of additional samples requested	Percentage agreement with provisional marks
1	13	64	25	76.92%
2	13	64	0	92.31%
3	13	64	16	84.62%

IA1: Project — folio (25%)

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Retrieving and comprehending	84.62%	15.38%	0%	0%
2	Analysing	84.62%	15.38%	0%	0%
3	Synthesising and evaluating	76.92%	23.08%	0%	0%
4	Communicating	84.62%	15.38%	0%	0%

IA1: Project — folio (25%)

The match of evidence revealed some effective practices and practices that need strengthening.

Effective practices

- gave opportunity to demonstrate understanding of the subject matter for the unit and topics covered
- provided a context relating to the subject matter
- contained authentication strategies

Practices to strengthen

- address topics as required by the syllabus
- address all assessment specifications
- allow opportunities for unique responses
- have appropriate scale

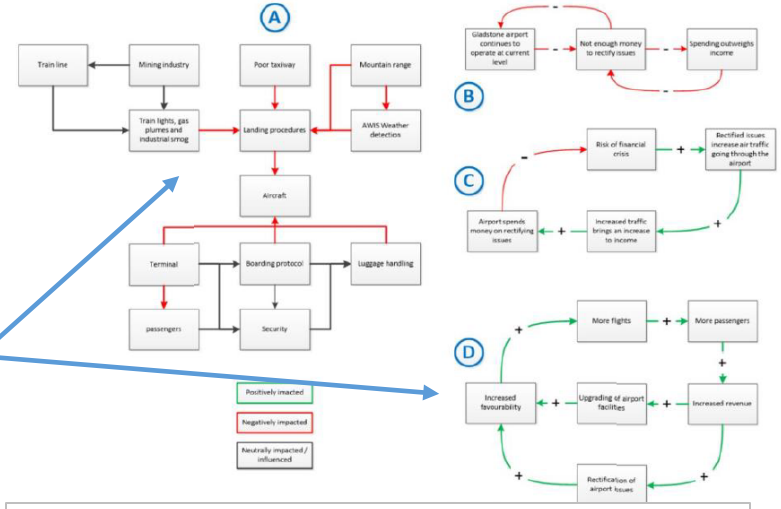
IA1: Project — folio (25%)

Sample response

Retrieving and comprehending (4–5 marks)

- accurate and discriminating recognition and discerning description of the operational systems problem, aerospace technology knowledge, concepts and principles, and systems thinking habits and systems thinking strategies in relation to aerospace management, safety, airline and/or airport operations
- adept symbolisation and discerning explanation of ideas, a solution and relationships in relation to aerospace management, safety, airline and/or airport operations with visual frameworks, causal and feedback loops, flow charts, diagrams, sketches and/or pictures

Excerpt 1



Excerpt 2

IA1: Project — folio (25%)

Analysing (4–5 marks)

- considered analysis of the operational systems problem, and relevant aerospace systems, technology, and research information in relation to aerospace management, safety, airline and/or airport operations to identify the relevant elements, components and features, and their relationship to the structure of the problem
- logical determination of effective solution success criteria for the operational systems problem

Excerpt 1

Pier/Finger Configuration

Advantages:

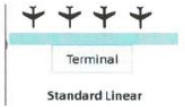
- Central amenities/facilities in terminal
- Facilitates passenger management
- Economical to build
- Efficient use of land

Disadvantages:

- Longer walking distances
- Kerb side congestion
- Limited capacity for expansion
- Reduced aircraft circulation and Manoeuvrability of aircraft
- Lesser compatibility with future aircraft designs

Pier

Figure 12: A pier terminal configuration (Educatererindia,2020)



Standard Linear

Figure 13: A standard linear terminal configuration (Educatererindia, 2020)

Linear Terminal Configuration

Advantages:

- Short walking distances
- Easy navigation
- Simple construction
- Adequate kerb length
- Shorter close-out times
- Lower baggage systems costs
- (conveying/sorting) using decentralised system

Disadvantages:

- Must provide multiple locations for terminal facilities/amenities
- Longer distances for passengers between gates (e.g. transfer pax) and more time for connecting flights
- Special logistics for handling of transfer bags
- Less flexibility in terminal and apron for future changes in operations e.g. aircraft design, airlines

7

IA1: Project — folio (25%)

Synthesising and evaluating (8–9 marks)

- coherent and logical synthesis of relevant aerospace systems, technology and research information, and ideas to propose a possible aerospace management, safety, airline and/or airport operations solution
- purposeful generation of an aerospace management, safety, airline and/or airport operations solution to provide valid data to critically assess the feasibility of a proposal
- critical evaluation and discerning refinement of ideas and a solution using success criteria to make astute recommendations justified by data and research evidence

Excerpt 2

Areas of Weakness

It can be said that the proposed removal of the Port Curtis Cemetery could pose a significant ethical issue. Additionally, the repurposing of Clinton Club Park could gain community backlash. The implementation of an additional runway will allow the local businesses an increase in revenue – although will bring significantly more noise risk to the area as the airport historically did not operate during night-time to keep the noise to a minimum for nearby residents. However, as the current position of the airstrip and railway are already in close proximity to the suburban area, it can be argued that the increase will be gradual, and the size of the aircraft will generally stay the same but be more frequent for the most part of the day.

Evaluation

The proposed solution has a very strong fundamental design. It incorporates a variety of important factors, such as terminal configuration, airside operations, terminal revenue, air traffic movements, taxiway and apron designs, runway materials and the carpark capacity.

The solution has been evaluated against the success criteria. It complies with the majority of airport design standards set by ICAO and CASA and should be able to cope with the estimated tripling of air traffic by 2051. Efficient passenger movements both within the aerodrome (landside and airside interactions) and the wider community will be maximised by the refinement of car parking and apron design. Throughout the report, the elements of airport design have been investigated in order to support the proposed development to cater for the increase in demand, whilst considering the underlying safety of airport personnel and property.

Reflection

Reflection questions

- Think about how your students are implementing the problem-solving process. Is their work truly iterative?
- Has the information revealed any specific areas where you could modify your practices?

IA2: Examination (25%)

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Aerospace systems knowledge and problem-solving	92.31%	0%	0%	7.69%

IA2: Examination (25%)

Assessment decisions: Accuracy and consistency

The match of evidence revealed some effective practices and practices that need strengthening.

Effective practices

- the balance of multiple-choice, single-word, sentence, short-paragraph and calculation responses
- clear instructions regarding the scope of information and connection to Unit 3 subject matter

Practices to strengthen

- appropriately constructed CF and CUF items that align with the syllabus construct
- items avoiding unnecessary repetition of cognitions
- items with appropriate scale
- marking schemes are accurate and clearly structured

IA2: Examination (25%)

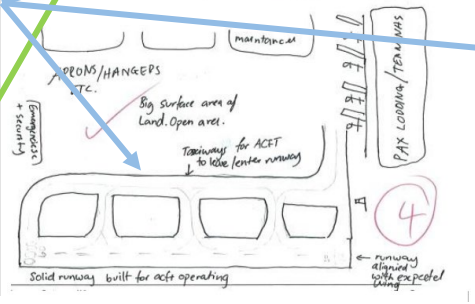
Sample response

Aerospace systems knowledge and problem-solving (4 marks)

- accurate and discriminating recognition and discerning description of aerospace operational systems problems, knowledge, concepts and principles, and systems thinking habits and systems thinking strategies
- adept symbolisation and discerning explanation of ideas, solutions and relationships
- insightful and accurate analysis of problems and information
- coherent and logical synthesis of information and ideas to propose possible solutions
- critical evaluation and discerning refinement of ideas and solutions to make astutely justified recommendations

Excerpt 1

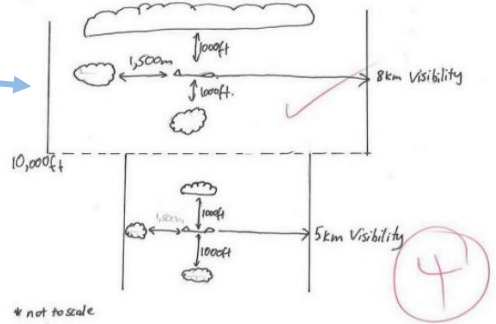
1. Location. The location of an airport is very important, they are best built on flat land in open areas for maximising space.
2. Runways & Taxiways. The runways must be built appropriately to withstand the type of aircraft using it. Built according to winds in the areas. Taxiways must effectively get aircraft off runways to terminals or aprons.
3. Terminal layout/pax handling. There must be a designated spot for passengers to board the aircraft, as well as luggage handling, ect.



Excerpt 2

VFR stands for Visual Flight Rules. VFR pilots fly visually, and navigate with reference to ground or water. In order to fly VFR, VMC must be maintained. IFR stands for instrument flight rules, they are to fly in conditions worse than VMC, namely, IMC. A pilot may elect to fly IFR in VMC, due to preference or benefits of ATC seperation.

Requirements for Class C airspace:



IA2: Examination (25%)

Sample response

Aerospace systems knowledge and problem-solving (4 marks)

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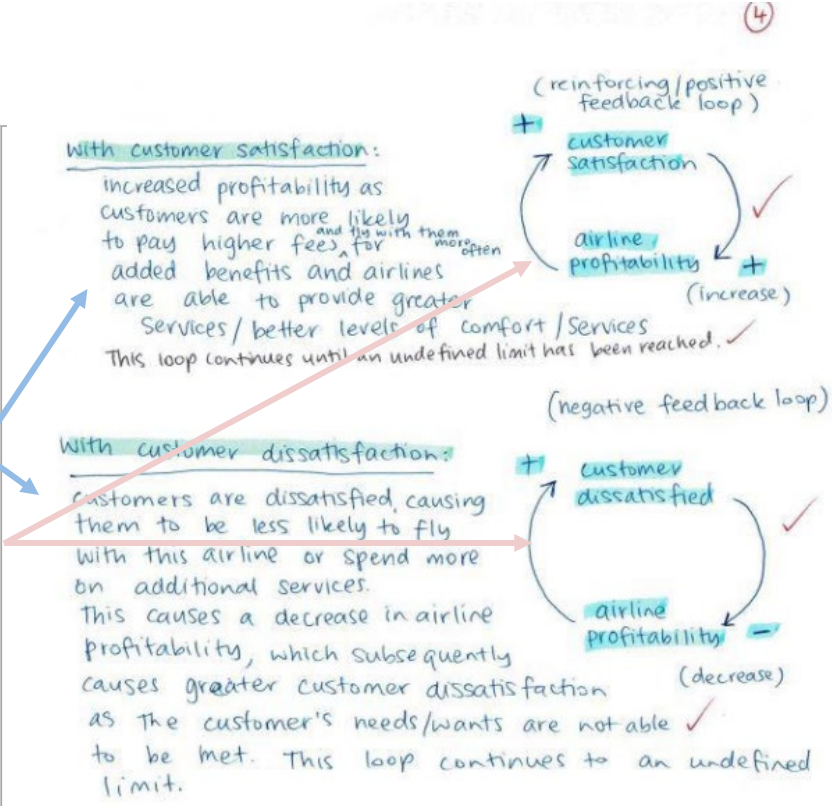

IA2: Examination (25%)

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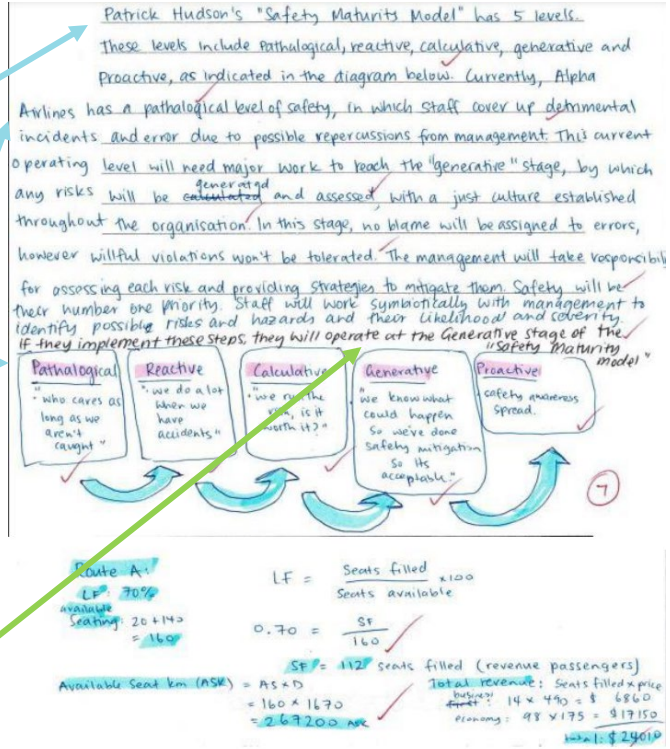

IA2: Examination (25%)

Excerpt 1

• in a range of simple familiar situations and in complex familiar situations – appropriate recognition and description of aerospace operational systems problems, knowledge, concepts and principles, and systems thinking habits and systems thinking strategies; competent symbolisation and appropriate explanation of ideas and solutions; appropriate analysis of problems and information; simple synthesis of information and ideas to propose possible solutions; feasible evaluation and adequate refinement of ideas and solutions to make fundamental recommendations.	> 68% 66% > 64%	17 16

66% $\frac{33}{50} = \frac{16.5}{25}$

Aerospace Systems
General Senior Syllabus

Queensland Curriculum & Assessment Authority
ISMG v1.1 May 2018

Clearly annotated with correct application of the percentage cut-off.

Excerpt 2

Marking summary

Criterion	Marks allocated	Provisional marks
Aerospace systems knowledge and problem-solving	25	16
Overall	**25**	

A: Hardware failures ✗
B: Unsafe supervision ✓
C: Preconceptions ✗
D: Unsafe Acts. ✓

2

Clearly annotated with ticks, crosses and numeric mark.

Reflection

Reflection questions

- Think about how your students are implementing the problem-solving process. Is their work truly iterative?
- Has the information revealed any specific areas of improvement in your own practice?

IA3: Project — folio (25%)

Agreement trends between provisional and confirmed marks

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1	Retrieving and comprehending	92.31%	0%	0%	7.69%
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3	Synthesising and evaluating	92.31%	7.69%	0%	0%
4	Communicating	92.31%	7.69%	0%	0%

IA3: Project — folio (25%)

Assessment decisions: Accuracy and consistency

The match of evidence revealed some effective practices and practices that need strengthening.

Effective practices

- gave opportunity to demonstrate understanding of the subject matter for the unit and topics covered
- provided a context relating to the subject matter
- contained authentication strategies

Practices to strengthen

- address topics as required by the syllabus
- address all assessment specifications
- opportunities for unique responses
- appropriate scale

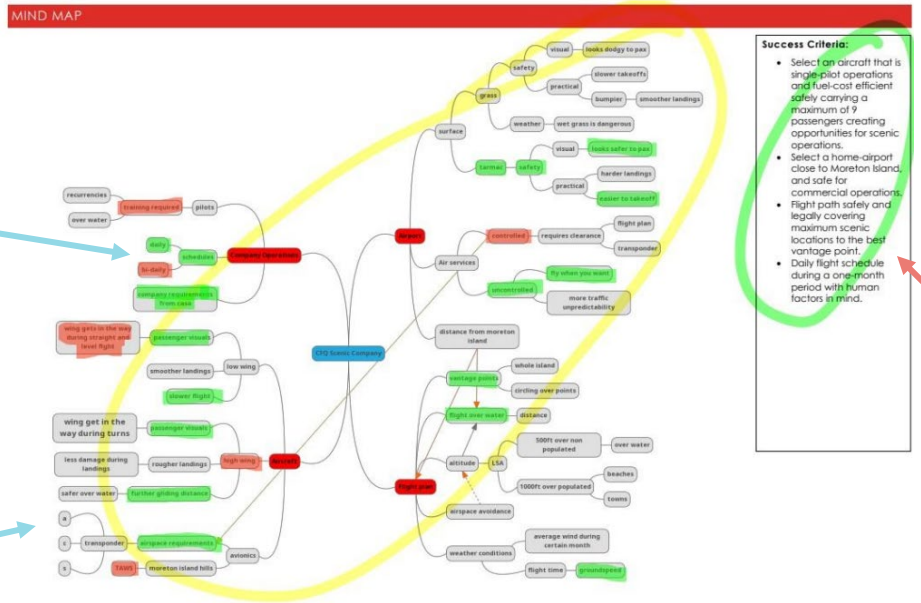
IA3: Project — folio (25%)

Sample response

Retrieving and comprehending (4–5 marks)

- accurate and discriminating recognition and discerning description of the aircraft performance systems and/or human factors problem, aerospace technology knowledge, concepts and principles, and systems thinking habits and systems thinking strategies in relation to aircraft performance systems and/or human factors
- adept symbolisation and discerning explanation of ideas, a solution and relationships in relation to aircraft performance systems and/or human factors with visual frameworks, causal and feedback loops, flow charts, diagrams, sketches and/or pictures

Excerpt 1



Analysing 4 – 5 marks)

- considered analysis of the aircraft performance systems and/or human factors problem and relevant aerospace systems, technology, and research information in relation to aircraft performance systems and/or human factors to identify the relevant elements, components and features, and their relationship to the structure of the problem
- logical determination of effective solution success criteria for the aircraft performance systems and/or human factors problem.

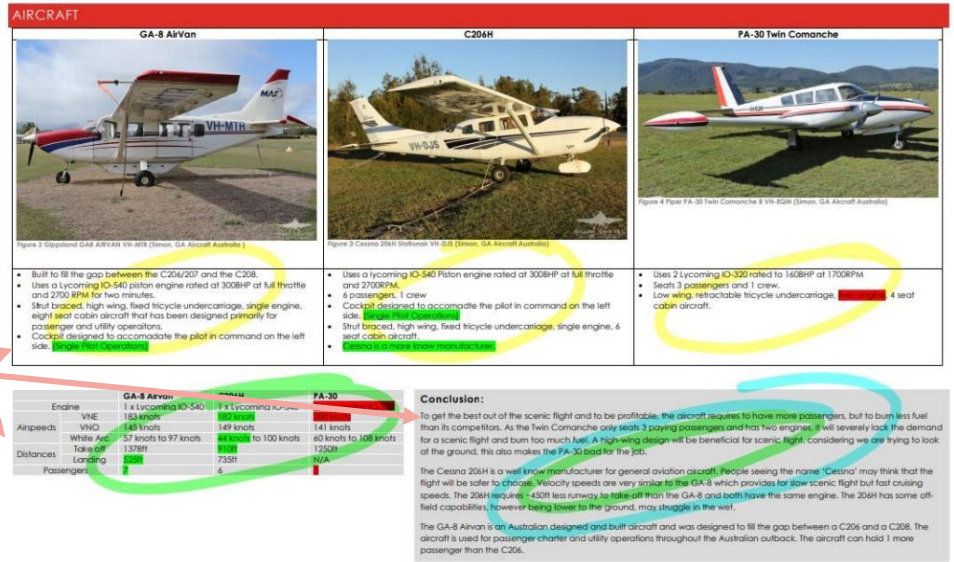
IA3: Project — folio (25%)

Sample response

Analysing 4 – 5 marks)

- considered analysis of the aircraft performance systems and/or human factors problem and relevant aerospace systems, technology, and research information in relation to aircraft performance systems and/or human factors to identify the relevant elements, components and features, and their relationship to the structure of the problem
- logical determination of effective solution success criteria for the aircraft performance systems and/or human factors problem.

Excerpt 2



AIRCRAFT

GA-8 AirVan	C206H	PA-30 Twin Comanche
• Built to fill the gap between the C206/207 and the C208. • Uses a Lycoming IO-540 piston engine rated at 300BHP at full throttle and 2700 RPM for two minutes. • Strut braced, high wing, fixed tricycle undercarriage, single engine, eight seat cabin aircraft that has been designed primarily for passenger and utility operations. • Cockpit designed to accomodate the pilot in command on the left side. Single Pilot Operations	• Uses a lycoming IO-540 Piston engine rated at 300BHP at full throttle and 2700RPM. • 6 passengers, 1 crew • Cockpit designed to accomodate the pilot in command on the left side. Single Pilot Operations • Strut braced, high wing, fixed tricycle undercarriage, single engine, 6 seat cabin aircraft. • Cessna is a more know manufacturer.	• Uses 2 Lycoming IO-320 rated to 160BHP at 1700RPM • Seats 3 passengers and 1 crew. • Low wing, retractable tricycle undercarriage, [illegible] 4 seat cabin aircraft.

		GA-8 AirVan	[illegible]	PA-30
Engine		1 x Lycoming IO-540	1 x Lycoming [illegible]	[illegible]
Airspeeds	VNE	183 knots	182 knots	[illegible]
	VNO	145 knots	149 knots	141 knots
	White Arc	57 knots to 97 knots	54 knots to 100 knots	60 knots to 108 knots
Distances	Take off	1378ft	910ft	1250ft
	Landing	525ft	735ft	N/A
Passengers		7	6	5

Conclusion:

To get the best out of the scenic flight and to be profitable, the aircraft requires to have more passengers, but to burn less fuel than its competitors. As the Twin Comanche only seats 3 paying passengers and has two engines, it will severely lack the demand for a scenic flight and burn too much fuel. A high-wing design will be beneficial for scenic flight, considering we are trying to look at the ground, this also makes the PA-30 bad for the job.

The Cessna 206H is a well know manufacturer for general aviation aircraft. People seeing the name 'Cessna' may think that the flight will be safer to choose. Velocity speeds are very similar to the GA-8 which provides for slow scenic flight but fast cruising speeds. The 206H requires ~450ft less runway to take off than the GA-8 and both have the same engine. The 206H has some off-field capabilities, however being lower to the ground, may struggle in the wet.

The GA-8 Airvan is an Australian designed and built aircraft and was designed to fill the gap between a C206 and a C208. The aircraft is used for passenger charter and utility operations throughout the Australian outback. The aircraft can hold 1 more passenger than the C206.

Aircraft images by Simon Coates http://gaaircraftaus.blogspot.com/ Used with permission.

IA3: Project — folio (25%)

Sample response

Flight planning Summary Table:

Airports	Leg Distance (NM)	Altitude (FT)	Track (T)	Track(M)	HDG	TAS (Kts)	ETI	EET	GPWT INFO	GAF INFO
Redcliffe (YRED)	-	-	-						120/15/21	SCT ST BKN CU/SC 3000-8000FT
Archerfield (YBAF)	23	1000	187	176	169	92	0.3	0.3	120/15/21	SCT ST BKN CU/SC 3000-8000FT
Stanthorpe (YSPE)	86	6500	219	208	210	103	0.8	1.1	340/5/11	>10km, BKN SC 2000-6000
Inverell (YIVL)	88	6500	210	199	201	99	0.9	2.0	260/2/10	>10km, BKN SC 2000-6000
Dubbo (YSDU)	195	4500	223	212	211	90	2.2	4.2	200/11/15	>10Km Nil Weather
Narrandera (YNAR)	185	4500	215	204	207	89	2.1	6.3	230/13/13	>10Km Nil Weather
Shepparton (YSHT)	118	2500	208	197	200	83	1.4	7.7	180/18/16	>10km, SCT CU/SC 4500/600ft FEW FM 09Z
Avalon (YMAV)	107	2500	204	193	195	85	1.3	9	180/16/09	>10Km, BKN CU/SC [illegible]0/6000FT [illegible] 3000

6a. Synthesise and evaluate: coherent and logical synthesis of relevant aerospace systems, technology and research information and ideas to propose a possible aircraft performance systems and/or human factors solution

Figure 17: Flight planning Table

Initial calculations showed it would take 8 hours to complete flight. However once wind was factored in it would find it would take 9 hours due to headwinds on the way down. It was found that the G2 would only benefit from a tailwind through one leg of the flight from Archerfield to the Stanthorpe waypoint. The weather is forecast to remain consistent with only slight variations in conditions. Slight cloud cover of scattered and broken is seen through the initial stages of the flight however at this point the aircraft will be flying well below the cloud, as the weather improves the G2 will then commence a climb up to 6500ft in order to comply with the VFR Legislation, (AIP ENR 1.7: Flying at cruising levels. when above 5000ft or if practicable below 5000 (CAR173). Heading (0-179 degrees)- Odd thousands of feet plus 500 feet, heading (180-359)- even thousands plus 500 feet.) as the terrain altitude increases over the Great Dividing Range. Once clear of the range the weather improves for majority of the way with only flight increases in headwind. Therefore, no alternate airports or fuel is required only a fixed reserve, however as previously mentioned the route will track overhead multiple airports along the way should and emergency occur.

6a. Synt

Cost Summary:

Cost:	Amount:
2x G2 Hourly rate $500/hour (Inc fuel)	$18000
Accommodation (2x nights)	$300
Transport	$100
Food	$300
Total:	**$18700**

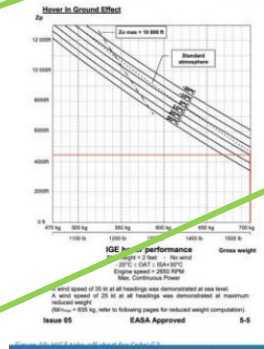
Seen to the left is a cost summary table which includes the total cost of the return trip from Redcliffe to Avalon including the overnight stop in Dubbo. Note the hourly rate for the G2 is a wet rate and includes fuel. The total cost for the return trip was approximately 18 700.00 which seems like a large amount of money however in the aviation industry and the larger outlook of things, this cost is minimised, for example if a student were to come and train at Redcliffe in a G2 they would be looking in the vicinity of $80 000 therefore, just the prospect of one

5a. Synth/eval: coherent and logical synthesis of relevant aerospace systems, technology and research information, and ideas

student following through with training would well and truly cover the cost of the course. Another consideration of why they money is well spent as an investment is to grow the reputation of training with Aeropower and Redcliffe Airports Operators, provides the foundations of relationships that could help other operators at YRED as well as other ariel work conducted by Aeropower Helicopters.

Aircraft Performance:

The Cabri G2 has a Basic empty weight of 430kg, therefore two pilots at 77kg as well as 12kg of luggage can take 144 litres of fuel onboard before reaching the MTOW. At the MTOW the aircraft is able to still hover at IGE at 4450ft, the highest elevation required to take-off from is Stanthorpe airport which has an elevation of 2934ft therefore as seen on the chart below the aircraft will have no problem flying through this higher altitude section of the flight especially considering the temperature of the day being below the ISA temperature, further increasing the aircraft performance.



Weight and Balance:

Station	Weight (KG)	Arm (mm)	Moment (/100)
A/C EW	430	2208	9494.4
Row 1	154	1300	2002
Baggage	12	1854	37.08
ZFW	596		11533.5
Fuel	104	1886	1960.4
Total	700	1927	13493.9

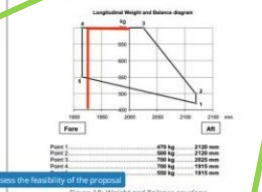


Figure 18: Weight and Balance envelope

c. purposeful generation of a solution to provide valid data to critically assess the feasibility of the proposal

In order to be able to achieve this take off performance the overwater floats and tank were removed to save 20kg and increase the fuel range. This decision was justified as the trip posed no long over water crossings therefore the floats weren't a necessity for concern.

It can be seen above that the aircraft loaded with both pilots as well as their baggage and full fuel reaming within the COG tolerances of the aircraft. With the Arm boundary being 1915mm the found arm was 1927mm placing it within the box along the 700kg line. It's important to note the empty weight used was not a basic empty weight therefore included the 5.7l of oil required onboard the aircraft. An average pilot mass of 77kg was used as its accepted as the industry standard for weight and balance sample calculations.

Synthesising and evaluating (8–9 marks)

- coherent and logical synthesis of relevant aerospace systems, technology, and research information and ideas to propose a possible aircraft performance systems and/or human factors solution
- purposeful generation of an aircraft performance systems and/or human factors solution to provide valid data to critically assess the feasibility of a proposal
- critical evaluation and discerning refinement of ideas and a solution using success criteria to make astute recommendations justified by data and research evidence

IA3: Project — folio (25%)

Synthesising and evaluating (8–9 marks)

- coherent and logical synthesis of relevant aerospace systems, technology, and research information and ideas to propose a possible aircraft performance systems and/or human factors solution
- purposeful generation of an aircraft performance systems and/or human factors solution to provide valid data to critically assess the feasibility of a proposal
- critical evaluation and discerning refinement of ideas and a solution using success criteria to make astute recommendations justified by data and research evidence

Excerpt 3

Evaluation and Refinement

Success Criteria Met

Solution Success Criteria	Was it met, partially met or not met?
• The solution can be considered a success if the flight plan successfully routes the aircraft on the most efficient route possible only stopping where necessary, optimising fuel burn and stops.	This criterion was met as the selected aircraft was able to fly an efficient route to Avalon from Redcliffe, the route was chosen to closely follow the straight-line distance, whilst avoiding terrain and overflying airports in case of an emergency and for the three fuel stops along the way. Consequently, the fuel burn was optimised by carrying slightly less fuel on the higher altitude legs to increase cruise speed and climb performance.
• The solution can be considered a success if it can adequately transport the group of pilots from Redcliffe to Avalon including their baggage and belongings within the weight and balance limitations of the chosen aircraft.	This criterion was met as the two Cabri G2 helicopters were able to factor in the pilots load as well as their baggage and fuel and still fall within the centre of gravity limitations envelope of the aircraft. It was found in the weight and balance that the aircraft fell comfortable into the envelope and spared the room for some of the fuel to burn off however it is acknowledged that this approximation would result in a decrease of weight likely minimizing the effect on the centre of gravity.
• The solution could be considered a success if the chosen aircraft from Redcliffe is able to demonstrate its flight training capability and performance to the visitors at Avalon Air Show.	This criterion was met as the aircraft is able to fly from Redcliffe to Avalon, and back demonstrating is cross country flight abilities to those who see it on display, furthermore the show covers are able to see the aircraft and all of its technological systems and safety features. Should the opportunity arise for the aircraft to conduct an ariel display it could effortlessly leverage its performance abilities by flying a few simple manoeuvres.
• The solution can be considered a success if it effectively analysis and acknowledges the human factors phenomena relevant to a flight of this nature.	This criterion was partially met as the solution acknowledged the rest intervals required so pilots don't get fatigued, however suggestions into the foods the pilots should eat to help stabilise their gastrointestinal system and reduce the likelihood of illness in the air. Factors such as hypoxia were considered however it was acknowledged that the given altitudes would not make then suspectable to this phenomenon. The final suggestion to be made would be for the pilots to wear sunglasses to reduce any induced fatigue as a result of flicker vertigo, a phenomenon caused by bright sunlight filtering through the blades.
• The solution could be considered a success if the operation and all its included and additional costs are within reason and viable to the company operating the aircraft.	This criterion was met as the final cost of the flight exercise from Redcliffe (YRED) to Avalon (YMAV) would cost approximately $18 700. This cost included the wet hire time of the aircraft for the 18 hours of total flying time as well as accommodation and food for the pilots each way. It was justified through the perspective that the cost would be easily covered by the prospect of just once student coming to fly with Aeropower for their pilot's license, it also provided valuable training time for the pilots helping them gain cross country experience.

Reflection

Reflection questions:

- Think about how your students are implementing the problem-solving process. Is their work truly iterative?
- Has the information revealed any specific areas of improvement in your own practice?

Any questions – please phone or email the PEO.

Contact details

Alan Kemp

PEO, Technologies Learning Area Unit

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