Design Project Part 2: Aircraft Configuration

Due date: Mon 22 Sep, 11:45 PM, submitted online at *myRMIT*.

Individual assignment: One per student.

Late submissions NOT allowed.

Submission must be a single file in .pdf format and a spreadsheet preferably in Excel format

Multiple submission attempts allowed, but only last submission graded.

Ensure you review your file after submission and avoid leaving submission until the last minute.

The assignment requires the determination of a sized design layout of an aircraft concept to meet a given mission specification.

The mission specifications are provided on the following pages. The mission specifications vary according to a classification or "variant code", where the letters A-B refer to the overall aircraft type and the variant numbers refer to variations in parameters in each mission. The allocation of a variant code for each student is provided in a separate file online.

The aircraft is to be designed using current technology, for immediate development and entry into service. If the requirements are such that a feasible design solution cannot be achieved, then this should be demonstrated, and a solution proposed that meets relaxed requirements. Any requirements assumed as part of the design process should be clearly stated and justified.

Present a brief summary of the method you have applied, in terms of equations, assumptions procedure and results, so that the overall method and results can be clearly understood. Justify the suitability of the assumptions and the method you have applied. Your discussion should seek to support the design decisions for the critical parameters. This could include the use of references, comparator aircraft, trade studies, sensitivity analyses, analytical equations, or practical reasoning. The discussion should make it clear how an optimum solution was reached.

You are required to conduct all calculations in a single spreadsheet file (or equivalent computer code), and to submit this spreadsheet in addition to your report. The spreadsheet should be saved so that the values correspond to the final design values provided in the report. The spreadsheet is to provide further evidence for the calculations, optimisation and results in the report. Marks are not awarded for the formatting of the spreadsheet, though the clarity of the spreadsheet will assist with ensuring all calculations and optimisation are evidenced.

A "threeview" drawing of your design should be presented. It is recommended to use a CAD package to develop your threeview, though to-scale hand sketches are acceptable. Additional drawings or tables with further detail to summarise the design can be presented. The methods, design decisions and optimisation required to generate the threeview should also be presented.

The report format and mark breakdown is provided below.

0 Mission Specification

On the top of the first page provide your student number and variant code.

Provide the mission specification for your aircraft design.

1 Configuration Design — 90%

Weight estimation	5
Matching chart	5
Fuselage	10
Propulsion system	5
Wing (including wing control surfaces and high lift devices)	15
Tail (including tail control surfaces)	5
Weight and balance	10
Stability and control	5
Landing gear	5
Drag polars	5
Threeview	20

2 Report — 10%

The assignment is to be professionally presented and should include: clear and efficient descriptions, clearly presented and labelled tables and diagrams, correct referencing, correct units, page numbering, consistency in formatting, lack of typos and grammatical errors, etc.

The report should be no more than 30 pages, and should use no smaller than 12 point font and 1 cm page margins at all locations. The reference list can be in 10 point font and is not included in the 30 page limit.

The threeview and other detailed drawings can be presented in an Appendix, which is not included in the 30 page limit. However, any discussion related to the generation of the threeview must be in the main body of the report.

A grading rubric for each section is outlined below.

1 Configuration Design

any pass level	The method applied and the results attained are summarised adequately and succinctly. The design decisions are supported with reference to an appropriate source (e.g. reference, comparator aircraft, calculation or sensitivity study, analytical equation, practical reasoning, etc.)
HD	The method is free from errors and produces results to the expected accuracy. The design is developed to an exceptional level of technical detail with evidence of comprehensive optimisation. Discussion demonstrates exceptionally clear understanding of subject matter, and evidence of creative insight, originality, synthesis and evaluation.
DI	The method has minor errors though produces results of expected accuracy. The design is developed to a high level of technical detail with some evidence of optimisation. Discussion demonstrates strong grasp of subject matter, and evidence of creative insight and synthesis, though some finer points lacking.
CR	At least one error in the method significantly affects the accuracy of the results. The design is developed to a high level of technical detail. Discussion demonstrates competent grasp of subject matter, and evidence of solid comprehension and application, though some gaps.
PA	Several errors in the method significantly affect the accuracy of the results. The design is developed to an adequate level of technical detail. Discussion demonstrates competent grasp of subject matter, and evidence of solid comprehension and application, though some gaps.
NN	The method is not reported to an adequate level for it to be independently verified and repeated. No or poor justification for the design decisions is presented. The design is not developed to an adequate level of technical detail

2 Report 10%

HD The report is at a standard suitable for professional engineering practice. This includes clear and efficient descriptions, clearly presented and labelled tables and diagrams, correct referencing, correct units, page numbering, consistency in formatting, lack of typos and grammatical errors, etc. The report is in the specified format.

DI The report requires minor corrections to bring it to a standard suitable for professional engineering practice, though the understanding of the technical content is not affected. The report is in the specified format.

CR The report requires minor corrections to bring it to a standard suitable for professional engineering practice, and the understanding of the technical content is affected in at least one area. The report is in the specified format.

PA The report requires significant corrections to bring it to a standard suitable for professional engineering practice, and the understanding of the technical content is affected in several areas. The report is in the specified format.

NN The presentation of the report is such that it is unacceptably poor in comparison with the standard for professional engineering practice, or it prevents understanding of the content in an overall sense. The report is not in the specified format.

Mission Specification A

A business jet for corporate and private use has the following requirements:

Payload:	at least *PAX* passengers, 1 pilot
Mission:	at least *R* nm with at least 1 hour loiter
	reserves for flight to an alternate airport, 100 nm away, then a 45 min loiter
Altitude:	at least 40,000 ft for design mission
Cruise speed:	at least V_{cr} kts
Takeoff:	FAR 25 fieldlength at most 5000 ft, at 5000 ft altitude and standard day
Landing:	FAR 25 fieldlength at most 3000 ft, at 5000 ft, standard day, $W_L \geq 0.85\ W_{TO}$
Climb:	climb to 40,000 ft in at least 20 min
Service ceiling:	at least 51,000 ft

Variant	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
PAX	5	5	5	5	7	7	7	7	9	9
R	1500	2000	1500	2000	1500	1500	2250	3000	1500	1500
V_{cr}	350	350	450	450	450	525	450	450	450	525

Variant	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
PAX	9	9	14	14	14	14	19	19	19	19
R	2250	3000	4000	4000	5000	6000	4000	4000	5000	6000
V_{cr}	450	450	475	525	475	475	475	525	475	475

Mission Specification B

A single engine aircraft for private use and sightseeing has the following requirements:

Payload:	1 pilot and at least *PAX* passengers
Mission:	2 consecutive sets of cruise at least *R* nm and loiter at least *E* min, then return trip at least 2*R* nm
Altitude:	at least 10,000 ft for design mission
Cruise speed:	at least 100 kts
Takeoff:	ground roll at most *S* ft, at sea level and 120°F
Landing:	ground roll at most *S*/2 ft, at sea level and 120°F
Climb:	climb to 10,000 ft in at least 15 min
Service ceiling:	at least 14,000 ft
Stall speed:	at most 49 kts

Variant	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
PAX	1	1	1	1	1	1	1	1	1	1
R	75	75	100	100	125	75	75	100	100	125
E	30	45	20	30	15	30	45	20	30	15
S	750	750	750	750	750	900	900	900	900	900

Variant	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
PAX	3	3	3	3	3	3	3	3	3	3
R	200	200	225	225	250	200	200	225	225	250
E	30	45	20	30	15	30	45	20	30	15
S	1000	1000	1000	1000	1000	1200	1200	1200	1200	1200