



Australian Government

AVIH0003 Manage aircraft performance and load

Release: 1

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Modification History

Release 1. This is the first release of this unit of competency in the AVI Aviation Training Package.

Application

This unit involves the skills and knowledge required to manage aircraft performance and load, in compliance with relevant regulatory requirements of the Civil Aviation Safety Authority (CASA) and national operating standards.

It includes applying mass and balance control to flight planning, identifying constraints affecting load planning, and planning an aircraft load. It also includes applying principles of aircraft balance and longitudinal stability to load planning, identifying aircraft structural limitations, and identifying aircraft mass and performance planning safety factors. It also includes determining aircraft mass and speed limitations, calculating take-off runway requirements, calculating climb performance, calculating landing runway requirements, and determining aircraft buffet boundaries and speeds.

This unit addresses aviation technical skill requirements (physical, mental and task-management abilities) related to route planning and navigation duties of flight dispatch personnel, and contributes to safe and effective performance in complex aviation operational environments.

Operations are conducted as part of commercial or military aircraft activities across a variety of operational contexts within the Australian aviation industry.

Work is performed independently or under limited supervision as a single operator or within a team environment.

Licensing, legislative, regulatory or certification requirements are applicable to this unit.

Use for Defence Aviation is to be in accordance with relevant Defence Orders, Instructions, Publications and Regulations.

Pre-requisite Unit

Not applicable.

Competency Field

H – Route Planning and Navigation

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Apply mass and balance control to flight planning

PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

- 1.1 Components of mass, balance and control are considered and applied in flight planning activities
- 1.2 Mass and control limitations are included in flight planning calculations
- 1.3 Required fuel and payload quantities, including minimum fuel reserves, maximum allowable payloads and fuel quantity limitations are considered when calculating mass and balance
- 1.4 Calculated aircraft mass centre of gravity is within aircraft limits and is established for take-off, cruise and fuel economy calculation purposes
- 1.5 Ground handling of baggage and cargo is minimised through load distribution and loading sequence planning
- 1.6 Mass and centre of gravity is derived and calculated using basic data methods and is applied to flight planning calculations
- 1.7 Comprehensive loadsheet is compiled that includes all required flight performance and load planning data

2 Identify constraints affecting load planning

- 2.1 Implications of advanced sales on payload, mass and control limitations are considered
- 2.2 Aircraft, route, fuel required and performance limitation planning factors are assessed for potential constraints to load planning activities
- 2.3 Hazards are identified, risks are assessed and hazard management is implemented
- 2.4 Operator advance index tables and potential impact of mass and fuel minima during seasonal change are identified and considered

- 2.5 Unusual conditions when advanced allotment tables may be exceeded, the operational impacts, and associated contingency planning factors are considered
 - 2.6 Load planning constraints and limitations are prioritised based on operational and regulatory requirements
- 3 Plan an aircraft load**
 - 3.1 Aircraft design and mass, taxi, take-off, landing and zero-fuel weights (ZFW) are reviewed and applied to load planning activities
 - 3.2 Operational load planning factors affecting a restriction on mass, operational (phase of flight), environmental, equipment, airspace and airport/aerodrome are considered and applied as required to aircraft load planning
 - 3.3 Aircraft operating mass and passengers mass limits are summarised within load planning documentation
 - 3.4 Mass of minimum fuel based on ZFW, quantity, fuel type and specific gravity (including fuel quantity conversions) are reviewed and applied to load planning calculations
 - 3.5 Available payload based on specific conditions affecting a flight including maximum take-off weight (MTOW), regulated take-off weight (RTOW), minimum fuel and taxi fuel requirements are determined
 - 3.6 Manual loadsheet including payload location and last minute changes is prepared
 - 3.7 Loadsheets including payload location and last minute changes is interpreted and automated
- 4 Apply principles of aircraft balance and longitudinal stability to load planning**
 - 4.1 Load planning factors including balance, centre of gravity (variations), balance on the ground, principles of lift and centre of pressure, mean aerodynamic chord (MAC) and functions of stabilisers are identified and considered when calculating aircraft performance and load
 - 4.2 Aircraft point of balance is calculated using aircraft data and aircraft balance principles, and is applied to load planning calculations
- 5 Identify aircraft structural limitations**
 - 5.1 Satisfactory aircraft balance calculations are achieved ensuring aircraft is safely loaded, floor strengths have not been exceeded and load/cargo is capable of being satisfactorily restrained

- 5.2 Fuselage structural limits over, forward and aft of the wing, and mass limitations for associated loading zones are considered and applied to load planning activities
- 5.3 Maximum allowable package sizes are determined using aircraft tables
- 5.4 Methods of restraint and the effect on passengers and crew, damage and centre of gravity (CG), including principles of inertia, and forces applied to load are considered and applied to load planning activities
- 5.5 Advantages and limitations of certified and non-certified cargo pallets and containers, and methods of load security are considered when calculating aircraft load limitations
- 6 Identify aircraft mass and performance planning safety factors**
 - 6.1 Aircraft certification considerations including structural strength, loads, speed limitations, operating environment, performance capability, runway lengths and terrain are considered and applied to aircraft mass and performance calculations
 - 6.2 Aircraft certification standards (including categories, state-based variations, operating mass or CG never exceeding limits), and aircraft flight manual restrictions are considered and applied to aircraft mass and performance calculations
 - 6.3 Environmental considerations (including certified aircraft operating envelope, pressurisation capabilities, system limitations and aircraft flight manual envelope charts) are considered and applied to aircraft performance calculations
- 7 Determine aircraft mass and speed limitations**
 - 7.1 Positive and negative load factor limitations including normal and ultimate (structural), speed limitations and differing express terms of speed are considered and applied to aircraft performance calculations
 - 7.2 Boundaries of aircraft operating envelope for a specific mass are determined using flight strength diagrams, illustrating effect of wind gusts, margins of speed limits, and turbulence penetration considerations
- 8 Calculate take-off runway requirements**
 - 8.1 Turbo-jet aircraft take-off requirements are determined considering clearways and stop-ways, runway requirements and alternatives to balanced field length methods
 - 8.2 Critical engine failure speeds, flap positions and reduced thrust take-off stopping distance at critical engine failure speeds is calculated

9 Calculate climb performance	9.1	Take-off flight path, climb segments including terrain and obstacle avoidance, and the effects of mass, altitude and temperature are determined
	9.2	En route considerations affecting climb performance such as take-off mass, en route alternate selection and terrain are considered and applied to aircraft performance calculations
	9.3	Approach and landing requirement planning factors including terrain and obstacle avoidance, and effects of mass, altitude and temperature are considered and applied to aircraft performance calculations
10 Calculate landing runway requirements	10.1	Runway landing distance requirements are determined, including effect of aircraft configuration, available stopping distance, and effects of marginal conditions
	10.2	Landing distance based on varying environmental conditions, effect of obstacles and braking systems is calculated
11 Determine aircraft buffet boundary and speeds	11.1	Aircraft buffet characteristics, and the effect of variations of a given mass and speed are identified and applied to aircraft performance calculations
	11.2	Permissible buffet for a range of aircraft speeds for combinations of mass and altitude, including safe operating margins is calculated

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Unit Mapping Information

No equivalent unit.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=4725260a-0af3-4daf-912b-ef1c2f3e5816>

Assessment Requirements for AVIH0003 Manage aircraft performance and load

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least one occasion and include:

- adapting to differences in equipment and operating environment in accordance with standard operating procedures
- applying basic principles of mass and performance limitations
- applying fuel, payload and load considerations while respecting regulatory and company approved requirements
- applying knowledge of low and high speed aircraft buffet characteristics and determining speeds at which aircraft buffet is encountered
- applying precautions and required action to minimise, control or eliminate identified hazards
- applying relevant aeronautical knowledge
- calculating aircraft centre of gravity (CG) arithmetically and graphically using practical methods of and within acceptable ranges
- calculating balance mass required given unequal lengths of arm of beam balance and mass of one pan
- calculating CG of fully loaded aircraft with variable passenger and cargo configurations
- calculating moments about aircraft in flight
- calculating point of suspension given unequal mass in the pans of a beam balance and total length of beam
- communicating effectively with others
- completing relevant documentation
- determining maximum permissible take-off and landing mass under variable operating conditions
- determining permissible mass, altitude and temperature limit data using aircraft operating flight manual in varying conditions
- determining take-off and landing runway length and speeds using aircraft operations and flight manual in varying configurations and conditions
- developing an International Air Transport Association (IATA) loadsheets based on mass, balance and control components
- establishing and applying aircraft climb performance limitations
- identifying aircraft mass and performance planning safety factors
- identifying and correctly using equipment required to manage aircraft performance and load
- implementing contingency plans

- implementing work health and safety (WHS)/occupational health and safety (OHS) procedures and relevant regulations
- modifying activities depending on workplace contingencies, situations and environments
- monitoring and anticipating operational problems and hazards and taking appropriate action
- monitoring work activities in terms of planned schedule
- operating electronic communications equipment to required protocol
- preparing and planning manual and automated loadsheets based on all known operational constraints and considerations
- reading, interpreting and following relevant regulations, instructions, procedures, information and signs
- reporting and/or rectifying problems, faults and malfunctions promptly, in accordance with workplace procedures
- selecting and using required personal protective equipment conforming to industry and WHS/OHS standards
- using aircraft flight manual charts and graphs to determine buffet boundaries and safe operating conditions
- using aircraft operating environment envelope chart effectively
- using operator advanced allotment tables to determine typical values for various routes, aircraft and operational needs
- working collaboratively with others
- working systematically with required attention to detail without injury to self or others, or damage to goods or equipment.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- aircraft design mass:
 - maximum taxi mass
 - maximum take-off mass
 - maximum landing mass
 - maximum zero-fuel mass
- aircraft mass, balance and control definitions:
 - basic operating mass (BOW)
 - dry operating mass (DOW)
 - zero-fuel mass (ZFW)
- critical engine failure speed V1 characteristics:
 - mass
 - runway slope
 - runway braking coefficient

- pressure altitude
- temperature
- wind component
- flap position
- definition of aircraft moment
- derivation of aircraft data and calculation techniques related to aircraft performance, and load planning factors and considerations
- express terms of speed:
 - indicated airspeed (IAS)
 - mach number
 - designed dive speed
 - maximum operating speed
 - normal operating speed
- IATA loadsheet information requirements and compilation:
 - flight number
 - aircraft registration
 - dry operating mass and dry operating CG
 - zero fuel mass
 - zero fuel CG
 - take off mass CG (MAC %)
 - landing mass
 - landing mass CG (MAC %)
 - passenger distribution
 - deadload distribution – baggage, cargo, mail
 - details of dangerous goods (NOTOC)
 - details of live and perishable cargo
- IATA numbering scheme for cargo holds
- mass and balance calculations:
 - graphical
 - arithmetical
 - $\text{mass} \times \text{arm} = \text{moment}$
 - $\text{total moments} = \text{arm of CG}$
 - use of automated systems
- maximum payload limitations:
 - volumetric, floor and loading limitations
 - ramp unload, reload limitations
 - CG
 - dangerous goods
 - differences between DOW and MZFW
 - passenger capacity

- meaning and calculation of take-off safety speed (V2)
- operating mass definitions and application to load planning:
 - basic operating mass (BOW)
 - BOW + crew, crew bags, catering, and spares = dry operating mass (DOW)
 - DOW + payload/passenger load = zero-fuel mass (ZFW)
 - DOW + take-off fuel = operating mass (OW)
 - ZFW + payload/passenger load = take-off mass (TOW)
 - TOW + taxi fuel = taxi mass
 - TOW – fuel consumed en route = landing mass (LDW)
 - TOW – take-off fuel = zero-fuel mass (ZFW)
- other terminology relevant to aircraft performance calculations not otherwise defined
- principles of balance control
- principles of mass control
- ramp mass or taxi mass:
 - take-off mass (TOW)
 - landing mass (LDW).

Assessment Conditions

As a minimum, assessors must satisfy applicable regulatory requirements, which include requirements in the *Standards for Registered Training Organisations* current at the time of assessment.

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Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Assessment must occur in workplace operational situations. Where this is not appropriate, assessment must occur in simulated workplace operational situations that reflect workplace conditions.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or simulations
- acceptable means of simulation assessment
- applicable documentation including workplace procedures, regulations, codes of practice and operation manuals
- relevant materials, tools, equipment and personal protective equipment currently used in industry.

Links

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