PRECISION FLIGHT CONTROLS, INC.

Modular Flight Deck

Advanced Aviation Training Device

Revised January 2017

Qualification and Approval Guide (QAG)

FAA APPROVED QAG
Signature and Date

Modular Flight Deck ™ cockpit system shown with integrated 225 degree 5-channel visual system and 6 DOF Motion Platform

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MFD Table of Contents

Overview Statement

This Qualification and Approval Guide (QAG) includes a detailed description of all components, functions, and capabilities for the Modular Flight Deck. This includes any optional aircraft configurations with quality pictures and diagrams. The required information as described in the current advisory circular, AC 61-136A / FAA Approval of Aviation Training Devices (ATD) and their use for training and experience required for FAA approval is contained within this document. This includes listing all the required qualifying items, functions, and capabilities.

This guide is used to clearly describe and verify the functionality of the aviation training device platform confirming its suitability for airman training and experience. A valid FAA Letter of Authorization (LOA) specifying the ATD allowances must also accompany the training device when utilized for airman training or experience requirements as specified in 14 CFR §61 or 141.

The ATD must maintain its performance and function without degradation. The operator of this device is expected to maintain its condition and functionally when used for airmen training or experience requirements. Only the configurations approved for this model, as described within this QAG, can be utilized when satisfying FAA experience or training requirements. Any additions, changes, or revisions to the model or to the available configurations described within this document must be approved in writing by The General Aviation and Commercial Division, AFS-800. Operators who use these trainers to satisfy FAA pilot training or experience requirements are obligated to allow FAA inspections ensuring training device compliance and approval.

Any questions concerning FAA approval or use of ATDs should be directed to the General Aviation and Commercial Division, AFS-800.

Overall Aviation Training Device (ATD) Description

The Modular Flight Deck closely represents the overall functionality, performance and instrumentation of single engine, multi-engine, turboprop and Jet aircraft. The platform consists of a cockpit section, instructor's station, visual display system and an audio system. It incorporates a combination of hardware and software components that is assembled and checked by Precision Flight Controls Inc. All hardware elements are permanently installed and designed so the cockpit has the appearance and feel of an actual aircraft. From the pilot's seated position, there are no computer hardware elements such as keyboards, pointing devices, etc. for his or her use.

The cockpit controls, switches, knobs and switch panels are replicas and located in the proper position and distance from the pilot's seated position are representative of the class of aircraft;

Primary flight and navigation instruments are life-sized that exhibit neither stepping nor excessive transport delay, and arranged so as to observe trends and provide a realistic scan pattern. All instruments are displayed on high resolution LCDs at 1024 X 768 or better resolution in millions of colors;

Integrated digital avionics complete with Autopilot, Nav/Com(s) ADF, DME, GPS(s), Transponder, Audio Panel and Altitude Pre-Selector;

An integrated five channel visual system that provides cues in both day and night, VFR/IFR, Airport environments, Enroute landscape and most weather conditions. The five channel integrated visual system consists of 1080p High Resolution LCD monitors.

The Modular Flight Deck provides a realistic generic cockpit design and provides an effective training environment for student and certificated pilots. This includes the capability of practicing scenario based flight training events, simulated equipment failures, normal and emergency procedures, pilot evaluations, instrument procedures/experience while facilitating increased pilot overall proficiency.

Overall Aviation Training Device (ATD) Description (cont.)

Modular Flight Deck Cockpit

Modular Flight Deck (Shown With ProMotion 3 DOF (Degrees of Freedom) Motion Base And Integrated Visual System

Software /Hardware Compatibility Statement

This is to certify that Lockheed X-Plane software has demonstrated that their software is compatible with the Modular Flight Deck AATD, and can assure that the communications/transport data latency is not greater than 200 milliseconds and all analog and digital input signals meet the performance criteria established for software performance by the ATD manufacturer.

Software Components

The ATD utilizes several software programs:

- X-Plane Professional version 8.0 or later
- Microsoft Windows
- Linux
- Lockheed PREPAR3D
- Quantum3D

Instruments and Indicators

(1) Instruments and indicators replicated and properly located as appropriate to the aircraft represented:

(a) Flight instruments for analog in a standard configuration which represent traditional "round" flight instruments or electronic primary flight displays (PFD) and multi-function displays with reversionary and backup flight instruments.

(b) A sensitive altimeter with incremental markings each 20 feet or less, operable throughout the normal operating range of the aircraft or family of aircraft represented.

(c) A magnetic direction indicator.

(d) A heading indicator with incremental markings each 5 degrees or less, displayed on a 360 degree circle. Arc segments of less than 360 degrees may be selectively displayed if desired or required, as applicable to the aircraft or family of aircraft represented.

(e) An airspeed indicator with incremental markings as shown on the aircraft or family of aircraft represented; airspeed markings of less than 40 knots may not be displayed.

(f) A vertical speed indicator with incremental markings each 100 fpm for both climb and descent, for the first 1,000 feet per minute (fpm) of climb and descent, and at each 500 fpm climb and descent for the remainder of a minimum ±2,000 fpm total display, or as applicable to the aircraft or family of aircraft being represented.

(g) A gyroscopic rate-of-turn indicator or equivalent with appropriate markings for a rate of 3 degrees per second turn for left and right turns. If a turn and bank indicator is used, the 3 degrees per second rate index must be inside of the maximum deflection of the indicator.

(h) A slip and skid indicator with coordination information displayed in the conventional skid ball format where a coordinated flight condition is indicated with the ball in the center position.

(i) An attitude indicator with incremental markings each 5 degrees of pitch or less, from 20 degree pitch up to 40 degree pitch down or as applicable to the aircraft or family of aircraft represented. Bank angles are identified at "wings level" and at 10, 20, 30, and 60 degrees of bank (with an optional additional identification at 45 degrees) in left and right banks.

(j) Engine instruments as applicable to the aircraft or family of aircraft being represented, providing markings for normal ranges and minimum and maximum limits.

(k) A suction gauge or instrument pressure gauge with a display applicable to the aircraft represented.

Instruments and Indicators (cont.)

(l) A flap setting indicator that displays the current flap setting. Setting indications are typical of that found in an actual aircraft.

(m) A pitch trim indicator with a display that shows zero trim and appropriate indices of airplane nose down and airplane nose up trim, as would be found in an aircraft.

(n) Communication radio(s) with display(s) of the radio frequency in use.

(o) Navigation radio(s) capable of replicating both precision and nonprecision instruments, including approach procedures (each with an aural identification feature), and a marker beacon receiver. An instrument landing system (ILS), non-directional radio beacon (NDB), Global Positioning System (GPS), Localizer (LOC) or Very high frequency Omnidirectional Range (VOR). Graduated markings as indicated below must be present on each course deviation indicator (CDI) as applicable. The markings include:

- One-half dot or less for course/glideslope (GS) deviation (i.e., VOR, LOC, or ILS), and
- Five degrees or less for bearing deviation for automatic direction finder (ADF) and radio magnetic indicator (RMI), as applicable.

(p) A clock with incremental markings for each minute and second, or a timer with a display of minutes and seconds.

(q) A transponder that displays the current transponder setting.

(r) A fuel quantity indicator(s) that displays the fuel remaining, either in analog or digital format, appropriate for the aircraft or family of aircraft represented.

NOTE: The minimum instrument and equipment requirements specified under 14 CFR part 91, § 91.205 for day visual flights rules (VFR) and instrument flight rules (IFR) are functional during the training session.

(2) All instrument displays listed above must be visible during all flight operations. Allowances can be made for multifunction electronic displays that may not display all instruments simultaneously. The update rate of all displays must provide an image of the instrument that:

(a) Does not appear to be out of focus or illegible.
(b) Does not appear to “jump” or “step” to a distracting degree during operation.
(c) Does not appear with distracting jagged lines or edges.
(d) Does not appear to lag relative to the action and use of the flight controls.

Instruments and Indicators (cont.)

(3) Control inputs are reflected by the flight instruments in real time and without a perceived delay in action. Display updates display all changes (within the total range of the replicated instrument) that are equal to or greater than the values stated below:

(a) Airspeed indicator: change of 5 knots.

(b) Attitude indicator: change of 2 degrees in pitch and bank.

(c) Altimeter: change of 10 feet.

(d) Turn and bank: change of ¼ standard rate turn.

(e) Heading indicator: change of 2 degrees.

(f) Vertical speed indicator (VSI): change of 100 fpm.

(g) Tachometer: change of 25 rpm or 2 percent of turbine speed.

(h) VOR/ILS: change of 1 degree for VOR or ¼ of 1 degree for ILS.

(i) ADF: change of 2 degrees.

(j) GPS: change as appropriate for the model of GPS based navigator represented.

(k) Clock or timer: change of 1 second.

(4) Displays reflect dynamic behavior of an actual aircraft display (e.g., a VSI reading of 500 fpm reflect a corresponding movement in altimeter and an increase in power reflects an increase in the rpm indication or power indicator.)

Flight instruments panels include (as per aircraft requirements): airspeed indicator, altimeter, radar altimeter, magnetic compass, OBS 1, OBS 2, ADF, DME, RMI, directional gyro, vertical speed indicator, vacuum, outside air temp, fuel tank gauge(s), alternator amps, bus amps, battery, flaps position indicator, cowl flaps position indicators, flight management annunciator and altitude pre-select.

Engine instruments (as per aircraft requirements): manifold pressure gauge(s), RPM gauge(s), fuel flow gauge(s), CHT, EGT, oil temp, oil pressure, ITT, TIT, and propeller sync.

- All aircraft modules have an adjustable altimeter that operates throughout the normal operating range of the aircraft being replicated.

- All aircraft modules have a heading indicator with incremental markings of 5 degrees and display on a 360 degree circle.

- All aircraft modules have an airspeed indicator with incremental markings appropriate to the aircraft being replicated.

- **Instruments and Indicators** (cont.)

- All aircraft modules have vertical speed indicators with markings appropriate to the aircraft being replicated.

- All aircraft modules have a turn-and-bank indicator with incremental markings of 3 degrees per second turn for left and right turns and the 3 degree index is inside the maximum deflection of the indicator.

- All aircraft modules have a skid and slip indicator with coordination information displayed in the conventional skid ball format with markings for the center position.

- All aircraft modules have attitude indicators appropriate to the aircraft being replicated with incremental markings for each 5 degrees of pitch, from 25 degrees pitch up to 25 degrees pitch down, which are appropriate to the attitude indicator being replicated. Left and right bank angles are marked at 10, 20, 30, and 60 degrees of bank respectively.

- All aircraft modules have suction gauges and/or indicators appropriate to the aircraft being replicated that indicate the vacuum pressure for the instruments requiring vacuum.

- All aircraft modules have a flap setting indicator, which displays the current flap setting with appropriate markings as to the aircraft being replicated.

- All aircraft modules have instruments appropriate to the aircraft including navigation radio displays for VOR/ILS frequency in use and radio display(s) for the NDB frequency in use.

- Each navigation radio is equipped with an aural identification feature and all aircraft modules have marker beacon receivers.

- A transponder that displays the current transponder setting.

- A fuel quantity indicator(s) that displays the fuel remaining, either in analog or digital format, appropriate for the aircraft represented. NOTE: The minimum instrument and equipment requirements specified under 14 CFR part 91, § 91.205 for day visual flights rules (VFR) and instrument flight rules (IFR) a functional during the training session.

- All instrument displays listed are visible during all flight operations, update frequency is at least 45fps and;

Instruments and Indicators (cont.)

Control inputs are reflected by the flight instruments in real time and without a perceived delay in action. Display updates displays all changes (within the total range of the replicated instrument) that are equal to or greater than the values stated below: Reference Page 5 11/17/14 AC 61-136A Appendix 2

Note:

LCD High Resolution Monitors are used to display all flight instruments, navigation displays, engine instruments, standby instruments and crew alerting system. Instrument displays listed above are visible during all flight operations.

Control Requirements. Physical flight and aircraft system controls are provided as follows:

(a) A self-centering displacement yoke or control stick that allows continuous adjustment of pitch and bank.

(b) Self-centering rudder pedals that allow continuous adjustment of yaw and corresponding reaction in heading and roll.

(c) Throttle or power control(s) that allows continuous movement from idle to full-power settings and corresponding changes in pitch and yaw, as applicable.

(d) Mixture/condition, propeller, and throttle/power control(s) as applicable to the aircraft or family of aircraft represented.

(e) Controls for the following items, as applicable to the category and class of aircraft represented:

- Pitch trim,
- Communication and navigation radios
- Clock or timer,
- Gear handle (if applicable),
- Transponder
- Altimeter
- Carburetor heat (if applicable
- Cowl flaps (if applicable)

Flight Deck and External Sounds / Intercom

A stereo system including subwoofer will be supplied for cockpit sounds, Aural Alerts speakers, and a subwoofer are included. The speakers are strategically located in the simulator to provide a realistic sound environment.

Sound Module Includes (but not limited to):
Engine
Landing Gear
Flaps/Slats
Annunciations
Marker Beacons
Stall
Aural Ground Runway Approach Warnings
TCAS
GPWS
Weather

Typical Speaker System

INTERCOM

4-Way intercom system included (headsets are not included)

Avionics

The avionics suite includes: Altitude Pre-Selector, Audio Panel, two NAV/COMMS, ADF, DME, transponder, autopilot, marker beacon, PFC 430w and PFC 530w GPS or (optional) Garmin GNS430/GNS530, Garmin G1000 or PFC1000.

Note: All GPS devices have integrated NAV/COMMs.

All flight instruments are controlled by rotary encoders located on each side of the main instrument panel or may be controlled with an instrument bezel include: Heading, Altimeter, Course, RMI, ADF, Radar Altimeter, OBS1, OBS2, DG, ADF and RMI.

Aircraft Flight & Engine Controls

- Control Inputs: Precision Flight Controls, Inc. has certified that the transport delay between the control inputs to recognizable system response is less than 300 milliseconds for all input controls (pitch, roll and yaw) of this Qualification Guide. The calculated and tested transport delay is approximately 300 milliseconds or less.

- The AATD has diagnostic software that can be utilized to run a series of tests and will display confirmation that all controls and switches are working properly. Appropriate warning messages are displayed, if any design parameter is out of tolerance.

Yokes, rudder pedals and engine controls are of aircraft quality and representative of a general aviation aircraft.

Flight Controls

Yokes	Pitch 0-60lbs at full travel from center with3 ” fwd and 3” aft for a total of 6”
	Roll 0-60lbs at full travel 270° movement from full left to right position.
Rudders	Yaw 0-65lbs force (each pedal) at full pedal deflection with 1.5” in fwd and 1.5” in aft travel (from center position) for a total travel of 3”.

Precision Flight Controls, Inc. has certified that the transport delay to recognizable system response is less than 300 milliseconds for all control inputs.

Control inputs are reflected by the flight instruments in real time and without a perceived delay in action. Display updates or actions show all changes (within the total range of the replicated instrument) that are equal to or greater than the following:

Computer System Requirements

Computer Rack Shown With Instructor's Monitor

Precision Flight Controls integrates high performance computer hardware and software components necessary to run the simulator. All computers are installed in a portable computer rack system. The Instructor's Operating Station (IOS) can be located near the aft of the cockpit structure for ease of use.

- High Performance Computer Rack System (multiple computers)
- IOS monitors (touch screen)
- Keyboard and mouse
- KVM Switch Rack System (Keyboard, Video and Mouse control)
- Multimedia PCs with Intel I7 processors
- Compatible operating systems, Windows 7+ and Lennox
- Super VGA monitor supporting 1024x768 resolution or higher in 32 bit color
- DirectX 9.0 API or later
- DirectX 9.0 or later
- DirectX 9.0 API compatible sound card with speakers or headphones
- Mouse or compatible pointing device
- Ethernet, internal and external network capability
- Windows 7 Professional operating system
- Gigabyte network

Instructor's Operating System (IOS) / Instructional Management

Instructor's Operating Station (IOS) permits effective interaction without interrupting the flight in overseeing the pilot's horizontal and vertical flight profiles in real time and space.

- Oversee tracks along airways, holding entries and pattern, and localizer and glide slope alignment/deviation (or other approaches with a horizontal and vertical track).
- Software checks for proper hardware configuration during system startup.
- Invoke failures in navigation and instruments, radio receivers, landing gear and flaps, engine power (partial and total), and other airplane systems by using either a keyboard or mouse.
- ATC communications or a Line-Oriented Flight Training (LOFT) type training scenario in which the instructor can evaluate pilot performance without having to act as ATC.
- Live ATC communication can be provided via PilotEdge (third party service).
- The instructor's station can pause, freeze or reset the simulation anytime and then reposition the aircraft anywhere in flight or on the ground.

The instructor has the ability to control the simulation at any point using a keyboard and/or mouse. The system is capable of recording both a horizontal and vertical track of aircraft movement for the entire training session for later playback and review.

The instructor can disable any of the instruments prior to or during a training session and simulate failure of any of the instruments without stopping the flight simulation to affect the failure.

The system provides worldwide navigational database. All navigational data is based on procedures as published per 14 CFR part 97.

The instructor can manipulate the following simulation parameters independently of the simulation with the following methods or devices (using mouse, keyboard or touch tablet).

- Aircraft geographic location: mouse, keyboard or notebook
- Aircraft heading: mouse, keyboard or touch tablet
- Aircraft airspeed: mouse, keyboard or touch tablet
- Aircraft altitude: mouse, keyboard or touch tablet

Weather:

- Wind direction and speed: mouse/keyboard or touch tablet
- Turbulence: Mouse/keyboard or touch tablet
- Visibility: Mouse/keyboard or touch tablet
- Cloud cover: Mouse/keyboard or touch tablet
- Dry, Wet, Icy Runway: Mouse/keyboard or touch tablet
- Seasonal Changes: Mouse/keyboard or touch tablet
- Wind/Rain/Snow: Mouse/keyboard or touch tablet

Instructor's Operating System (IOS) / Instructional Management (cont.)

The IOS is capable of recording both horizontal and vertical tracks of the aircraft movement. These recordings can be stored and then played back for review using a mouse, keyboard and IOS monitor.

The instructor can manually preset or set failures prior to the beginning of a training session and can simulate failures without stopping or freezing the simulation. Each failure may be set by using the keyboard and mouse via the instructor's station.

Failures include (but are not limited to):

- Pitot system
- Static
- Electrical system
- Generator
- Landing gear failures
- Flap system failures
- Primary and multi-function instrument and map displays

Engine failures include (but are not limited to):

- Engine fire
- Oil pressure
- Oil temperature
- Oil quantity
- TIT temperature
- Fuel pump / Fuel pressure
- Fuel system failures
- Power loss

Instrument failures include (but are not limited to):

- AI
- DG
- VSI
- ASI
- TC
- CD/LOC/GS
- PFD
- MFD
- ECIAS

Instructor's Operating System (IOS) / Instructional Management (cont.)

Avionics failures include (but are not limited to):

- VHF1, VHF2
- NAV 1, NAV 2
- Autopilot/MCP
- Transponder
- DME
- ADF

X-Plane Professional software has navigational databases, obtained and compiled from the NIMA's DAFIF data and/or Jeppesen for the United States, ICAO region K. All navigational data is based on procedures as published in 14 CFR Part 97 and is updated and maintained by Precision Flight Controls. Jeppesen nav data is available via the Jeppesen website and updateable via subscription on a 28 day cycle or as needed.

ADDITIONAL FEATURES:

Airport Set Page Prepares the Aircraft for Flight, e.g., Fuel on Board, Weight and Balance, Fluids Quantities, Oxygen Levels, etc. Airport Positioning allows the user to move/slew the aircraft to any location in the air or on the ground.

Approach Page lets the user view the Vertical and Lateral flight path with the ability to pause or freeze the Aircraft's position.

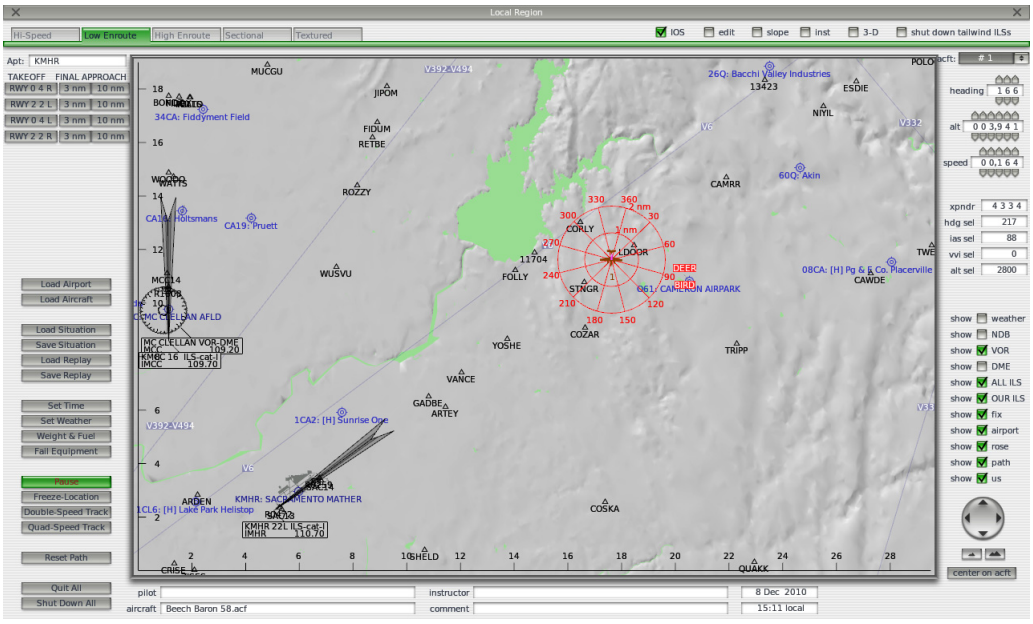
The environment section allows the user to easily change clouds and visibility, time of season and add rain, snow and winds.

Fuel Weight allows the user to easily manage the fuel weight and position.

The Scenarios function allows the user to create, save and recall a flight/training scenario for a later time. For example; the user may want to start the simulation with the aircraft located at Los Angeles International Airport with CAT III conditions on a specific runway or taxiway with improper fuel balance.

The MAP Page is useful for tracking the aircraft in flight and verifying the aircrafts position along a route, also the instructor can use the map for issuing ATC commands.

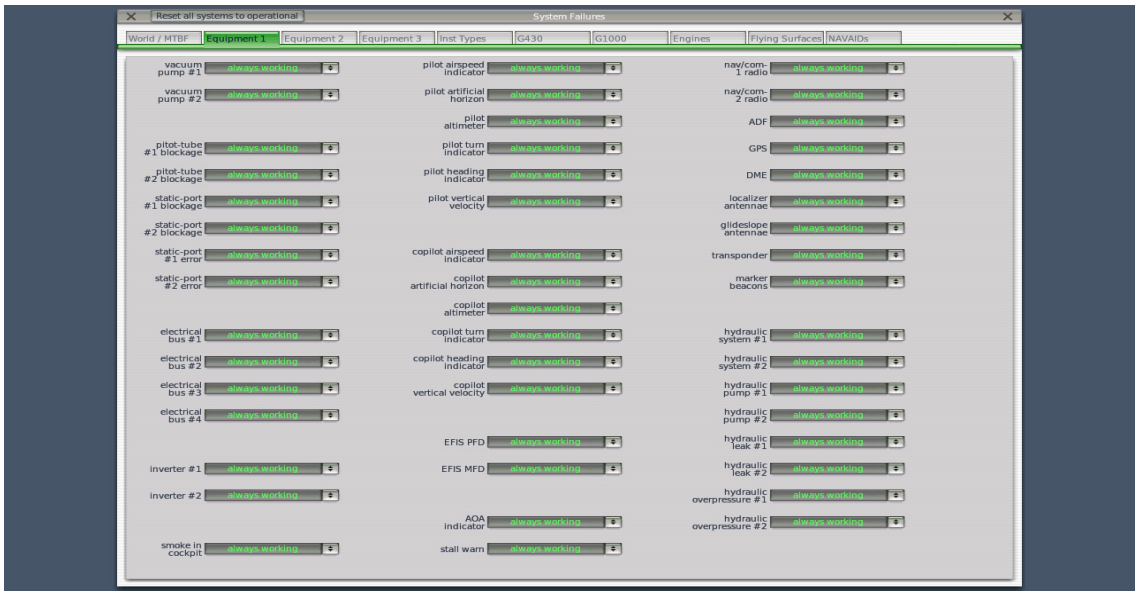
Instructor's Operating System (IOS) / Instructional Management (cont.)



The moving map page is useful for tracking the aircraft in flight and verifying the aircrafts position along a route, also the instructor can use the map for issuing ATC commands.

The Weather Page allows the user to quickly set up weather condition, e.g. cloud types, wind speed and direction, turbulence, runway conditions and altimeter settings.

Instructor's Operating System (IOS) / Instructional Management (cont.)



The Systems Failures Page allows the user to set up system failures on the fly (immediate) or on an event, e.g., set an engine failure at V2

Failures Screen (2 of 9 shown above)

Access to all type of failures such as, landing gear, flaps, icing, alt air, flight controls, engine, navaids, avionics are almost limitless. Multiple failures can be achieved simultaneously as well.

Flight Dynamics

Flight performance and flight dynamics data come from:

- Aircraft Operation Manuals
- Type Certificate Data Sheets (TCDS)
- Supplemental Type Certificates (STC)
- Aircraft Flight Manuals (AFM)
- Pilot's Operating Handbooks (POH)
- Pilot Input

Note: Aircraft are created from the airplane's Type Certificate Data Sheet (TCDS), pilot operating handbooks (POH), engine and maintenance manuals and Pilots experience.

The flight dynamics and performance parameters are comparable to the aircraft being replicated. The vertical lift component changes as a function of bank comparable to the aircraft being replicated. Changes of flap settings and changes of retractable gear cause changes in flight dynamics comparable to the aircraft being replicated. The presence and intensity of wind and turbulence are reflected in the handling and performance qualities of the aircraft module and are comparable to the aircraft being replicated.

AIR files are used to provide flight dynamics data, in the form of coefficients and data tables that determine the flying qualities of the aircraft.

Statement of Compliance

The following statement of compliance certifies the requirements for an AATD have been met as demonstrated in accordance with the guidelines published in AC-61-136A.

The Modular Flight Deck has an ergonomic cockpit design with full scale hardware components designed for basic and advanced flight training.

Modular Flight Deck incorporates simulated or actual aircraft hardware with advanced avionics and systems that meets or exceeds all requirements of AC-61-136A.

Instruments, equipment, panels, systems and controls installed in the AATD are of sufficient realism (visually, spatially and tactile) to allow for procedures training on all systems identified below. Actuation of installed switches and controls replicate those installed in general aviation aircraft

The cockpit structure is enclosed and sufficient lighting is provided on all panels to permit all training tasks to be accomplished in both day and night simulated environments.

The software simulates a 6 degrees of freedom aerodynamic flight models with validated data that ensures faithful replication of this class of aircraft in all phases of flight to include effects of thrust and drag, realistic effects of pressure and temperature changes in gross weight and center of gravity throughout the normal flight envelope. Source date for flight models are acquired by using:

- Aircraft Operation Manuals
- Type Certificate Data Sheets (TCDS)
- Supplemental Type Certificates (STC)
- Aircraft Flight Manuals (AFM)
- Pilot's Operating Handbooks (POH)
- Pilot Input

The digital computational system has sufficient accuracy, resolution, spare capacity and dynamic response to simulate the class of aircraft to FAA ATD standards and testing requirements.

Instrument response is completely automatic based on systems simulation of control inputs.

Navigation and communication equipment installed in the system, match the form, fit and function and operate within tolerances of those installed in the class of aircraft being simulated.

The systems provide a sufficiently accurate training environment representing aircraft equipment for procedures training, in accordance with the relevant FARs, in normal, abnormal and emergency conditions.

Statement of Compliance (cont.)

Seat(s) are provided for the instructor/check airman and FAA inspector. The seats are moveable which facilitate adequate viewing of the cockpit panels and visual displays.

The Instructor's Operating Station (IOS) comprises one or two LCD displays, keyboard and mouse that will allow the instructor to position and configure the simulated aircraft for normal, abnormal and emergency conditions.

A five channels visual system is provided via 1080p high resolution LED monitors. The displays used for the forward and side views represent at least a 30° vertical field of view and 225° horizontal field of view.

Cockpit Features

The Modular Flight Deck is based on the dimensional layout of a typical general aviation cockpit. The Modular Flight Deck closely represents the overall functionality, performance and instrumentation of general aviation aircraft. The platform consists of a cockpit section, instructor's station, visual display system and an audio system. It incorporates a combination of hardware and software components that is assembled and checked by Precision Flight Controls Inc. All hardware elements are permanently installed and designed so the cockpit has the appearance and feel of the actual aircraft. From the pilot's seated position, there are no computer hardware elements such as keyboards, pointing devices, etc. for his or her use.

The Modular Flight Deck provides a realistic scaled cockpit design. This simulator provides an effective training environment for student and certificated pilots. This includes the capability of practicing scenario based flight training events, simulated equipment failures, normal and emergency procedures, pilot evaluations, instrument procedures/experience while facilitating increased pilot overall proficiency.

The cockpit controls, switches, knobs and switch panels are replicas and located in the proper position and distance from the pilot's seated position are representative of the class of aircraft.

Cockpit Instrument Response

The basic iteration rate for simulator programs is 32Hz, yielding a frame time of 1/32= 31.25 ms or better.

The sequence of events for a control input, in any axis is as follows:

- Mechanical input
- Analog to digital conversion (if required)
- Communication to controls position
- Aerodynamic computation
- Instrument scaling

Training Device Components List

Item	Component	Manufacturer	Model	Version	Details
1	Cockpit Enclosure	PFC	MFD	Ver 1 or Higher	Steel and Aluminum construction
2	Control Yoke(s)	PFC	Beech, Mooney, Cessna, Saab and Boeing	Ver 1 or Higher	Cast aluminum control yokes, elevator, A/P disconnect, CWS, push to talk
3	Rudder pedals with toe brakes	PFC	PFC PRO	Ver 1 or Higher	Cast Aluminum/Steel construction hydraulic dampening or dynamic control loading
4	Avionics Suite: Alt Pre-Select, Audio Panel, Marker Beacon, Dual Com/Nav, DME, Transponder, ADF and Autopilot	PFC	DAVI-ENH	Ver 1 or Higher	Simulated digital avionics (Similar to King Silver Crown)
5	GPSW 530 or 430 or both	PFC	PFC 430W/530W or Garmin's GNS 430W/530w	Ver 1 or Higher	Real or simulated Garmin GNS 430/530W PFC 430, PFC 530
6	PFC 1000 Suite (Retrofit Panels)	PFC	PFC 1000 1040 and or 1044 PFD and MFD with 1347 Audio Panel	Ver 1 or Higher	PFC1000 MFD/PFD and audio panels
7	Garmin G1000 Suite	Garmin	Garmin 1040 and or 1044 PFD and MFD with 1347 Audio Panel	N/A	OEM Garmin G1000 panels
8	PFC Instrument Bezels	PFC	PFC BZL SEL PFC BZL MEL PFC BZL Turbo PFC BZL JET	Ver 1 or Higher	Instrument panel overlay with encoder control for most instruments
9	TO/GA switches	PFC	N/A	N/A	Panel or throttle quadrant mounted

Training Device Components List (cont.)

Item	Component	Manufacturer	Model	Version	Details
10	Panels/Switches master start panels, magneto switches, battery switches, alternator switches, parking brake. landing gear panel, flaps panel, horn silence, pressurization controls, circuit breaker panel, pitot, heat, anti-Ice, nav light, strobe light, landing light, taxi light, aileron trim, elevator trim, rudder trim, cowl flaps levers, carb heat,fuel boost pump switches, fuel tank selectors, emergency landing gear extension	PFC	N/A	N/A	Ancillary panels provide fully functional system(s) interfacing
11	Instrument Controls, RMI, OBS, HDG,CRS,ALT,BARO, A/S,DG and Radar Altimeter	PFC	RIC 8	Ver 1 or Higher	8 Digital Encoders
12	Digital Clock/Stopwatch	Davtron	MA77 or MA800	N/A	Digital Clock/Timer
	Pilots, Co-Pilots Instrument Panels	PFC	PFCIP	N/A	Hi-Resolution instrument LED panels
13	Throttle quadrants, vernier or lever type	PFC	PFCTQ	Ver 1 or Higher	Fiber Reinforced ABS with Die Stamped Levers
14	3 DOF Motion Base not an AATD requirement(optional)	D-BOX	PFC 3DOF	Ver 1 or Higher	3 DOF motion
15	6 DOF Motion Base not an AATD requirement(optional)	PFC	PFC 6 DOF	Ver 1 or Higher	6 DOF motion
16	Visual System (external)	40” LCD	Visio, Samsung or equivalent	N/A	One to five 40” LCD 1080p monitors
17	Seating (Pilot and Co-Pilots) w armrest	PFC	FCS-ADJBASE-TRCKS	N/A	Full adjustable, tilt, fwd, aft and vertical movement
18	Overhead light panel	Map lights Inc.	N/A	N/A	Dual articulating LED lights on/off controls
19	Post lamp panel lighting	PFC	PFC	N/A	Adjustable LED
20	4 way intercom	PFC	N/A	N/A	Pilot, Co-Pilot, instructor and observer inputs

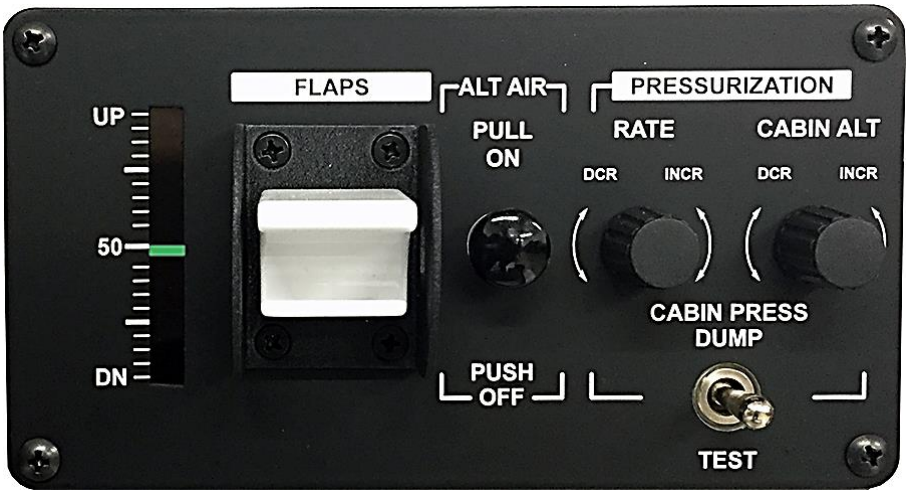
Training Device Components List (cont.)

21	Speaker system(s) internal sounds and external sounds	PFC	PFC	N/A	Cockpit sounds, ATC, ATIS, MKR beacon, morse code external Sounds, engine, flaps, landing fear, runway, braking, skidding
22	Instructor's station	Laminar Research	X-Plane Professional	Version 8.0 or Higher	24"-30" LCD Mouse and Keyboard or Touchpad
23	Navdata (worldwide)	Jeppesen		N/A	Can Be Updated On a 28 Day Cycle
24	Core simulation software	Laminar Research	X-Plane Professional	Version 8.0 or Higher	Visual and Navigational Database
25	Computers (2), or as required	PFC	PFC	Intel I7 Solid State	Custom High Performance
26	Instrument Procedures Data Base	DAFIF or Jeppesen		N/A	Provides for FAA published instrument navigation procedures, data base per 14 CFR 97 (en-route and approach)
27	Hobbs Meter	DACTON	Mini	102033	Hour Meter

Example of Bezeled Instrument Panel (JET)

Center Console, Circuit Breaker Panel, and Flaps Panel

Lights Panel



Flaps and Pressurization Panel

Fuel Pump/Landing Gear Panel

Training Device Components List (cont.)

Single Engine

Multi-Engine

Turboprop

Jet

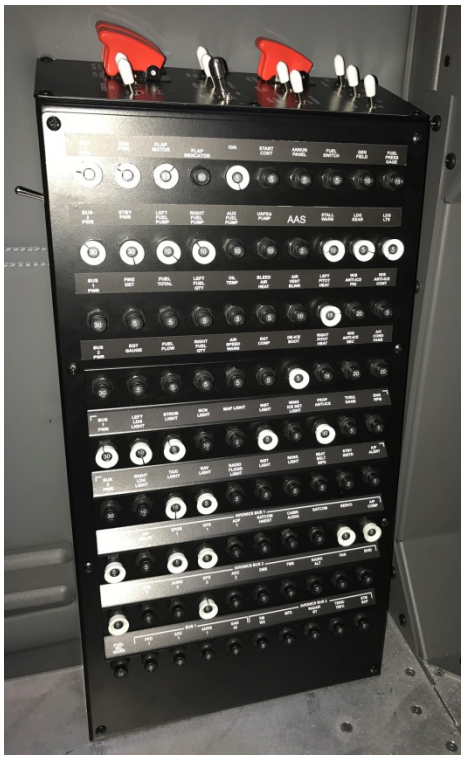
Interchangeable Master Start Panels

Training Device Components List (cont.)

Intercom and Parking Brake Panel

Circuit Breaker and IOS Panel

(Circuit Breakers can be manually pulled or controlled by the Instructors Station for failing components or systems)



Cessna 208 Master Panel and Circuit Breaker Panel (Optional)

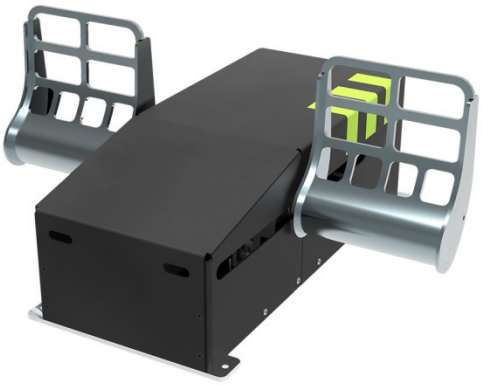
G1000 Retrofit Bezels (optional)

Quest Kodiak / G1000

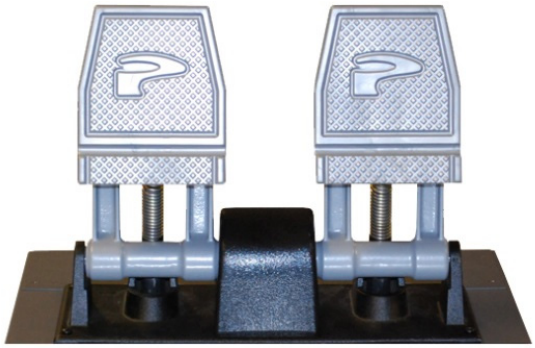
Training Device Components List (cont.)

Dynamic Control Loading Yoke(s)

Enhanced Yoke Features



Control Loading Rudder Pedals

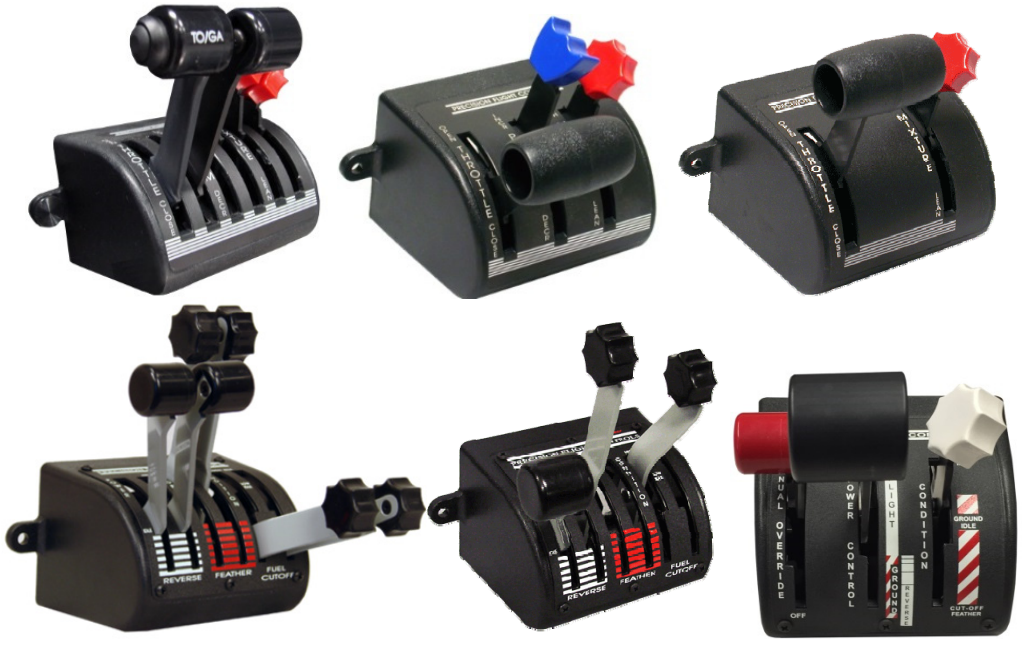


Hydraulic Dampened Rudder Pedals

Turboprop Instrument Bezel

Technically Advanced Instrument Bezel

Single Engine Instrument Panel

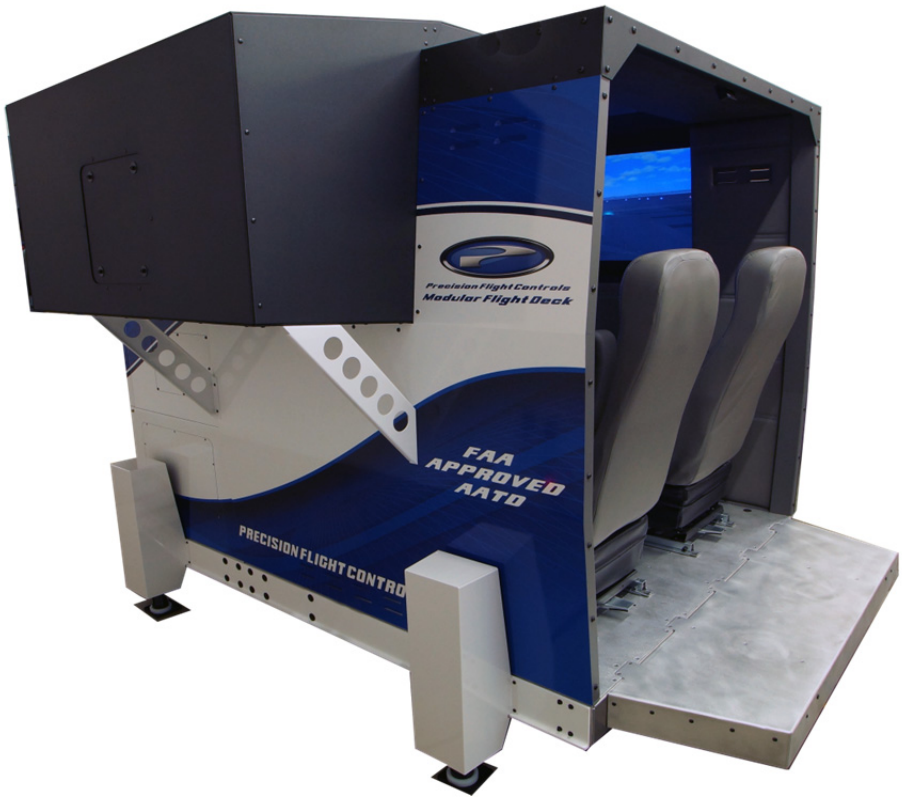


Interchangeable Throttle Quadrants (not all combinations shown)

Interchangeable Throttle Quadrants (not all combinations shown)

Ergonomic Pilots Seats with adjustable arm rests, tilt and vertical adjustment. The seats are attached to seat tracks for easy movement forward and aft and also allows for entrance and egress of the simulator.

Center Flight Console with Elevator, Aileron and Rudder Trim Controls
Post Lamps, Cowl Flaps, Interchangeable Fuel Tank Selector and
Emergency Gear Extension Switch



Modular Flight Deck Cockpit Show with (optional) ProMotion 3 DOF Motion Base

The MFD meets the following Control Input requirements:

Physical flight and aircraft control systems are designed such that they are recognizable as to their function and how they are manipulated solely from their appearance. No keyboard, mouse, or gaming joystick is used to control the aircraft.

Virtual controls are limited to setting the aircraft configuration, location, weather conditions, and pausing action.

No keyboard or mouse is used to set or position any of the listed features of this device. The required and additional equipment is operated in the same manner in which it would be operated in the aircraft represented.

The physical arrangement, appearance, and operation of controls, instruments, and switches closely represent the model of aircraft.

Only the software package evaluated and approved by the FAA is available for use on this computer system.

(1) A realistic shrouded (enclosed) cockpit design and instrument panel arrangement representing a specific model aircraft cockpit.

(2) Cockpit knobs, system controls, switches, and/or switch panels in realistic sizes and design appropriate to each intended functions, in the proper position and distance from the pilot's seated position, and representative of the category and class of aircraft being represented.

(3) Primary flight and navigation instruments appropriately sized and properly arranged that exhibit neither stepping nor excessive transport delay.

(4) Digital avionics panels.

(5) Global Positioning System (GPS) navigator with moving map display.

(6) Three-axis autopilot and flight director (FD).

(7) Pitch trim (manual or electric pitch trim) permitting indicator movement either electrically or analog in an acceptable trim ratio.

(8) An integrated visual system provides realistic cues in both day and night visual flight rules (VFR) and instrument flight rules (IFR) meteorological conditions to enhance a pilot's visual orientation in the vicinity of an airport including:

• Adjustable visibility parameters; and adjustable ceiling parameters.

(9) A pilot seat(s) appropriate to the aircraft configuration.

(10) Rudder pedals secured to the cockpit floor structure, or that can be physically secured to the floor beneath the device in proper relation to cockpit orientation.

(11) Push-to-talk switch on the control yoke.

(12) A separate instructor station to permit effective interaction without interrupting the flight in overseeing the pilot's horizontal and vertical flight profiles in real time and space. This must include the ability to:

(a) Oversee tracks along airways, holding entries and patterns, and Localizer (LOC) and glideslope (GS) alignment/deviation (or other approaches with a horizontal and vertical track).

(b) Function as air traffic control (ATC) in providing vectors, etc., change in weather conditions, ceilings, visibilities, wind speed and direction, light/moderate/severe turbulence, and icing conditions.

(c) Invoke failures in navigation and instruments, radio receivers, landing gear and flaps, engine power (partial and total), and other aircraft systems (pitot, electric, static, etc.) by using either a keyboard or mouse.

(13) Capable of simulating all of the emergency procedures for which a checklist is prescribed in the aircraft pilot's operating handbook (POH) or flight manual.

Note:

LCD High Resolution Monitors are used to display all flight instruments, navigation displays, engine instruments, standby instruments and crew alerting system. Instrument displays listed above are visible during all flight operations.

(1) Instruments and indicators replicated and properly located as appropriate to the aircraft represented:

(a) Flight instruments for analog in a standard configuration which represent traditional "round" flight instruments or electronic primary flight displays (PFD) and multi-function displays with reversionary and backup flight instruments.

(b) A sensitive altimeter with incremental markings each 20 feet or less, operable throughout the normal operating range of the aircraft or family of aircraft represented.

(c) A magnetic direction indicator.

(d) A heading indicator with incremental markings each 5 degrees or less, displayed on a 360 degree circle. Arc segments of less than 360 degrees may be selectively displayed if desired or

required, as applicable to the aircraft or family of aircraft represented.

(e) An airspeed indicator with incremental markings as shown on the aircraft or family of aircraft represented; airspeed markings of less than 40 knots may not be displayed.

(f) A vertical speed indicator with incremental markings each 100 fpm for both climb and descent, for the first 1,000 feet per minute (fpm) of climb and descent, and at each 500 fpm climb and descent for the remainder of a minimum ±2,000 fpm total display, or as applicable to the aircraft or family of aircraft being represented.

(g) A gyroscopic rate-of-turn indicator or equivalent with appropriate markings for a rate of 3 degrees per second turn for left and right turns. If a turn and bank indicator is used, the 3 degrees per second rate index must be inside of the maximum deflection of the indicator.

(h) A slip and skid indicator with coordination information displayed in the conventional skid ball format where a coordinated flight condition is indicated with the ball in the center position.

(i) An attitude indicator with incremental markings each 5 degrees of pitch or less, from 20 degree pitch up to 40 degree pitch down or as applicable to the aircraft or family of aircraft represented. Bank angles are identified at “wings level” and at 10, 20, 30, and 60 degrees of bank (with an optional additional identification at 45 degrees) in left and right banks.

(j) Engine instruments as applicable to the aircraft or family of aircraft being represented, providing markings for normal ranges and minimum and maximum limits.

(k) A suction gauge or instrument pressure gauge with a display applicable to the aircraft represented.

(l) A flap setting indicator that displays the current flap setting. Setting indications are typical of that found in an actual aircraft.

(m) A pitch trim indicator with a display that shows zero trim and appropriate indices of airplane nose down and airplane nose up trim, as would be found in an aircraft.

(n) Communication radio(s) with display(s) of the radio frequency in use.

(o) Navigation radio(s) capable of replicating both precision and nonprecision instruments, including approach procedures (each with an aural identification feature), and a marker beacon receiver. An instrument landing system (ILS), non-directional radio beacon (NDB), Global Positioning System (GPS), Localizer (LOC) or Very high frequency Omnidirectional Range (VOR). Graduated markings as indicated below must be present on each course deviation indicator (CDI) as applicable. The markings include:

• One-half dot or less for course/glideslope (GS) deviation (i.e., VOR, LOC, or ILS), and

- Five degrees or less for bearing deviation for automatic direction finder (ADF) and radio magnetic indicator (RMI), as applicable.

(p) A clock with incremental markings for each minute and second, or a timer with a display of minutes and seconds.

(q) A transponder that displays the current transponder setting.

(r) A fuel quantity indicator(s) that displays the fuel remaining, either in analog or digital format, appropriate for the aircraft or family of aircraft represented.

NOTE: The minimum instrument and equipment requirements specified under 14 CFR part 91, § 91.205 for day visual flights rules (VFR) and instrument flight rules (IFR) are functional during the training session.

(2) All instrument displays listed above must be visible during all flight operations. Allowances can be made for multifunction electronic displays that may not display all instruments simultaneously. The update rate of all displays must provide an image of the instrument that:

(b) Does not appear to be out of focus or illegible.
(b) Does not appear to "jump" or "step" to a distracting degree during operation.
(c) Does not appear with distracting jagged lines or edges.
(d) Does not appear to lag relative to the action and use of the flight controls.

(3) Control inputs are reflected by the flight instruments in real time and without a perceived delay in action. Display updates display all changes (within the total range of the replicated instrument) that are equal to or greater than the values stated below:

(a) Airspeed indicator: change of 5 knots.

(b) Attitude indicator: change of 2 degrees in pitch and bank.

(c) Altimeter: change of 10 feet.

(d) Turn and bank: change of ¼ standard rate turn.

(e) Heading indicator: change of 2 degrees.

(f) Vertical speed indicator (VSI): change of 100 fpm.

(g) Tachometer: change of 25 rpm or 2 percent of turbine speed.

(h) VOR/ILS: change of 1 degree for VOR or ¼ of 1 degree for ILS.

(i) ADF: change of 2 degrees.

(j) GPS: change as appropriate for the model of GPS based navigator represented.

(k) Clock or timer: change of 1 second.

(4) Displays reflect dynamic behavior of an actual aircraft display (e.g., a VSI reading of 500 fpm reflect a corresponding movement in altimeter and an increase in power reflects an increase in the rpm indication or power indicator.)

Flight instruments panels include (as per aircraft requirements): airspeed indicator, altimeter, radar altimeter, magnetic compass, OBS 1, OBS 2, ADF, DME, RMI, directional gyro, vertical speed indicator, vacuum, outside air temp, fuel tank gauge(s), alternator amps, bus amps, battery, flaps position indicator, cowl flaps position indicators, flight management annunciator and altitude pre-select.

Engine instruments (as per aircraft requirements): manifold pressure gauge(s), RPM gauge(s), fuel flow gauge(s), CHT, EGT, oil temp, oil pressure, ITT, TIT, and propeller sync.

- All aircraft modules have an adjustable altimeter that operates throughout the normal operating range of the aircraft being replicated.

- All aircraft modules have a heading indicator with incremental markings of 5 degrees and display on a 360 degree circle.

- All aircraft modules have an airspeed indicator with incremental markings appropriate to the aircraft being replicated.

- All aircraft modules have vertical speed indicators with markings appropriate to the aircraft being replicated.

- All aircraft modules have a turn-and-bank indicator with incremental markings of 3 degrees per second turn for left and right turns and the 3 degree index is inside the maximum deflection of the indicator.

- All aircraft modules have a skid and slip indicator with coordination information displayed in the conventional skid ball format with markings for the center position.

- All aircraft modules have attitude indicators appropriate to the aircraft being replicated with incremental markings for each 5 degrees of pitch, from 25 degrees pitch up to 25 degrees pitch down, which are appropriate to the attitude indicator being replicated.

- Left and right bank angles are marked at 10, 20, 30, and 60 degrees of bank respectively.

- All aircraft modules have suction gauges and/or indicators appropriate to the aircraft being replicated that indicate the vacuum pressure for the instruments requiring vacuum.

- All aircraft modules have a flap setting indicator, which displays the current flap setting with appropriate markings as to the aircraft being replicated.

- All aircraft modules have instruments appropriate to the aircraft including navigation radio displays for VOR/ILS frequency in use and radio display(s) for the NDB frequency in use.

- Each navigation radio is equipped with an aural identification feature and all aircraft modules have marker beacon receivers.

- A transponder that displays the current transponder setting.

- A fuel quantity indicator(s) that displays the fuel remaining, either in analog or digital format, appropriate for the aircraft represented. NOTE: The minimum instrument and equipment requirements specified under 14 CFR part 91, § 91.205 for day visual flights rules (VFR) and instrument flight rules (IFR) a functional during the training session.

- All instrument displays listed are visible during all flight operations, update frequency is at least 45fps and;

Control inputs are reflected by the flight instruments in real time and without a perceived delay in action. Display updates displays all changes (within the total range of the replicated instrument) that are equal to or greater than the values stated below: Reference Page 5 11/17/14 AC 61-136A Appendix 2

Control Requirements

Physical flight and aircraft system controls are provided as follows:

(a) A self-centering displacement yoke or control stick that allows continuous adjustment of pitch and bank.

(b) Self-centering rudder pedals that allow continuous adjustment of yaw and corresponding reaction in heading and roll.

(c) Throttle or power control(s) that allows continuous movement from idle to full-power settings and corresponding changes in pitch and yaw, as applicable.

(d) Mixture/condition, propeller, and throttle/power control(s) as applicable to the aircraft or family of aircraft represented.

(e) Controls for the following items, as applicable to the category and class of aircraft represented:

- Pitch trim,
- Communication and navigation radios
- Clock or timer,
- Gear handle (if applicable),
- Transponder
- Altimeter
- Carburetor heat (if applicable
- Cowl flaps (if applicable)

Aircraft Configurations

The Modular Flight Deck is configured as a generic general aviation category cockpit. The Modular Flight Deck is capable of flying SEL, MEL, Turboprop, Jet and technically advanced aircraft by simply re-configuring components and software in the cockpit, e.g. instrument panels, throttle quadrants, master start panels and software.

Aircraft Instrument Panels

Beechcraft Bonanza

Aircraft Configurations (cont.)

Beechcraft Baron

Beechcraft Travel Air

Aircraft Configurations (cont.)

Beechcraft Duchess

Cessna 152

Aircraft Configurations (cont.)

Cessna 172 (typical)

Cessna 182(typical)

Aircraft Configurations (cont.)

Cessna 206

Cessna 208 Caravan

Cessna 414

Cessna 421

Aircraft Configurations (cont.)

Diamond DA20

Mooney

Aircraft Configurations (cont.)

Piper Cheyenne

Piper Archer

Piper Arrow

Piper Warrior

Aircraft Configurations (cont.)

Piper Malibu/Meridian

Piper Seminole

Aircraft Configurations (cont.)

Piper Seneca V

Piper Chieftain

Aircraft Configurations (cont.)

Piper Seneca I and III

PC-12 Pilatus

Aircraft Configurations (cont.)

Beechcraft C90

Beechcraft A100

Aircraft Configurations (cont.)

Beechcraft B200

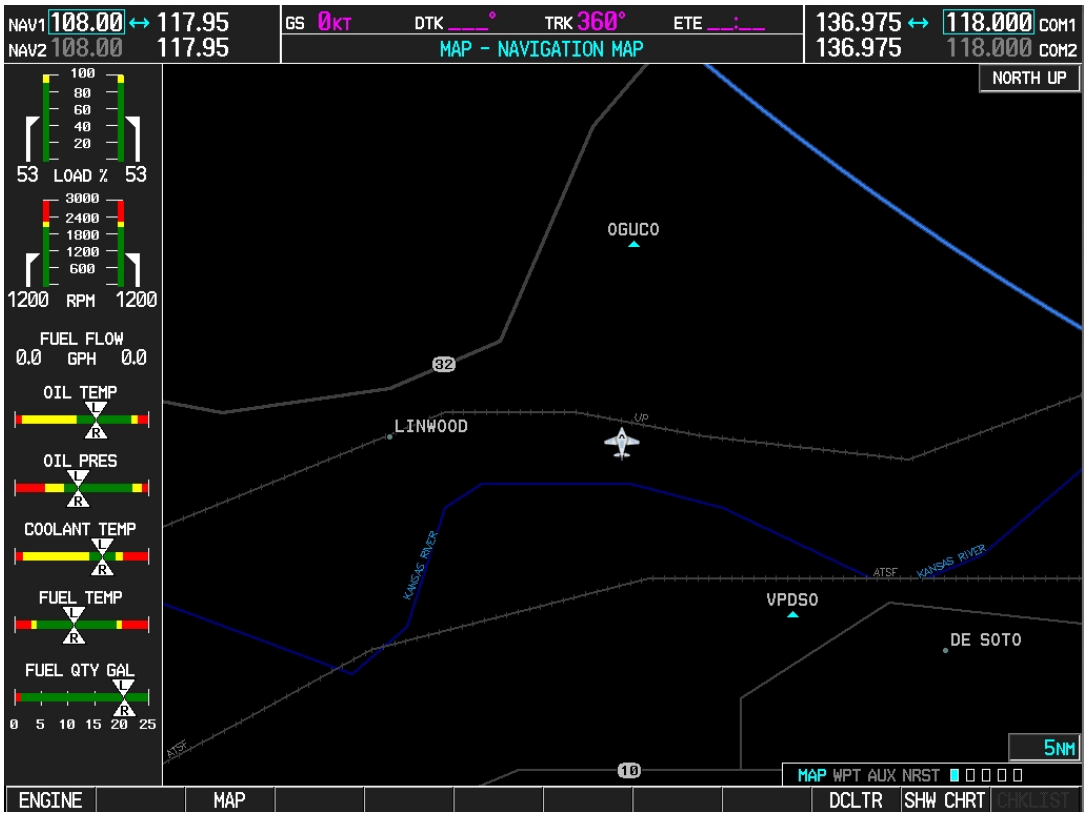
Beechcraft 1900C

Aircraft Configurations (cont.)

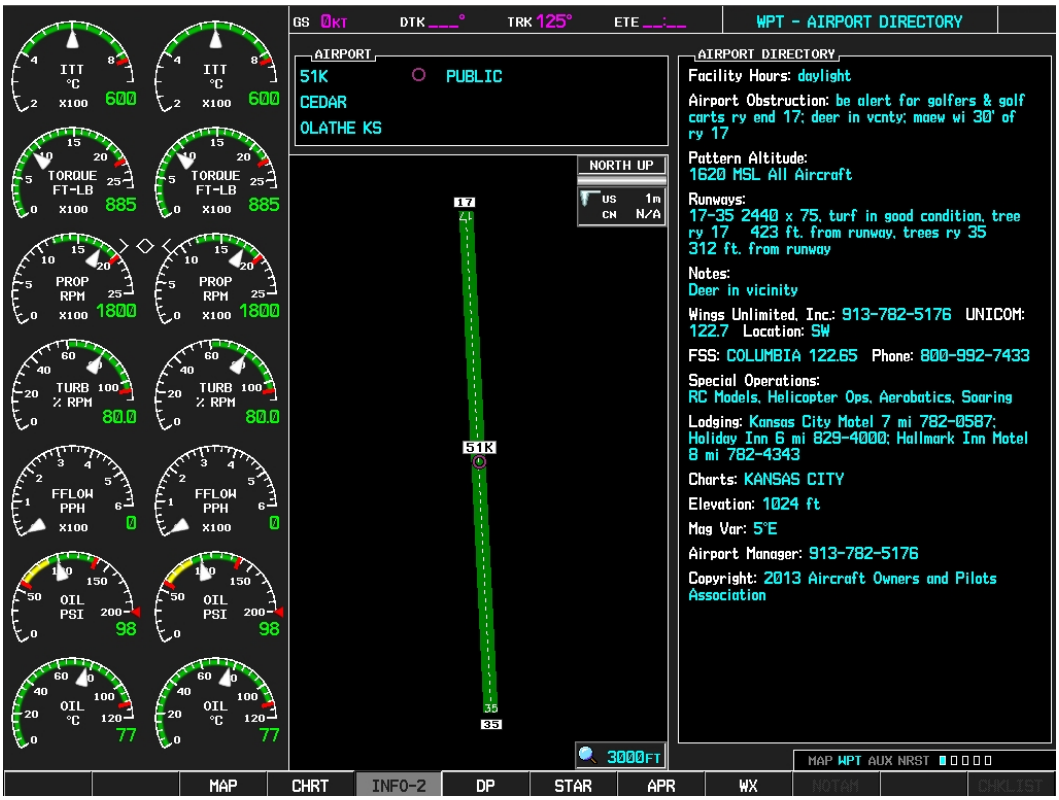
Cessna 501/550

G1000 Typical Screen Captures

Aircraft Configurations (cont.)



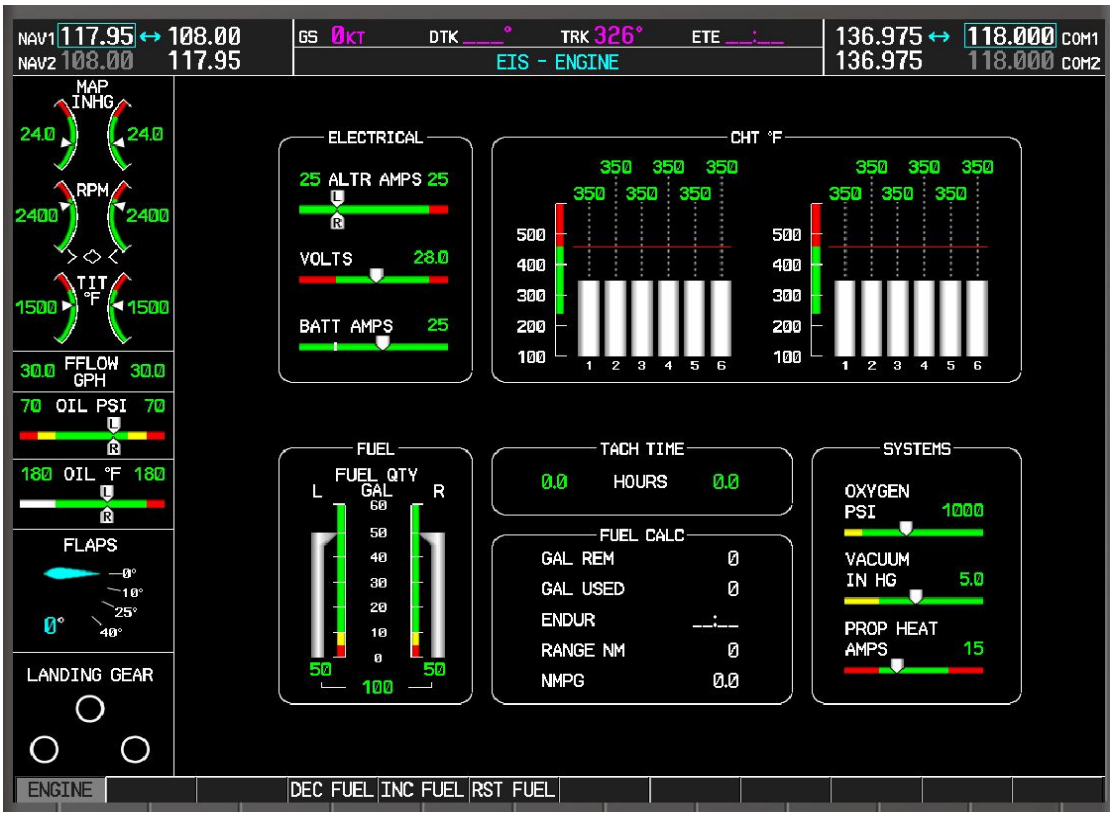
G1000 Typical Screen Captures



Aircraft Configurations (cont.)

G1000 Typical Screen Captures

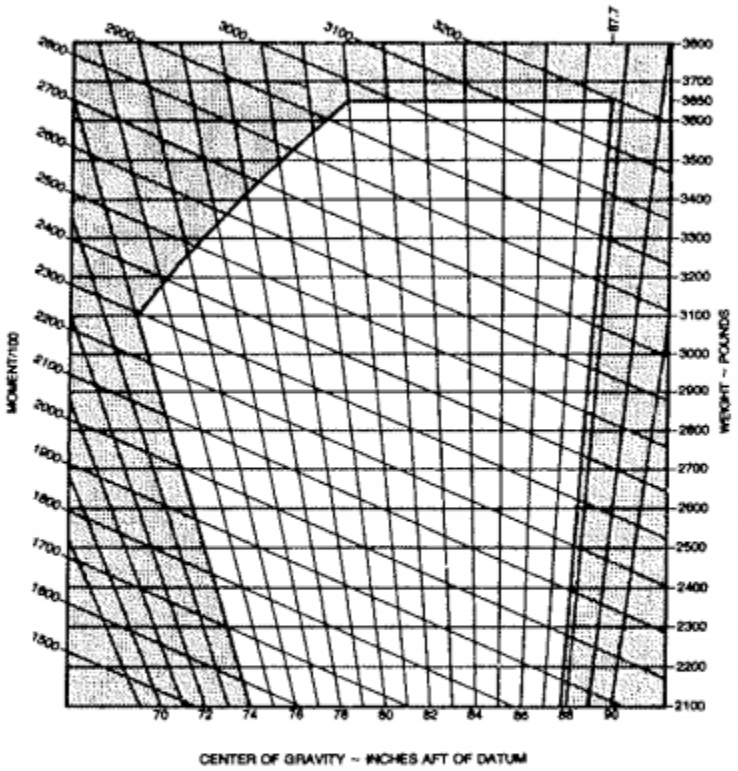
G1000 Typical Screen Captures



Weight and Balance Charts

CG References / Limitations come from several sources including but not limited to: Manufactures POH, STC and AFMs

MOMENT LIMITS VS WEIGHT



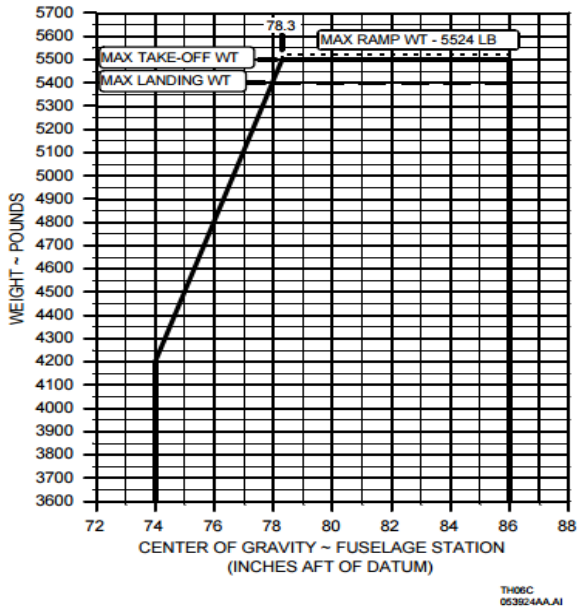
Envelope Based On The Following Weight And Center Of Gravity Limit Data (Landing Gear Down)

Weight Condition	Forward C. G. Limit	Aft C. G. Limit
3850 Lb. (Max. Take-Off or Landing)	81.0	87.7
3100 Lb or Less	74.0	87.7

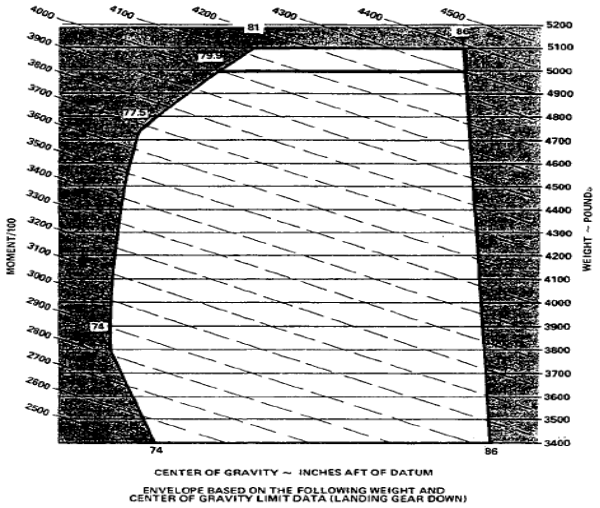
A36-601-171

Weight and Balance Charts (cont.)

WEIGHT AND BALANCE DIAGRAM



MOMENT LIMITS vs WEIGHT



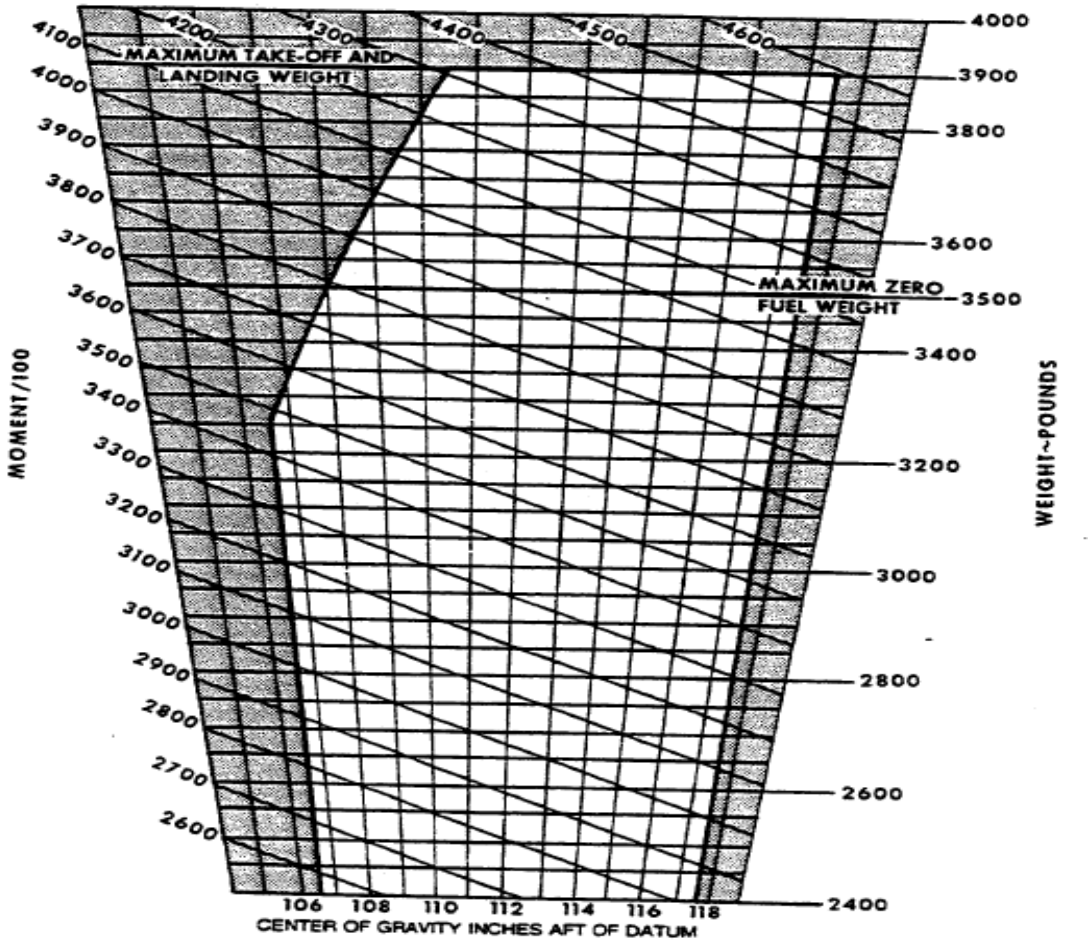
Beechcraft Baron

Weight and Balance Charts(cont.)

Wt & Bal/Equip List

BEECHCRAFT
Duchess 76

MOMENT LIMITS VS WEIGHT



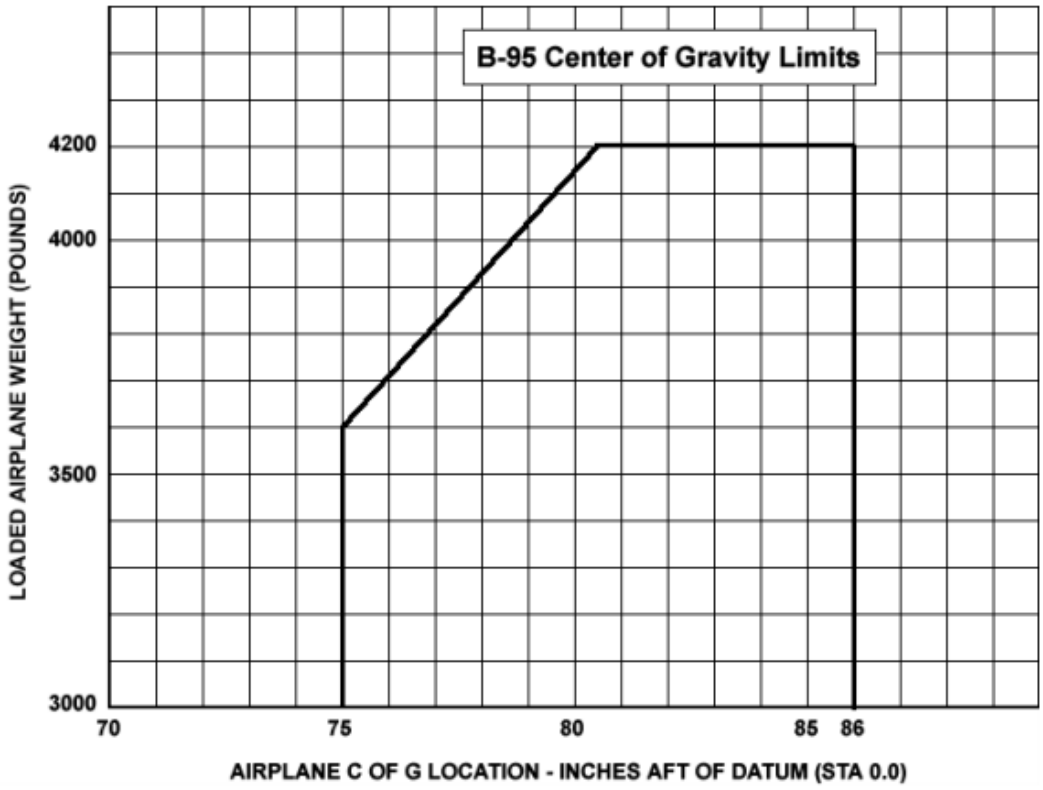
ENVELOPE BASED ON THE FOLLOWING WEIGHT AND CENTER OF GRAVITY LIMIT DATA (LANDING GEAR DOWN)

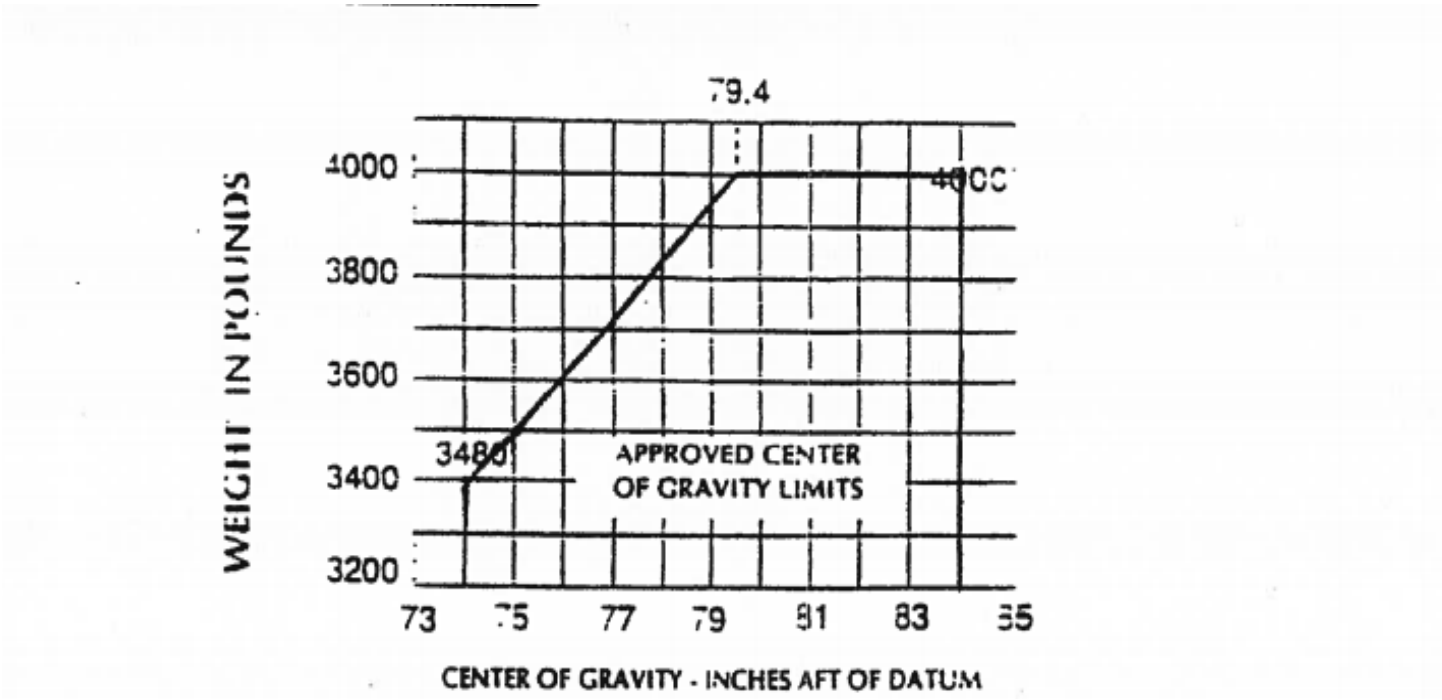
WEIGHT CONDITION	FWD C. G. LIMIT	AFT C. G. LIMIT
3900 POUNDS (MAX. TAKE-OFF/LANDING)	110.6	117.5
3250 POUNDS OR LESS	106.6	117.5

76.601.6

Beechcraft Duchess

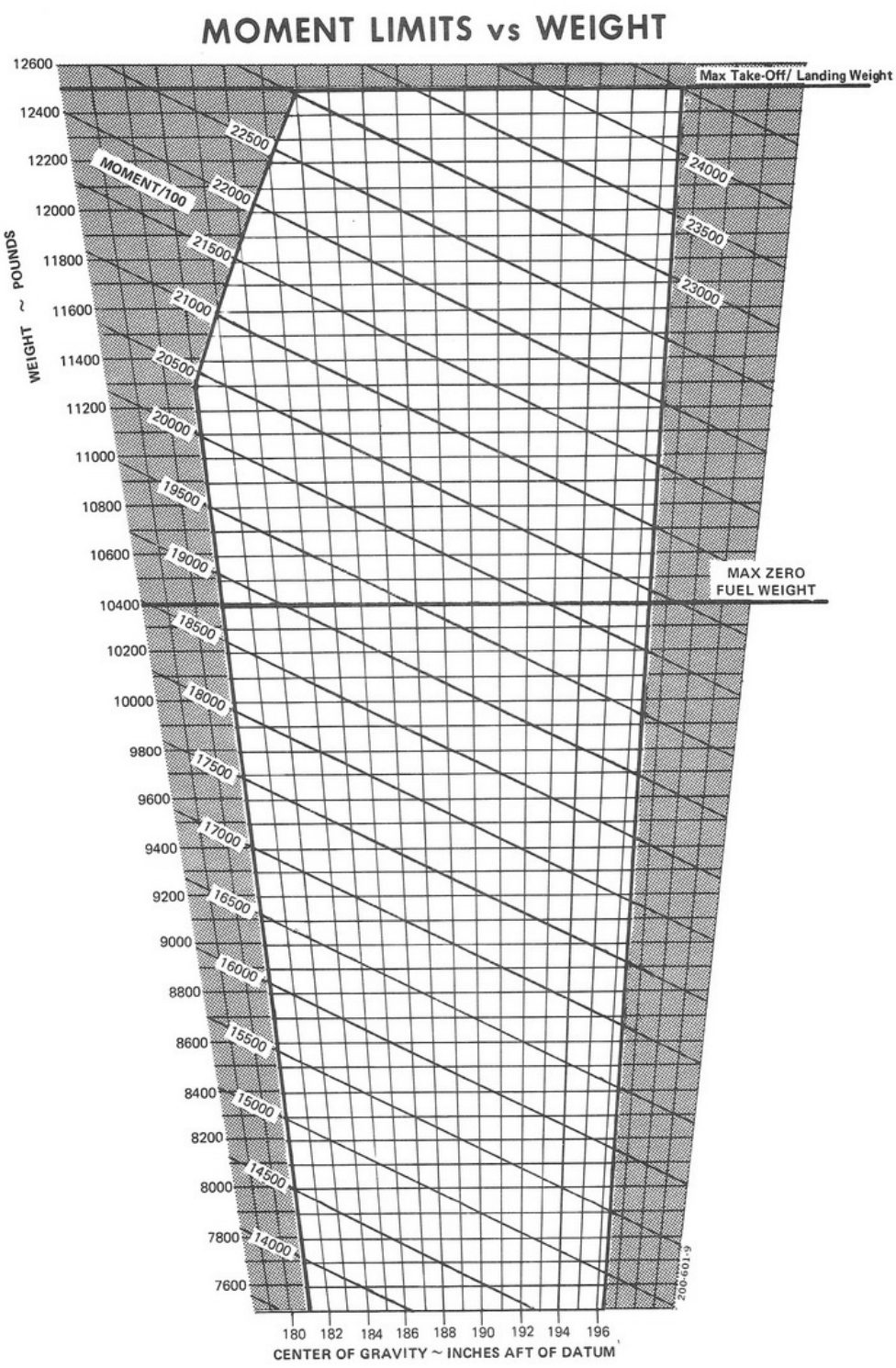
Weight and Balance Charts(cont.)





Beechcraft Travel Air

Weight and Balance Charts(cont.)

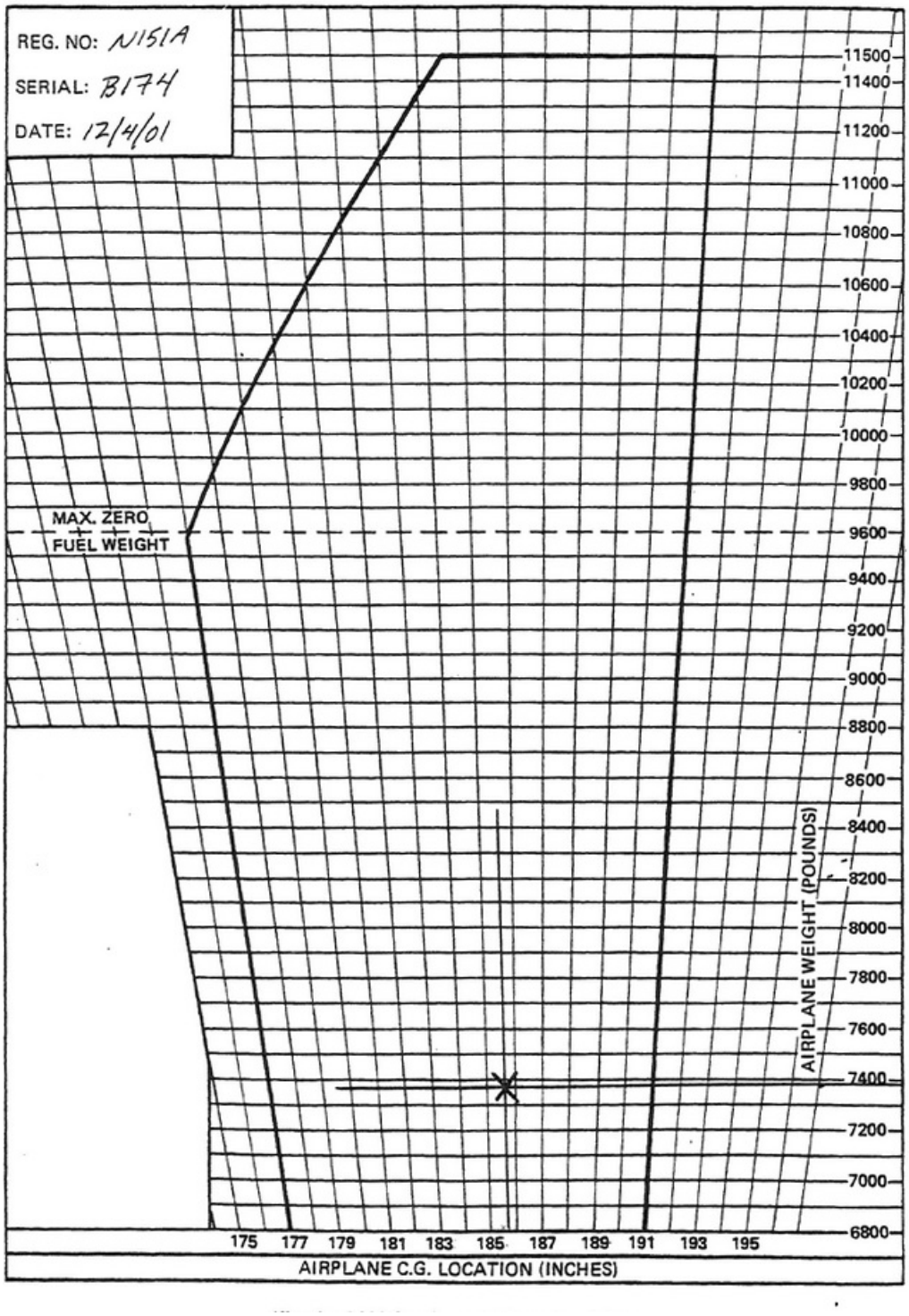


Beechcraft B200

Weight and Balance Charts(cont.)

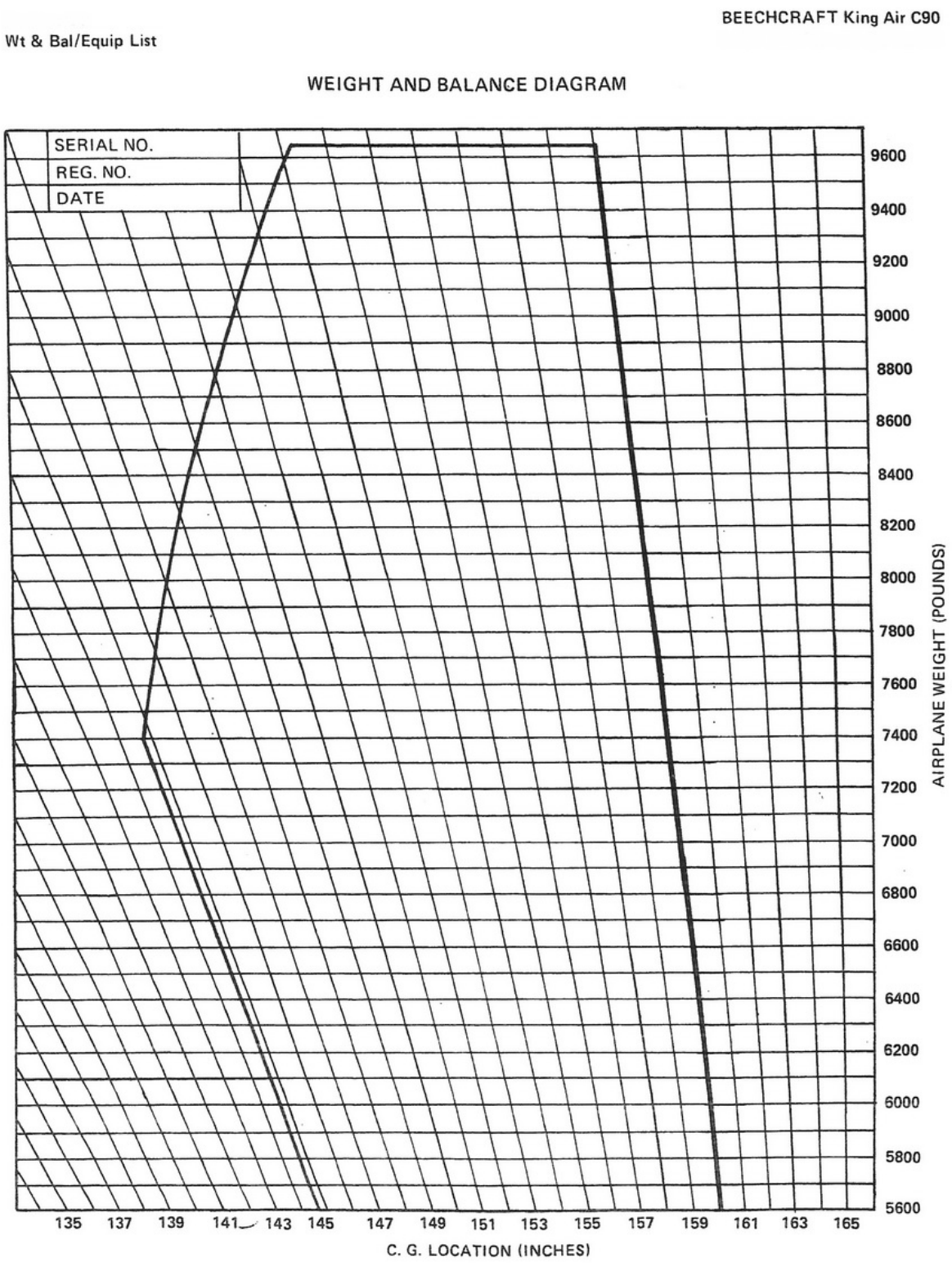
Beechcraft® KING AIR A100

WEIGHT & CENTER OF GRAVITY DIAGRAM



Beechcraft A100

Weight and Balance Charts (cont.)



Beechcraft C90

Weight and Balance Charts (cont.)

CENTER OF GRAVITY LIMITS

AFT LIMIT

Takeoff, Climb Approach, and Landing	299.9 inches (761.8 centimeters) aft of datum at all weights.
Cruise and Descent	303.0 inches (769.6 centimeters) aft of datum from 17,120 pounds to 12,313 pounds. 299.9 inches (761.8 centimeters) aft of datum for 12,312 pounds and below.

FORWARD LIMITS

283.0 inches (718.8 centimeters) aft of datum at 17,120 pounds (7765 kilograms), with straight line variation to 274.5 inches (697.2 centimeters) aft of datum at 11,600 pounds (5262 kilograms).

DATUM

The reference datum is located 83.5 inches (212.1 centimeters) forward of the center of the front jack point.

Beechcraft 1900

Weight and Balance Charts (cont.)

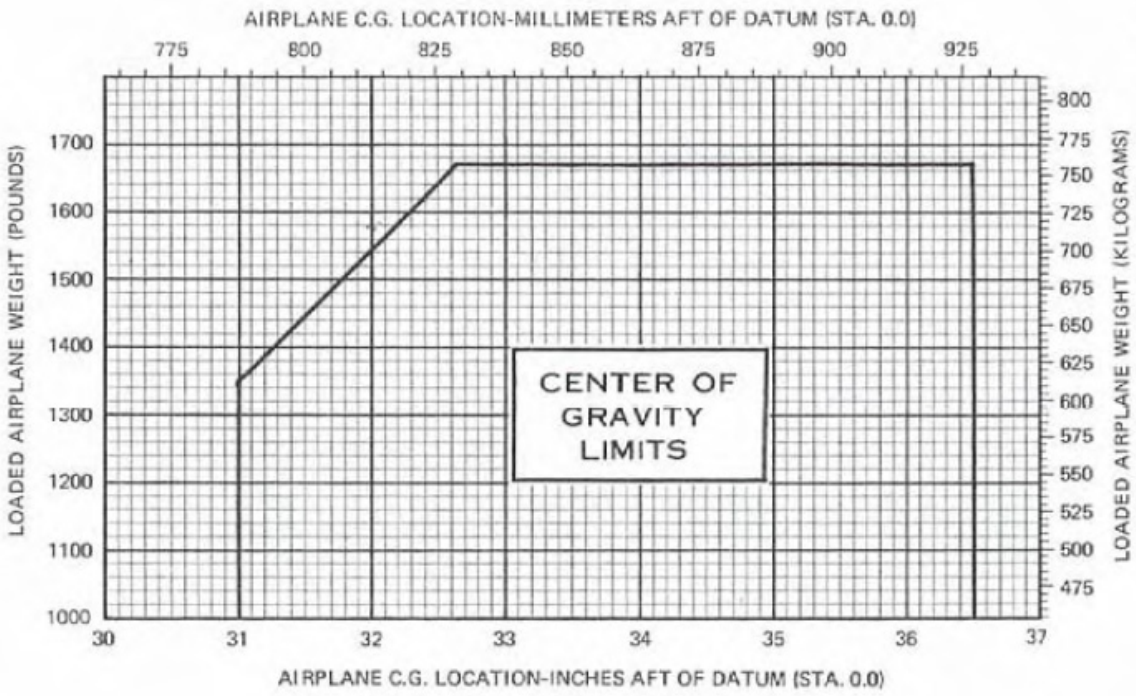
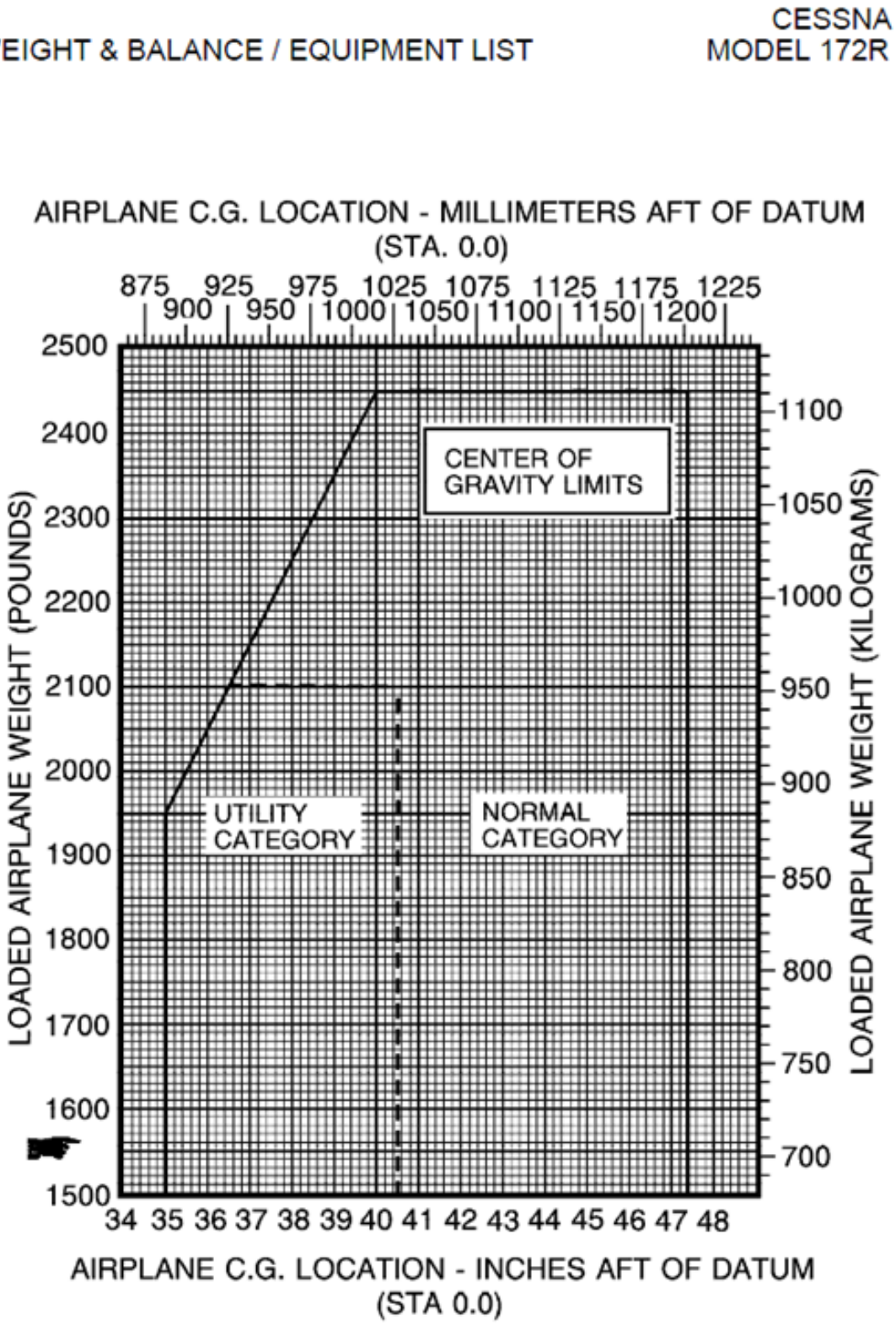


Figure 6-9. Center of Gravity Limits

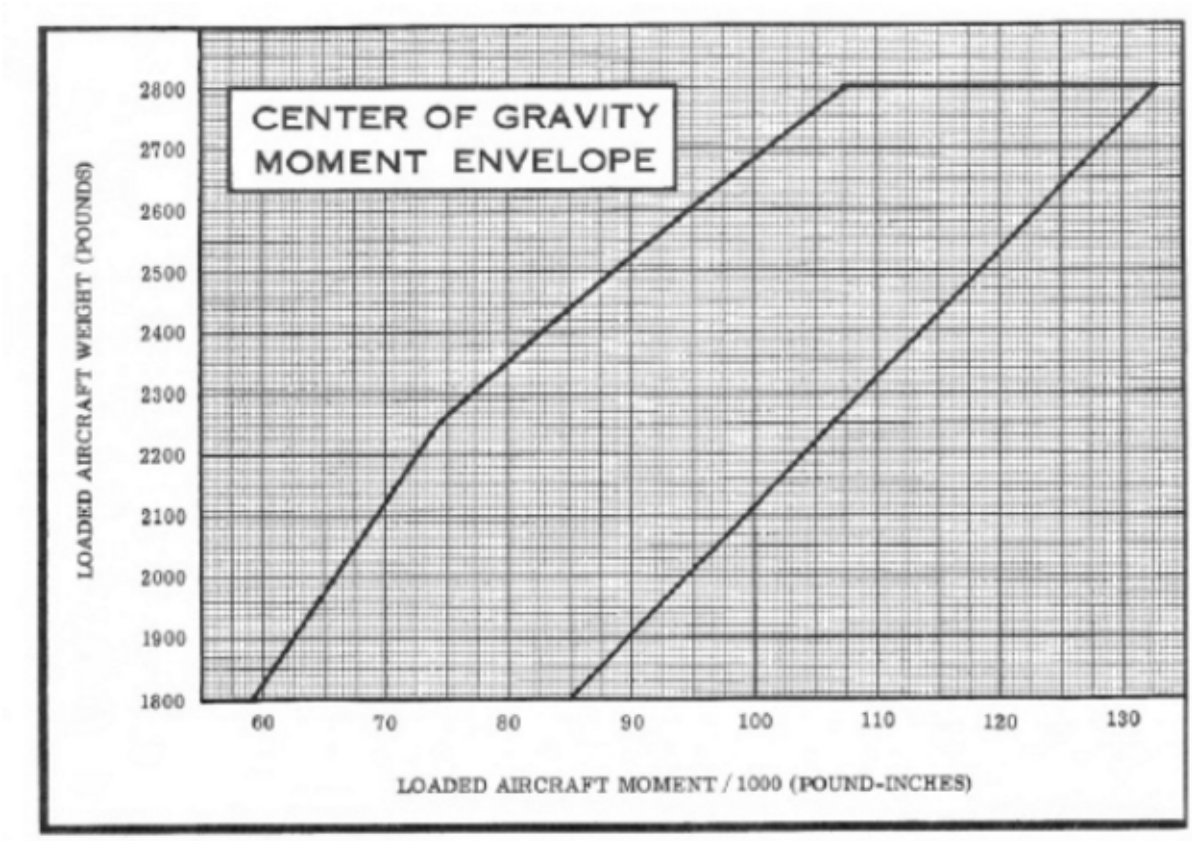
Cessna 152

Weight and Balance Charts (cont.)



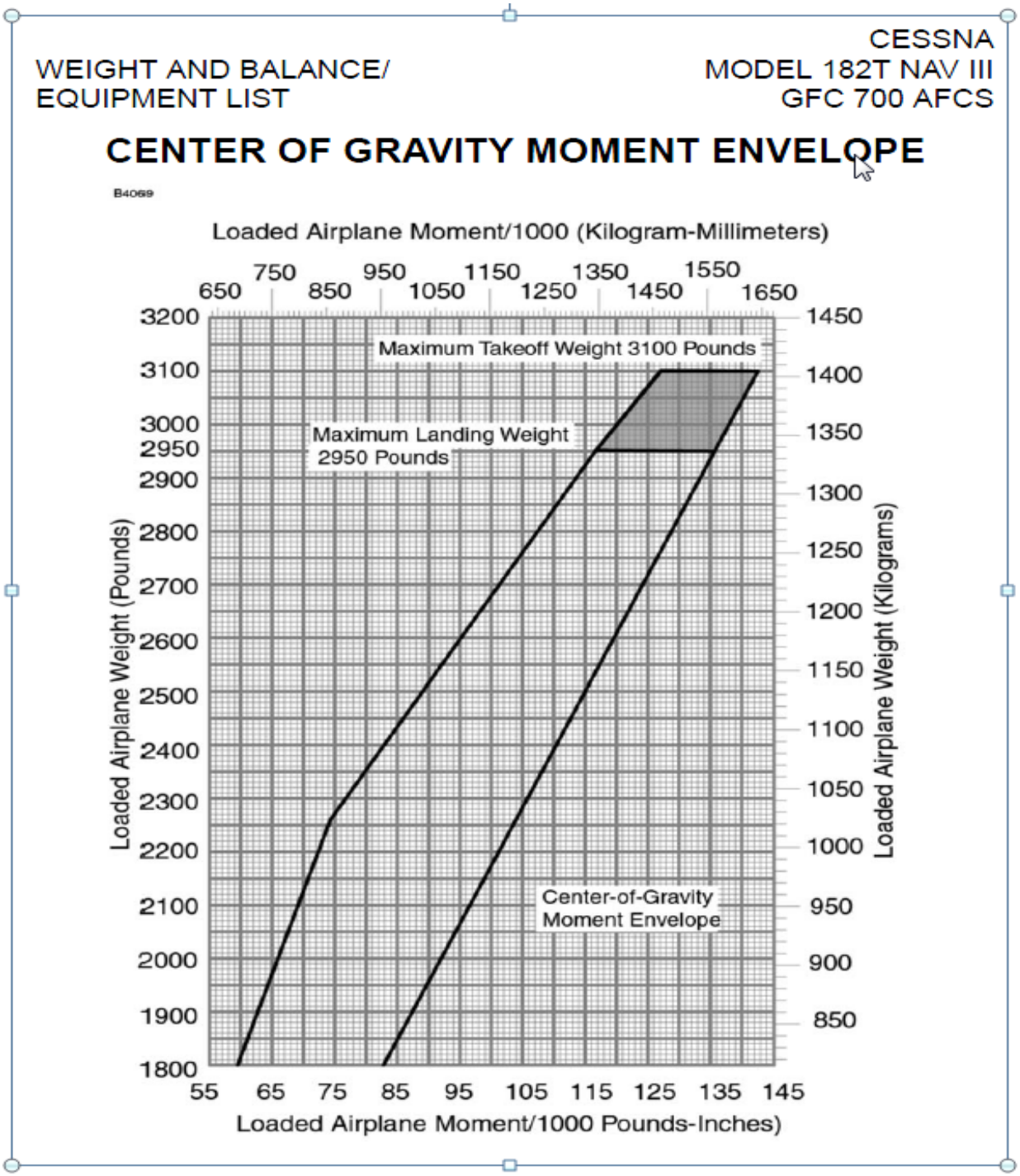
Cessna 172

Weight and Balance Charts (cont.)

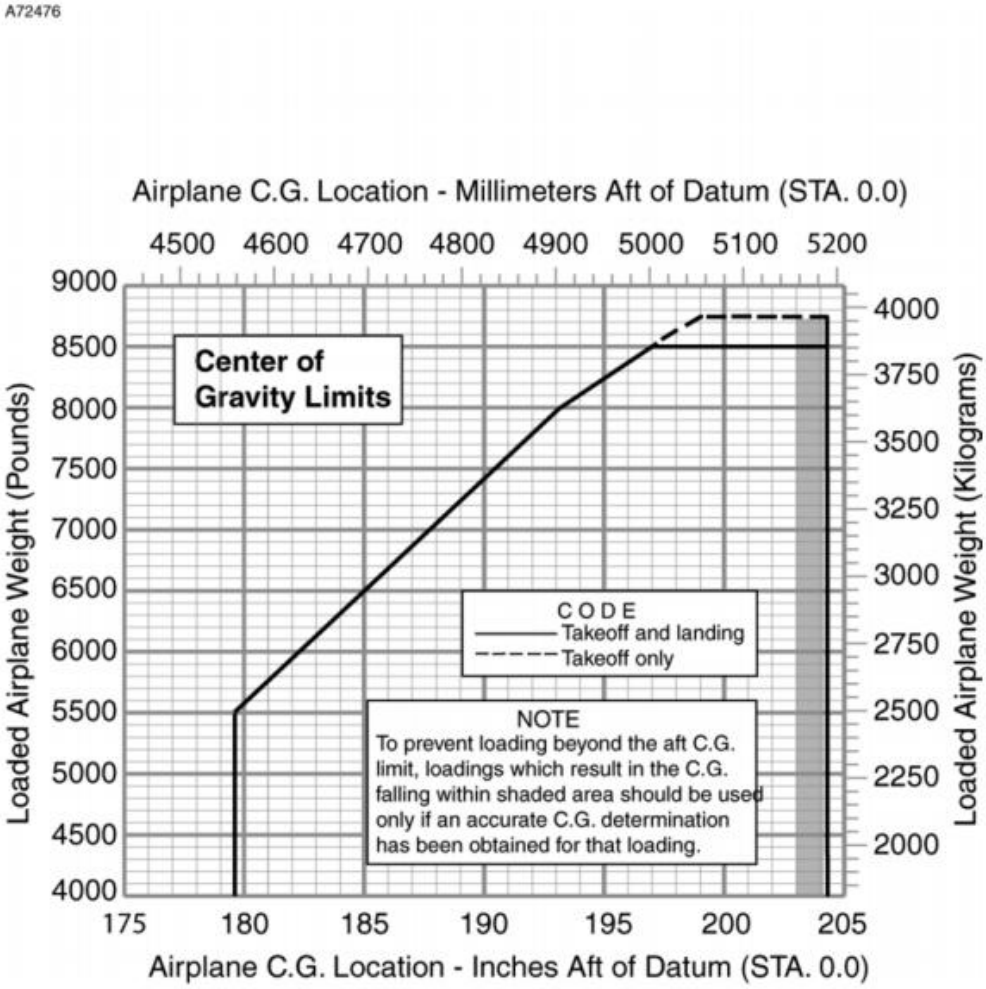


Cessna 182

Weight and Balance Charts (cont.)



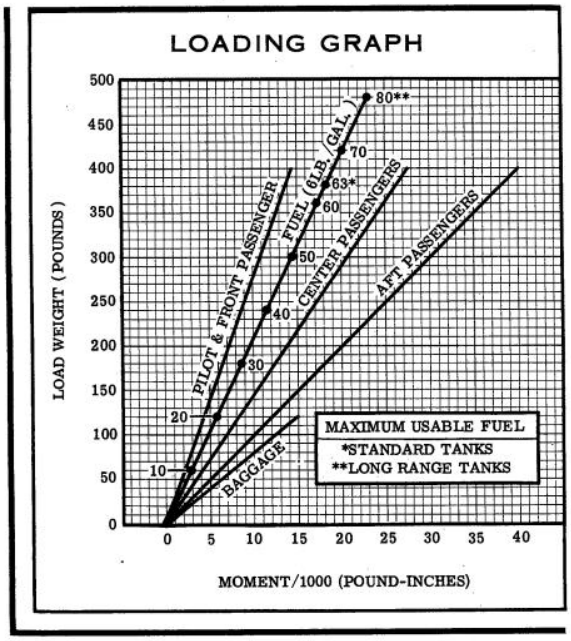
CENTER OF GRAVITY LIMITS



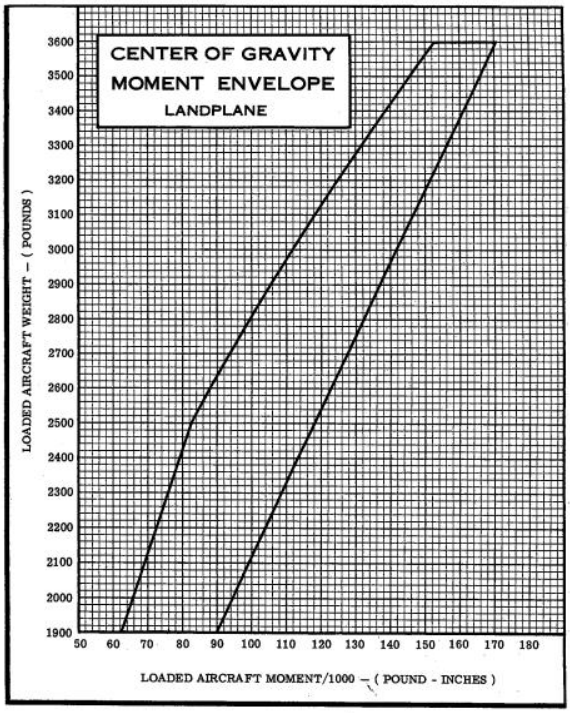
WARNING

It is the responsibility of the pilot to make sure that the airplane is loaded correctly. Operation outside of prescribed weight and balance limitations could result in an accident and serious or fatal injury.

Weight and Balance Charts (cont.)



3-6



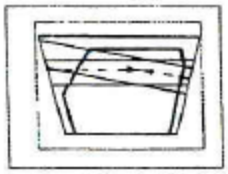
3-7

Cessna 206

SECTION 6
WEIGHT & BALANCE

MODEL 421C

WEIGHT AND MOMENT TABLES



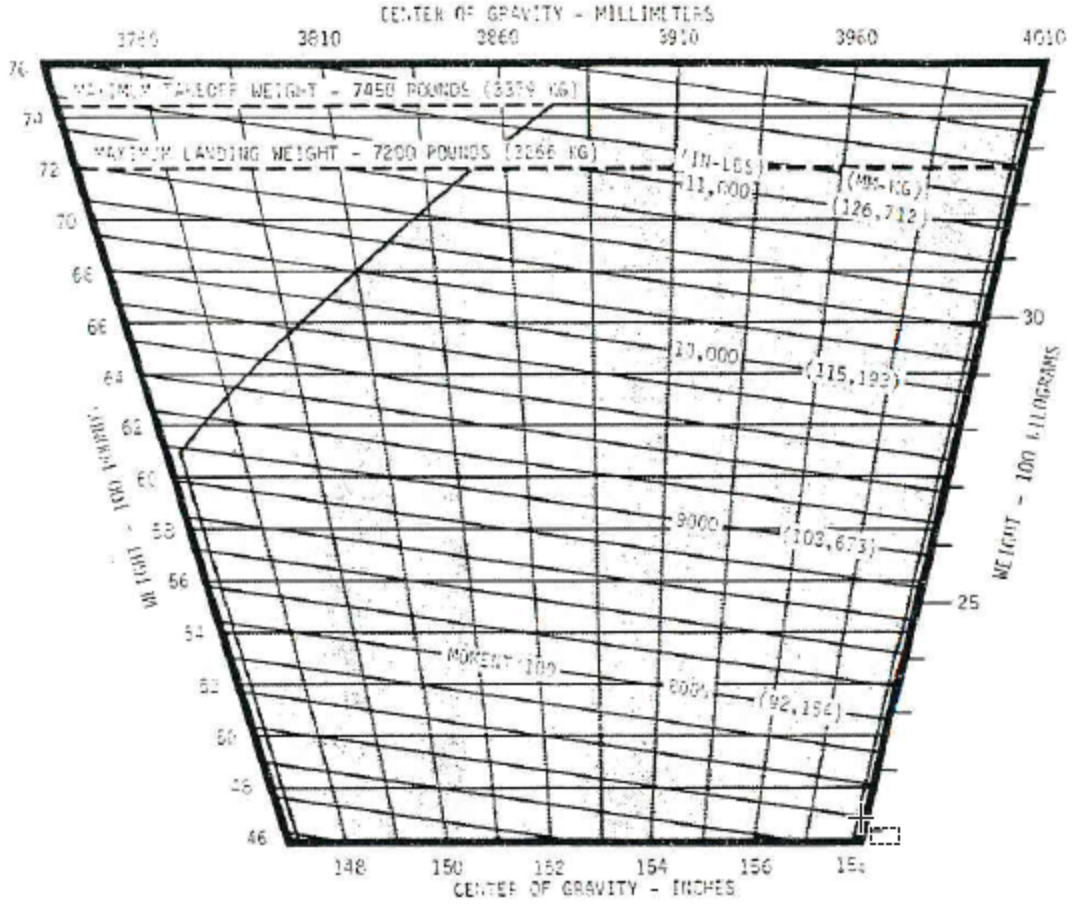
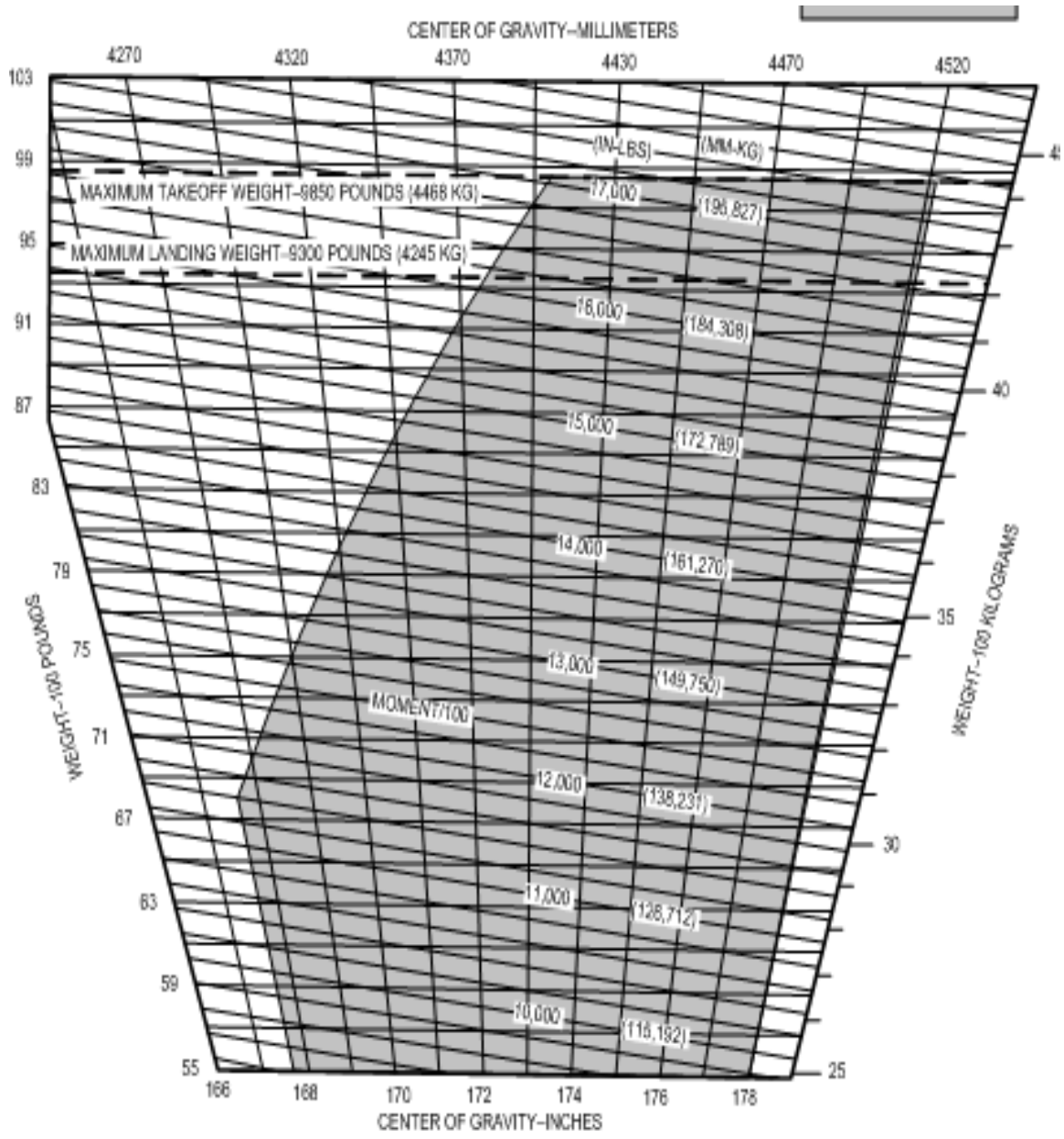


Figure 6-2 (Sheet 2 of 2)

Weight and Balance Charts (cont.)



Cessna 414

Cessna CE-500/501 (Cessna Citation I) - Weight and Balance

(Serial Numbers 500-0303 to 500-0689 (and 500-0001 to 500-0302 with Cessna Service Bulletin upgrades)

Aircraft _____ (i.e., N12345)	Weight (Lbs.)	Arm (In.)	Moment (In-lbs.)
Basic Empty Weight - Weighing Due _____			
Pilot-in-Command		131.0	
Second-in-Command		131.0	
Seat #3 Occupant		207.0	
Seat #4 Occupant		207.0	
Seat #5 Occupant		241.0	
Seat #6 Occupant		241.0	
Seat #7 Occupant		167.0	
Seat #8 Occupant		167.0	
Nose Baggage Compt. - *350 Lbs Max*		74.0	
Aft Cabin Baggage Compt. - *650 Lbs Max*		286.3	
Zero-Fuel Weight - *8400 Lbs Max*			
FUEL TANKS (Ramp) Gals		256.0	
Ramp Gross Weight - *12,000 Lbs Max*			
FUEL TANKS (Takeoff) Gals		256.0	
Takeoff Gross Weight - *11,850 Lbs Max*			
FUEL TANKS (Landing) Gals		256..0	
Landing Gross Weight - *11,350 Lbs Max*			

TCDS No. A22CE

Typical Empty Weight: 7084 Lbs.

Approximate Fuel Densities @ 15° C	
Jet A / A-1	6.75 PPG
JET B / JP-4	6.5 PPG
JP-5	6.8 PPG
JP-8	6.7 PPG
AVGAS 100LL	6 PPG
AVGAS 100 / 80	5.8 PPG

Max. Useable Fuel: *564 Gallons*

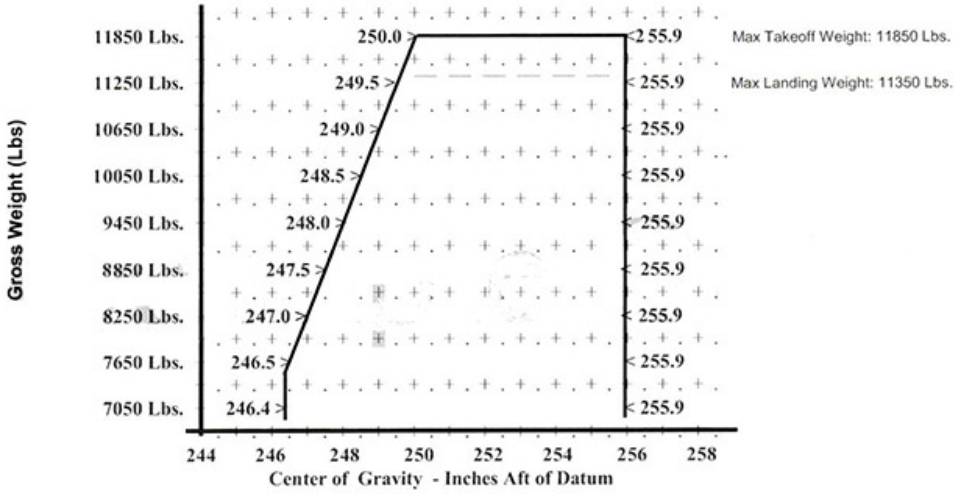
Fuel to Taxi: *209 Lbs. every 10 Mins.*

Fuel used, *Takeoff to Landing:*

CE-500/501 - Center of Gravity Limits vs. Gross Weight

[**C.G. Range** (Gear Extended): **11,850 Lbs**: +250.0 to +255.9 / **7,500 Lbs or less**: +246.4 to +255.9]

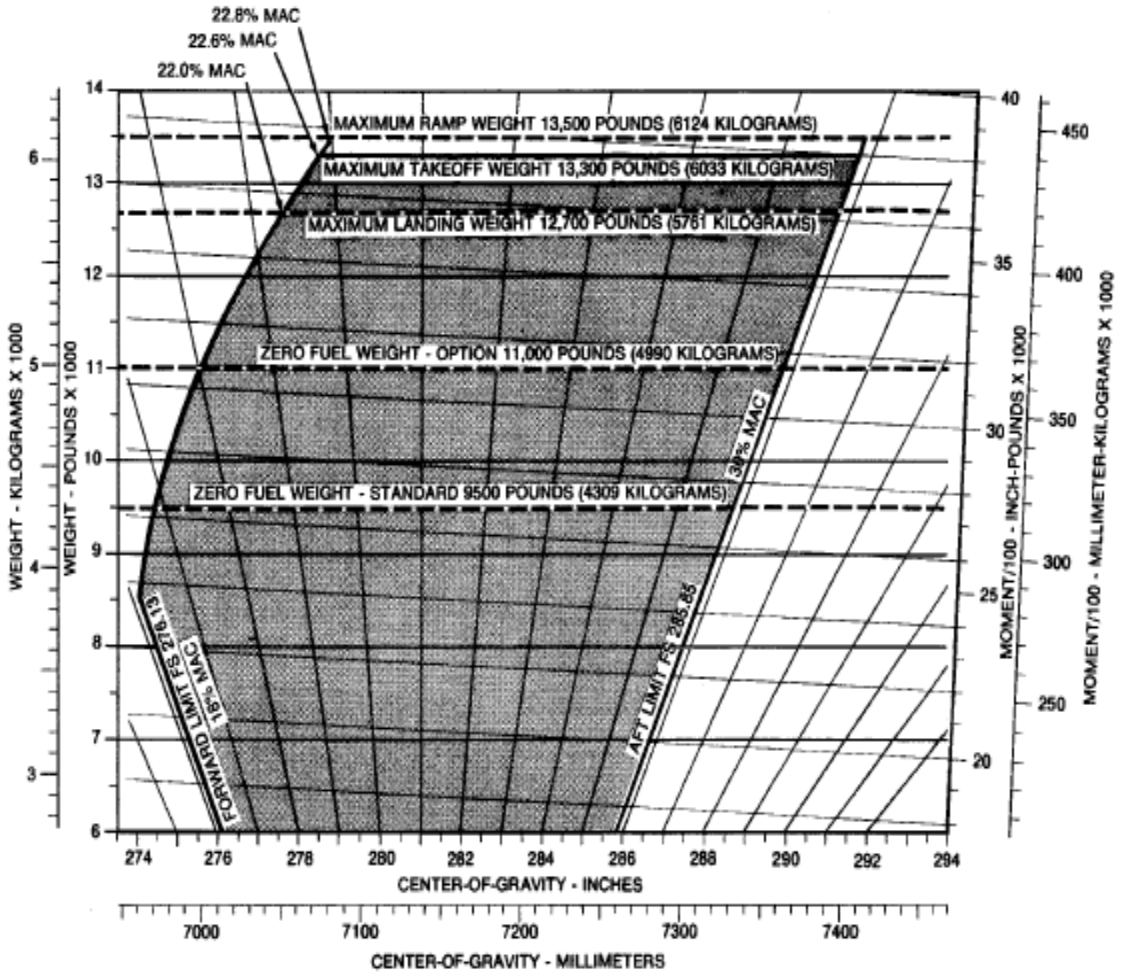
(Straight line variation between points given).

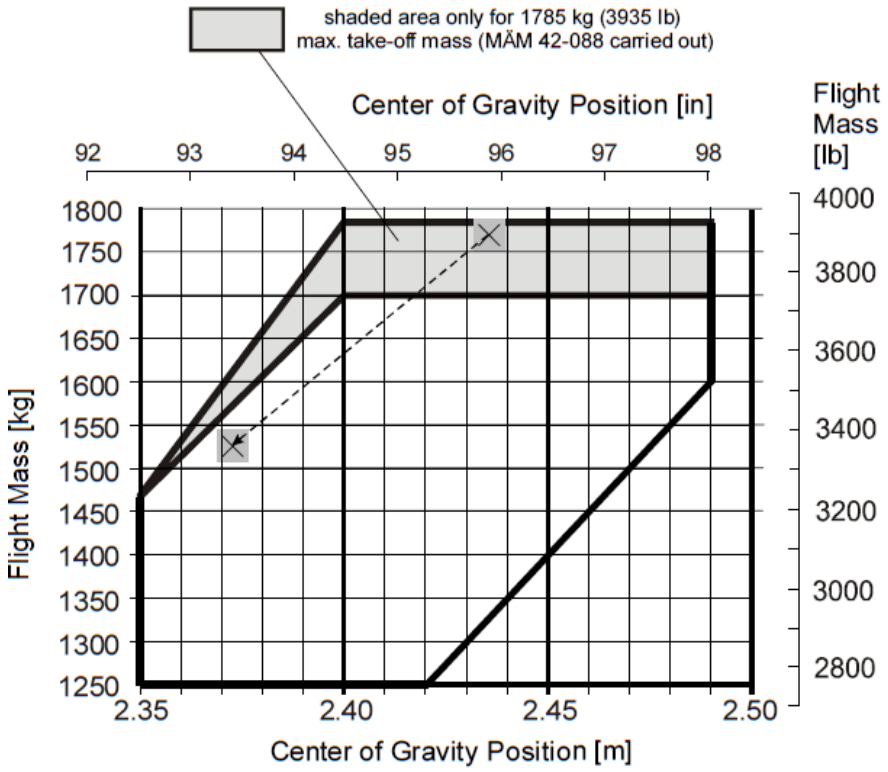


Cessna Citation 501

MODEL 550

CENTER-OF-GRAVITY MOMENT ENVELOPE





DA 42 AFM	Diamond AIRCRAFT	Mass and Balance

The flight CG position must be within the following limits:

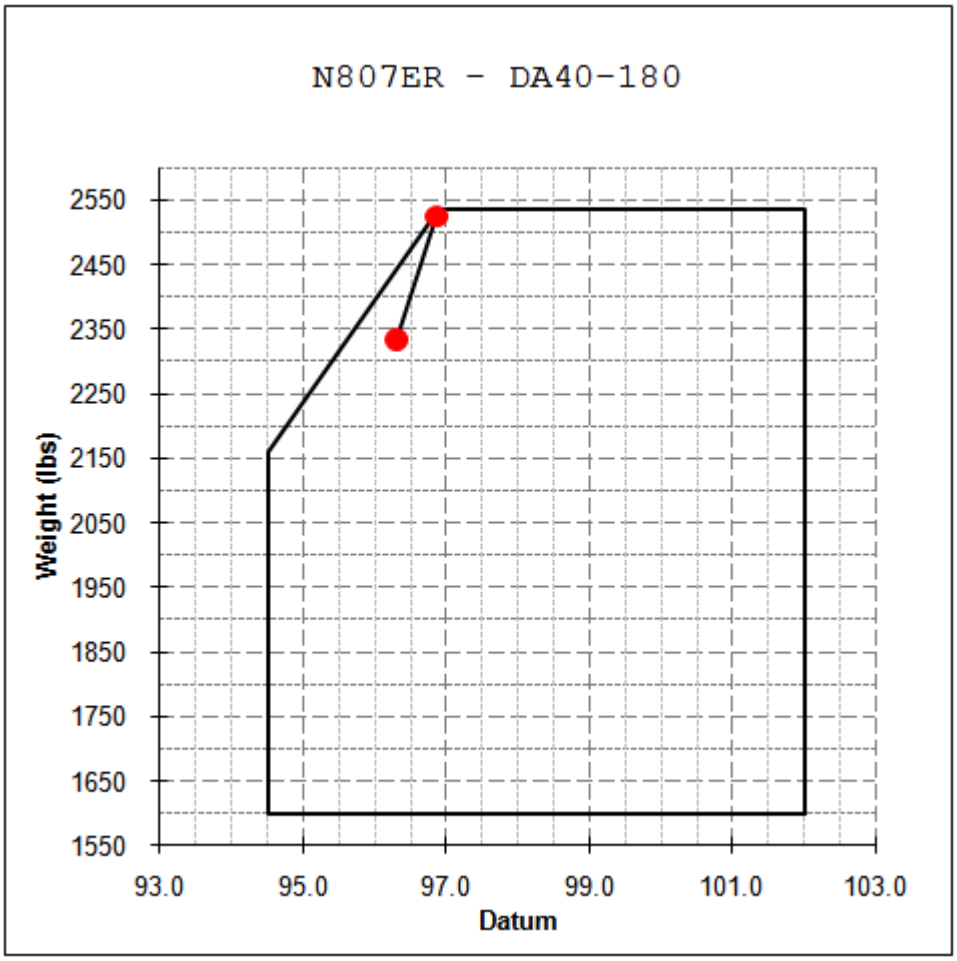
Most forward flight CG:

2.35 m (92.52 in) aft of Datum Plane at 1250 kg (2756 lb)
2.35 m (92.52 in) aft of Datum Plane at 1468 kg (3236 lb)
2.40 m (94.49 in) aft of Datum Plane at max. take off mass (see Section 2.7)
linear variation in between

Most rearward flight CG:

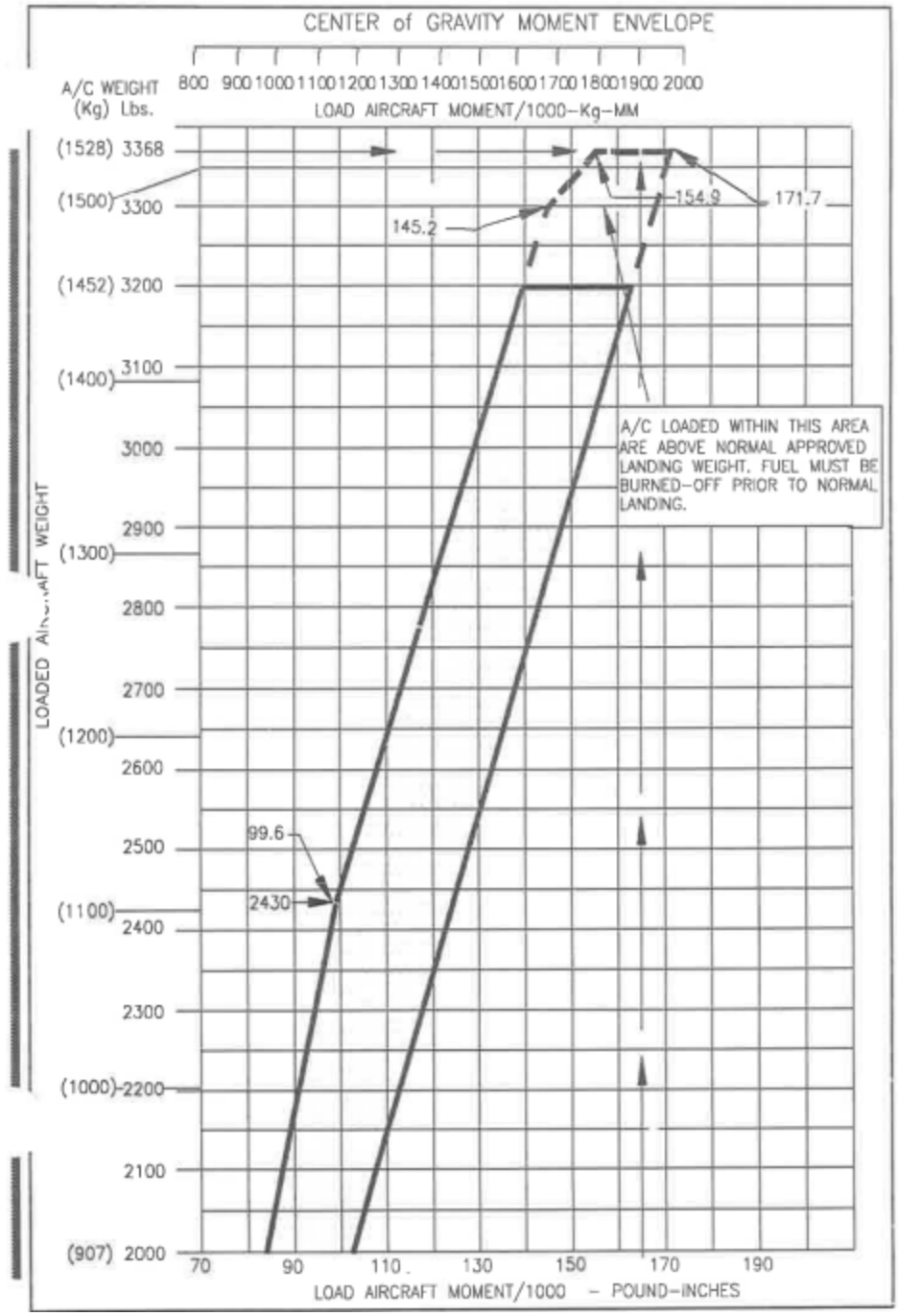
2.42 m (95.28 in) aft of Datum Plane at 1250 kg (2756 lb)
2.49 m (98.03 in) aft of Datum Plane at 1600 kg (3527 lb)
2.49 m (98.03 in) aft of Datum Plane at max. take off mass (see Section 2.7)
linear variation in between

Center of Gravity Charts and References (cont.)



Weight and Balance Charts (cont.)

M20M - CENTER OF GRAVITY MOMENT ENVELOPE

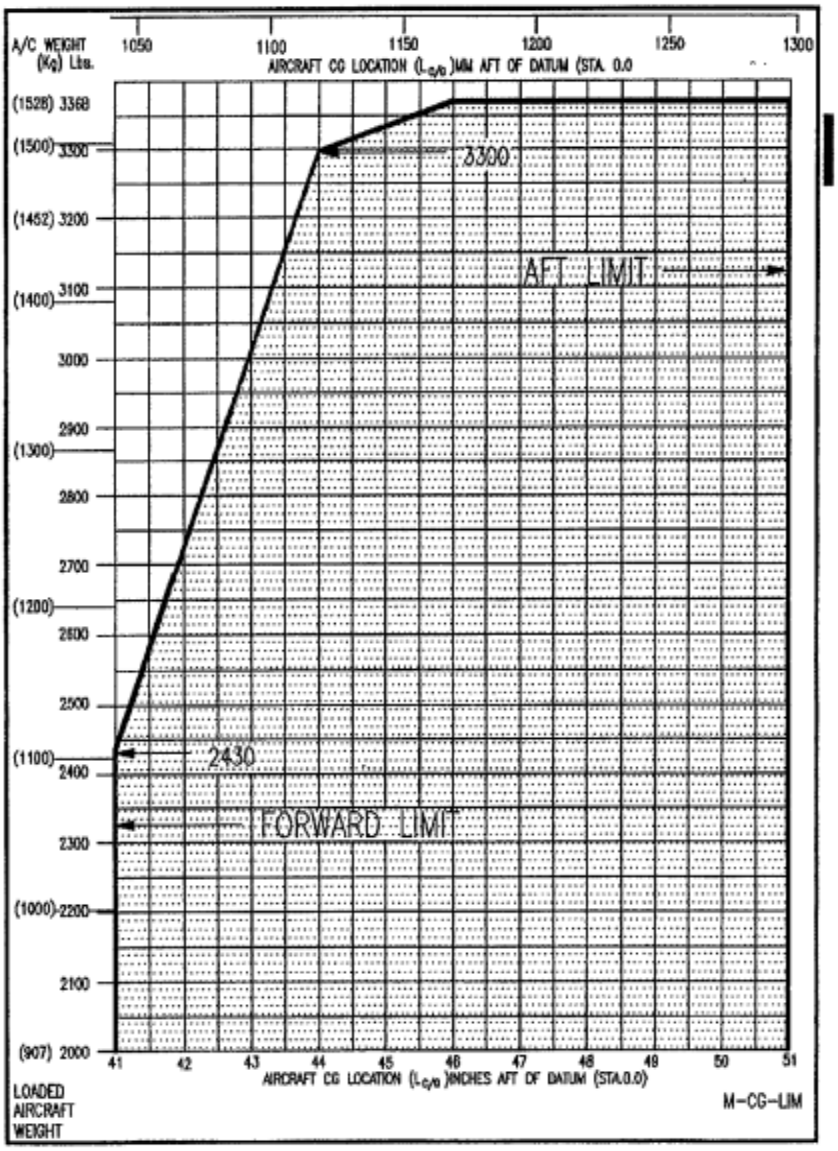


Weight and Balance Charts (cont.)

MOONEY
M20M

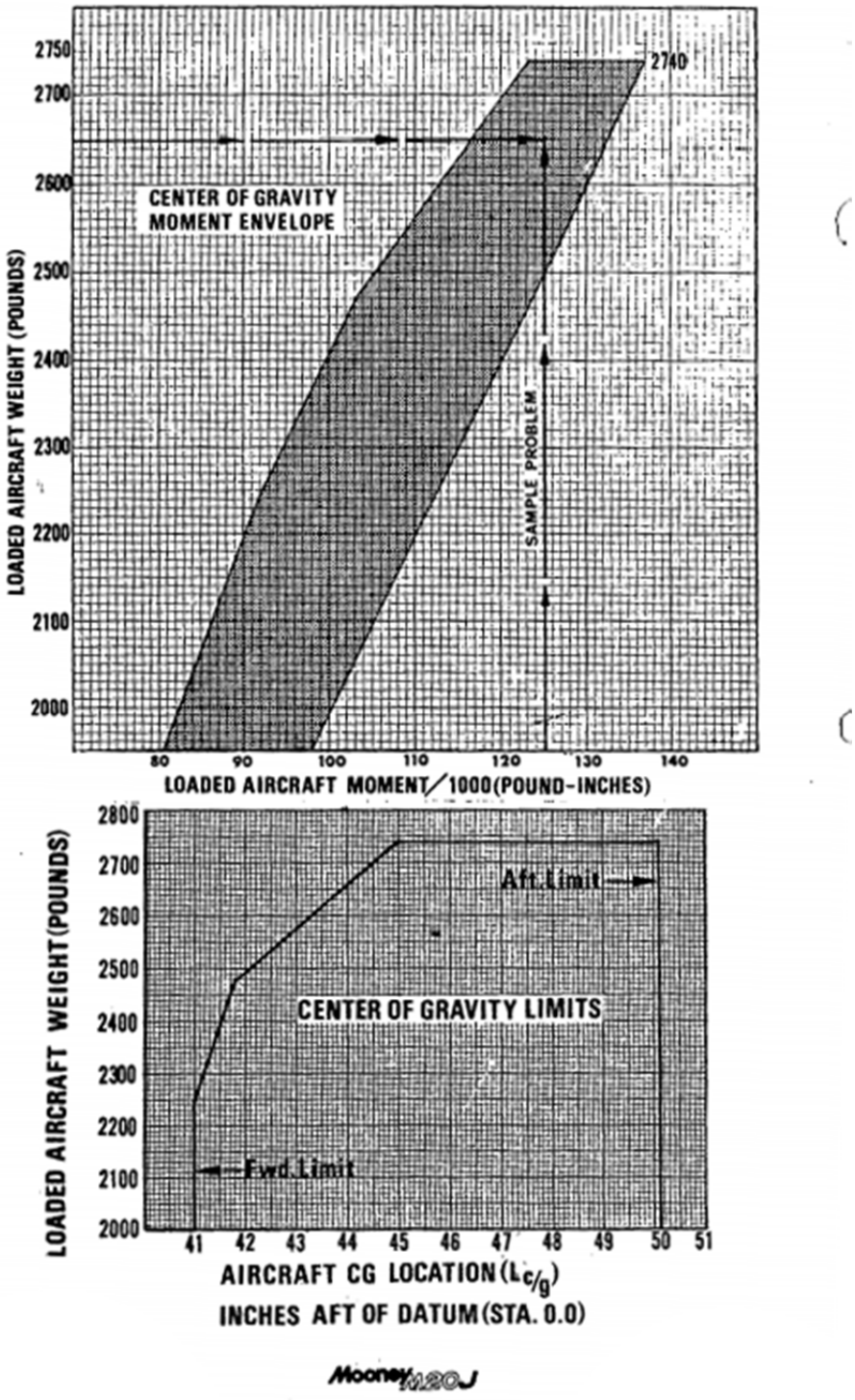
WEIGHT AND BALANCE

M20M - CENTER OF GRAVITY LIMITS ENVELOPE



Mooney M20M

Weight and Balance Charts (cont.)

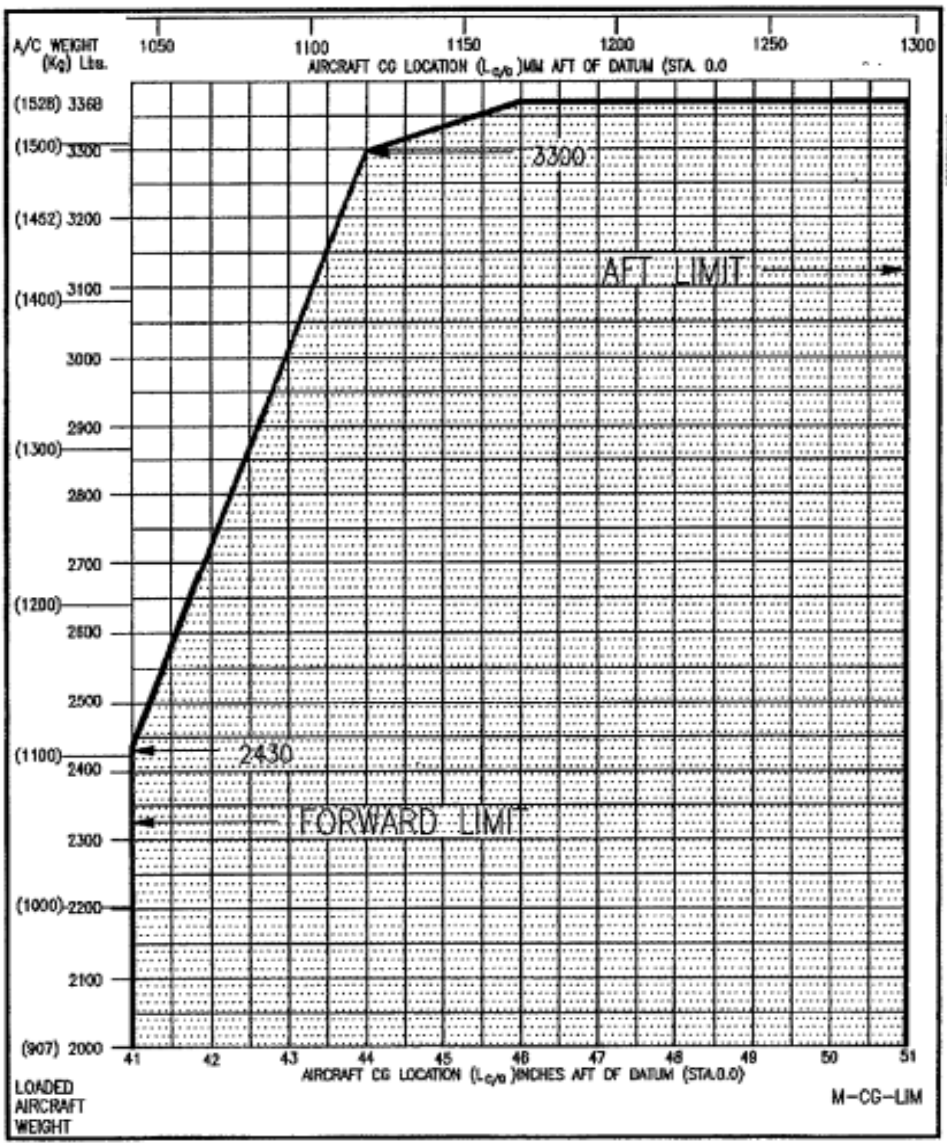


Mooney M20J

MOONEY
Encore

WEIGHT AND BALANCE

M20M - CENTER OF GRAVITY LIMITS ENVELOPE

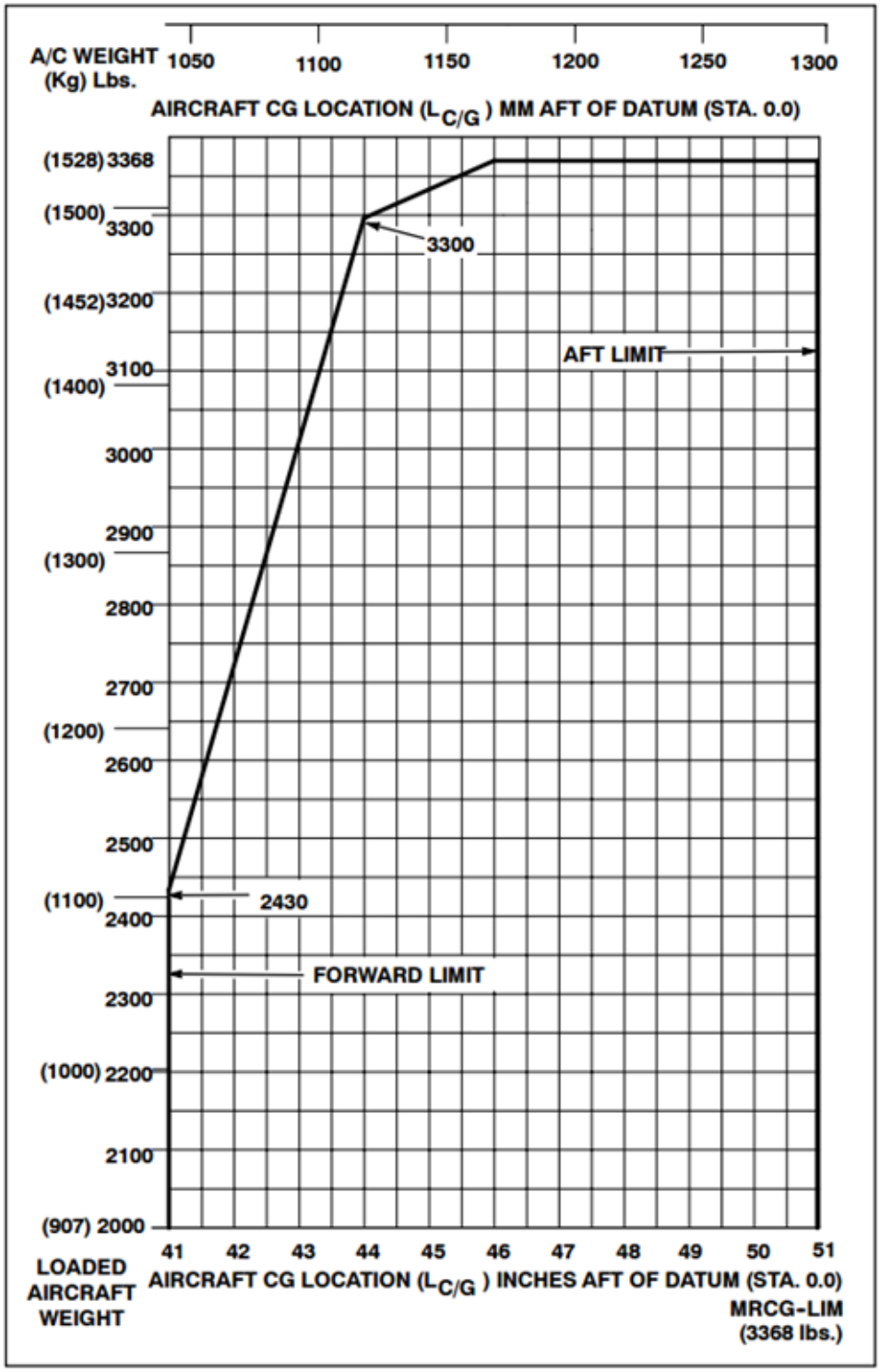


Weight and Balance Charts (cont.)

MOONEY

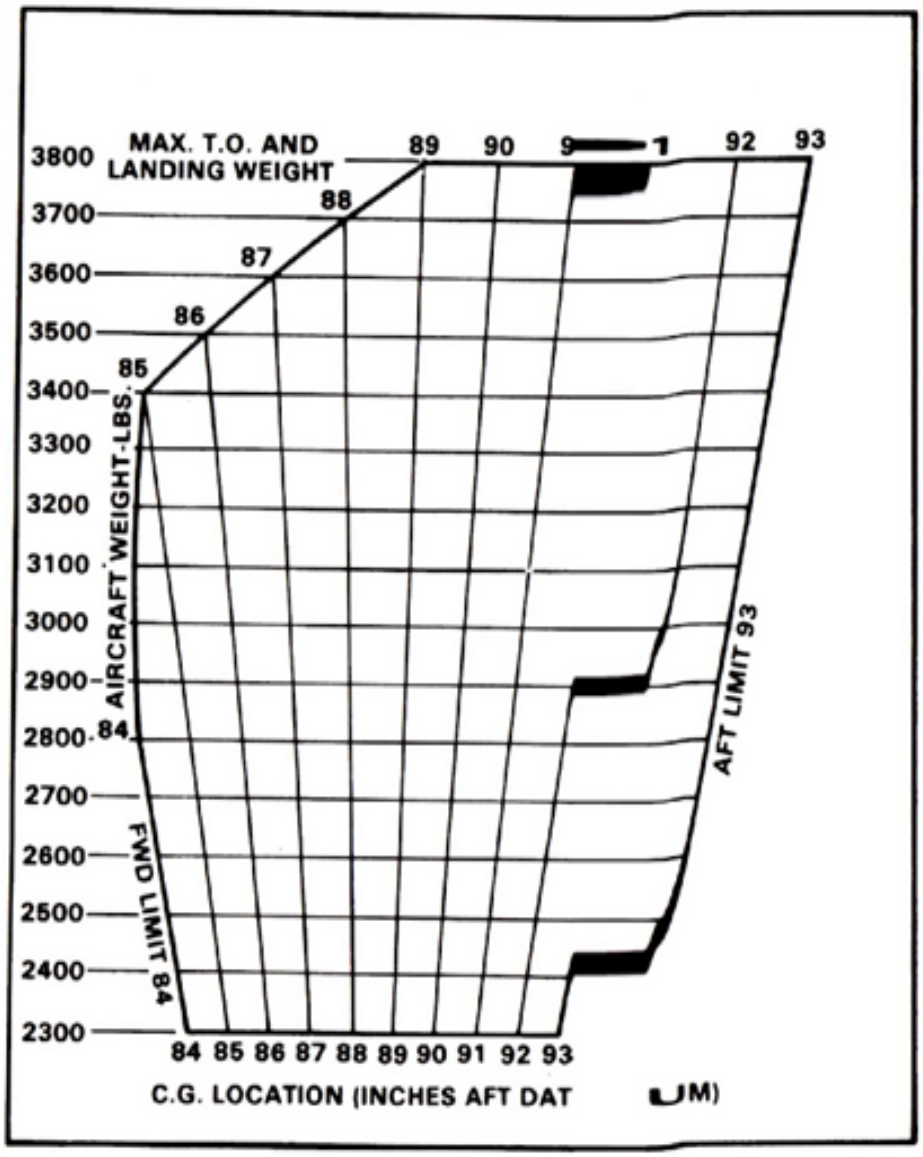
WEIGHT AND BALANCE

M20TN - CENTER OF GRAVITY LIMITS ENVELOPE



Mooney 231

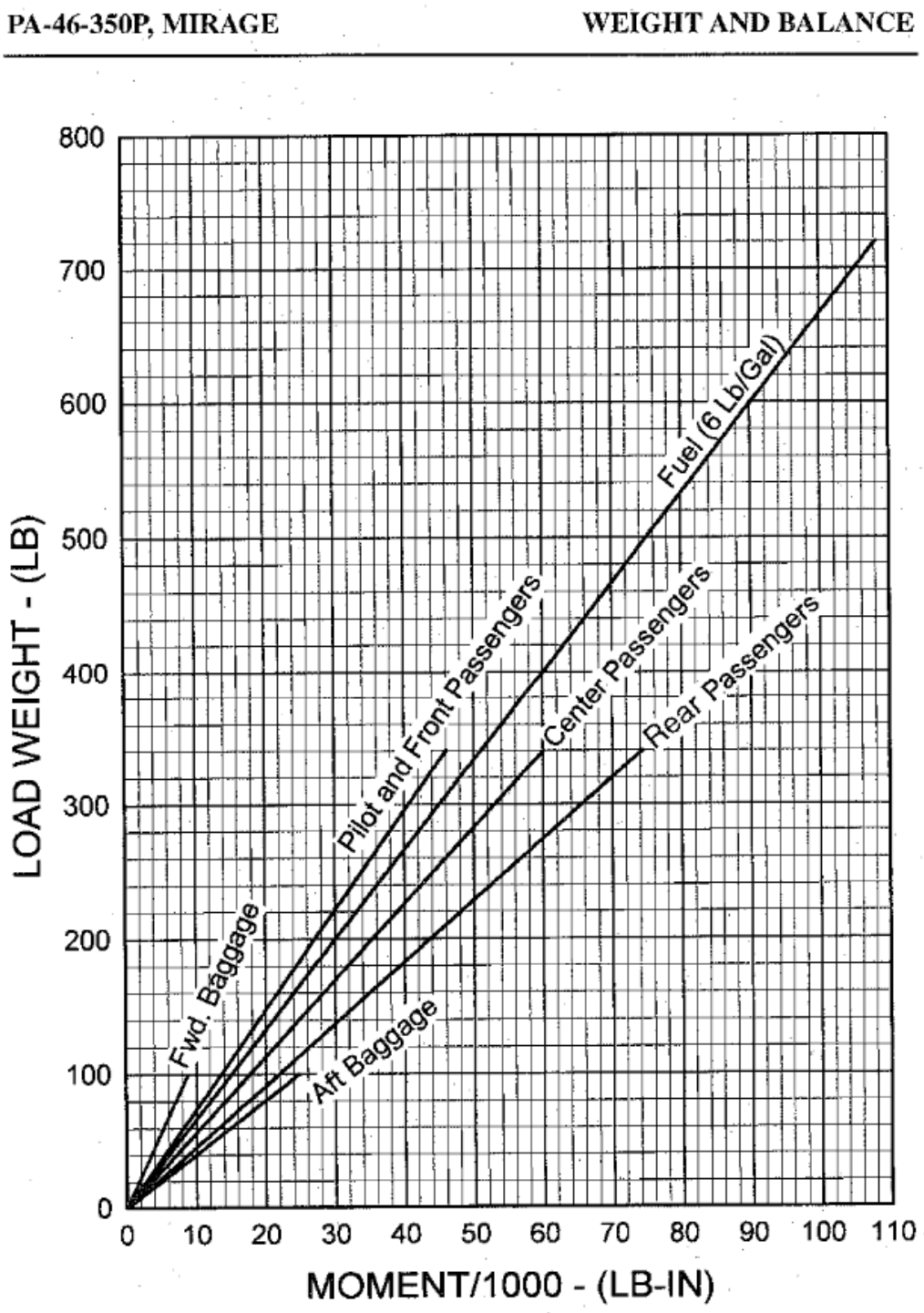
Weight and Balance Charts (cont.)



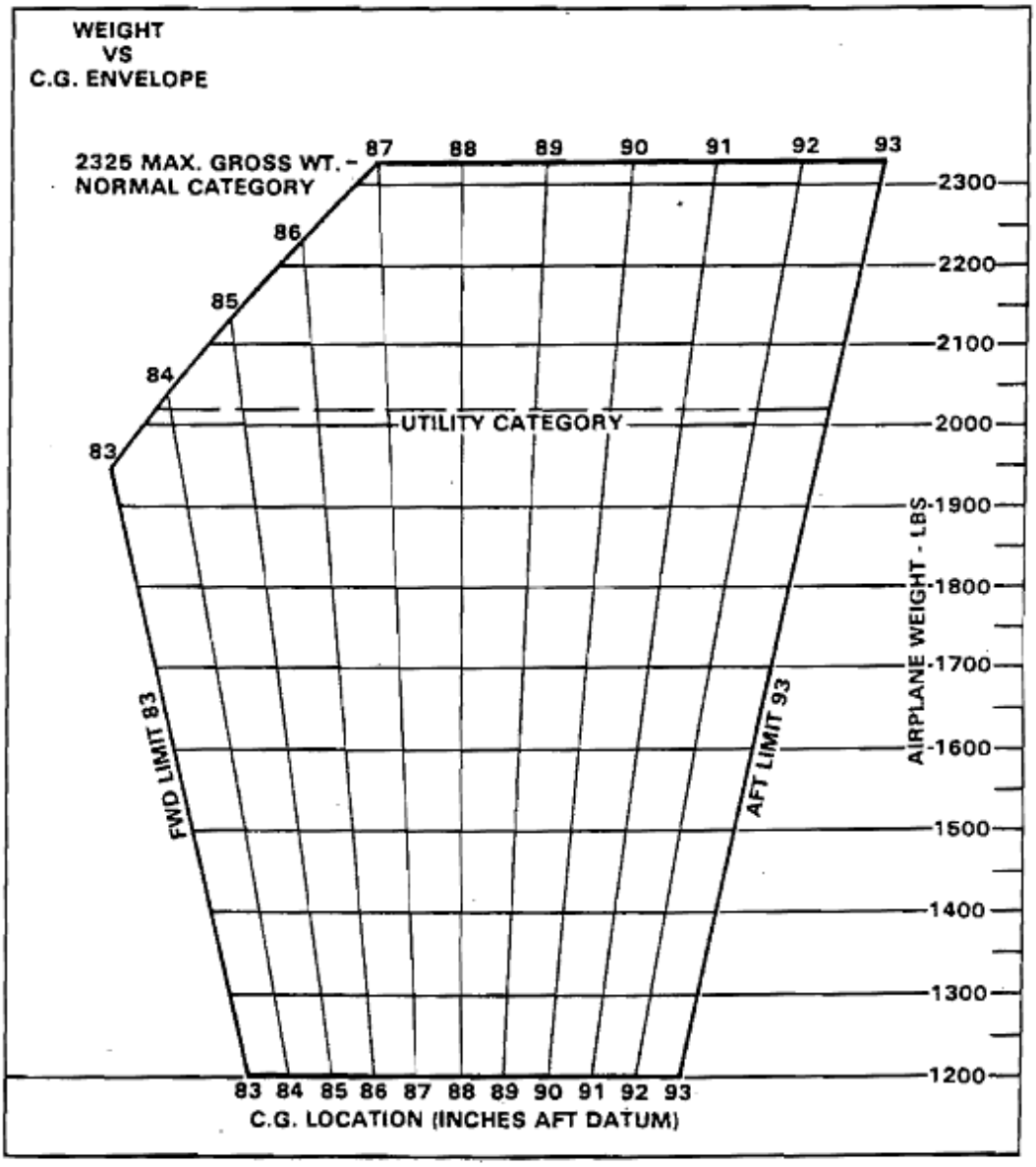
C.G. RANGE AND WEIGH[redacted]T
Figure 6-15

Piper Seminole

Weight and Balance Charts (cont.)



Piper Mirage

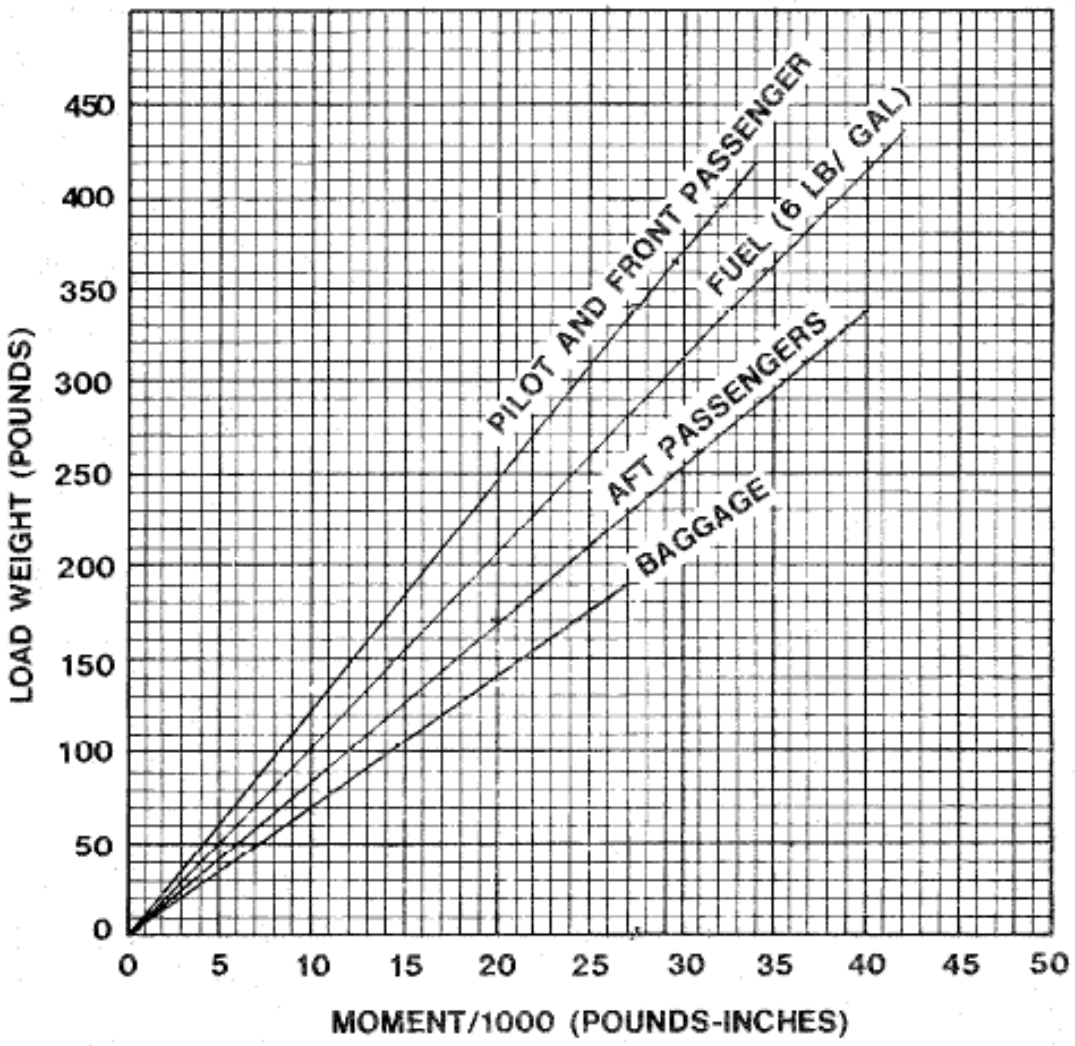


Piper Warrior

Weight and Balance Charts (cont.)

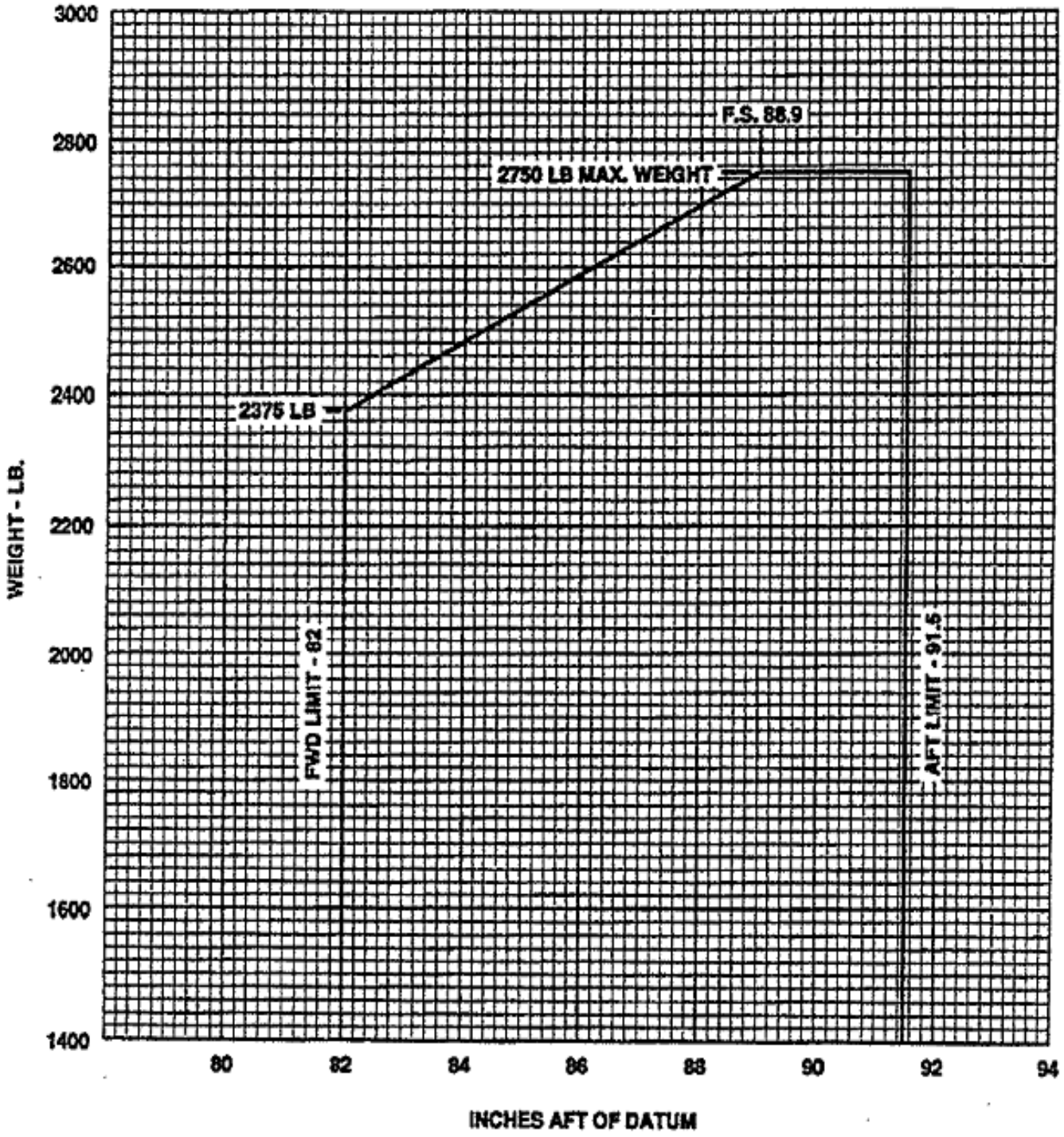
PIPER AIRCRAFT CORPORATION
PA-28R-201, CHEROKEE ARROW III

WEIGHT AND BALANCE



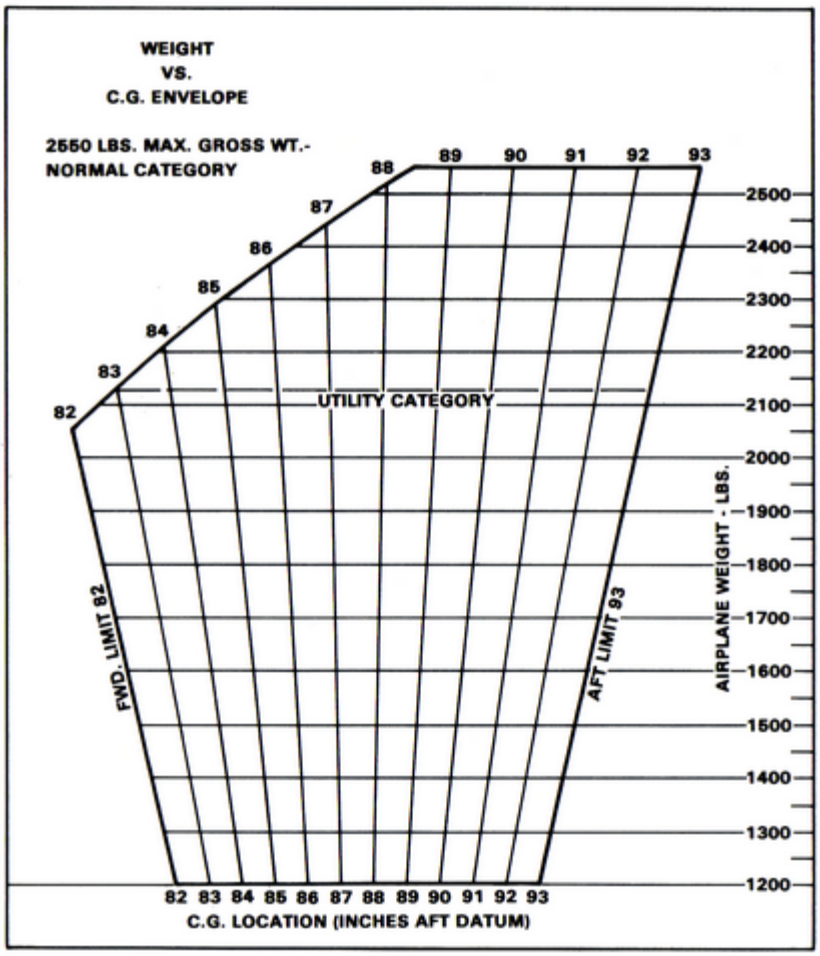
Piper Arrow III

Weight and Balance Charts (cont.)



Piper Arrow IV

Weight and Balance Charts (cont.)

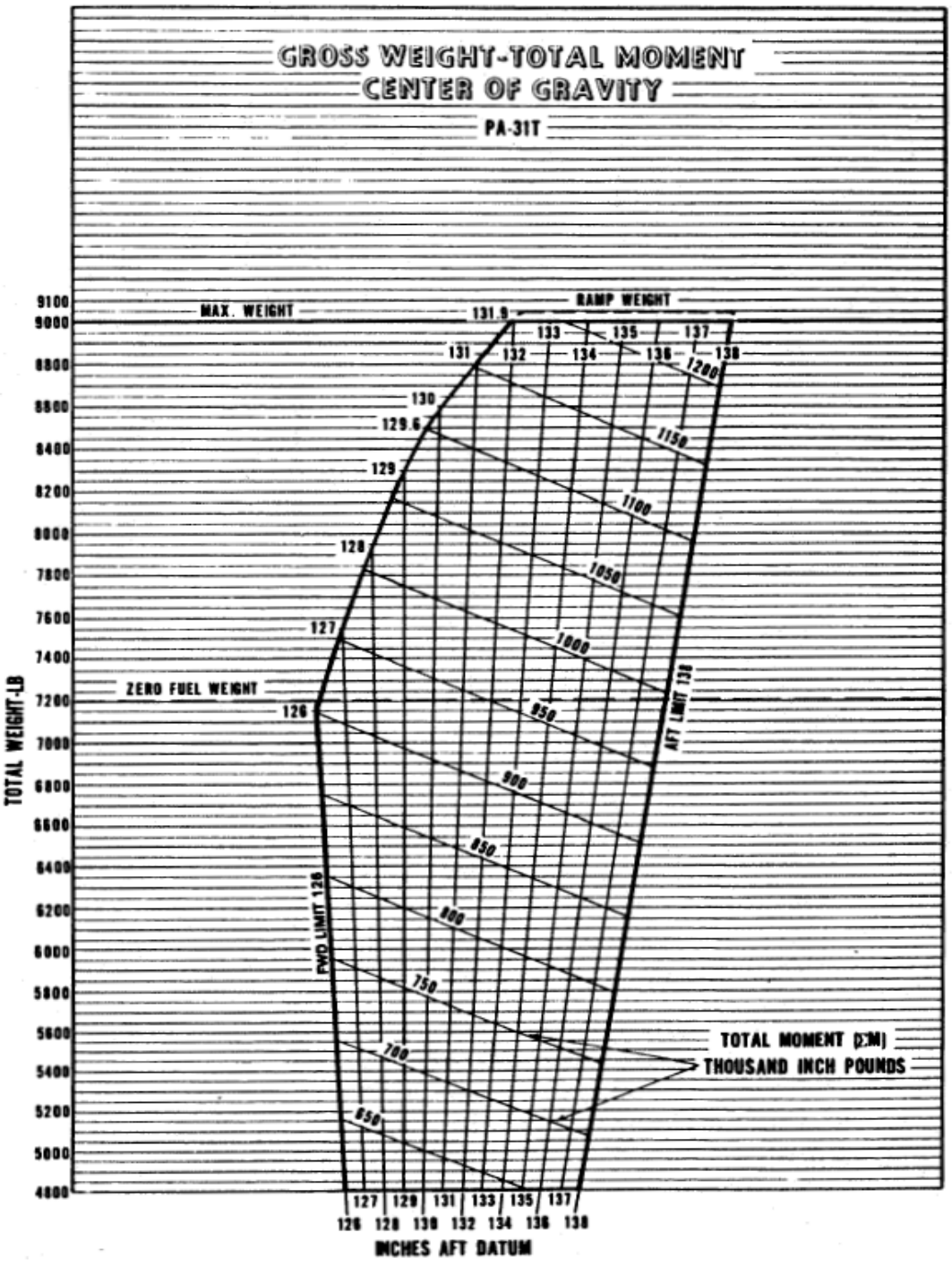


C.G. RANGE AND WEIGHT
Figure 6-15

Piper Archer

Weight and Balance Charts (cont.)

WEIGHT AND BALANCE PIPER AIRCRAFT CORPORATION
PA-31T, CHEYENNE

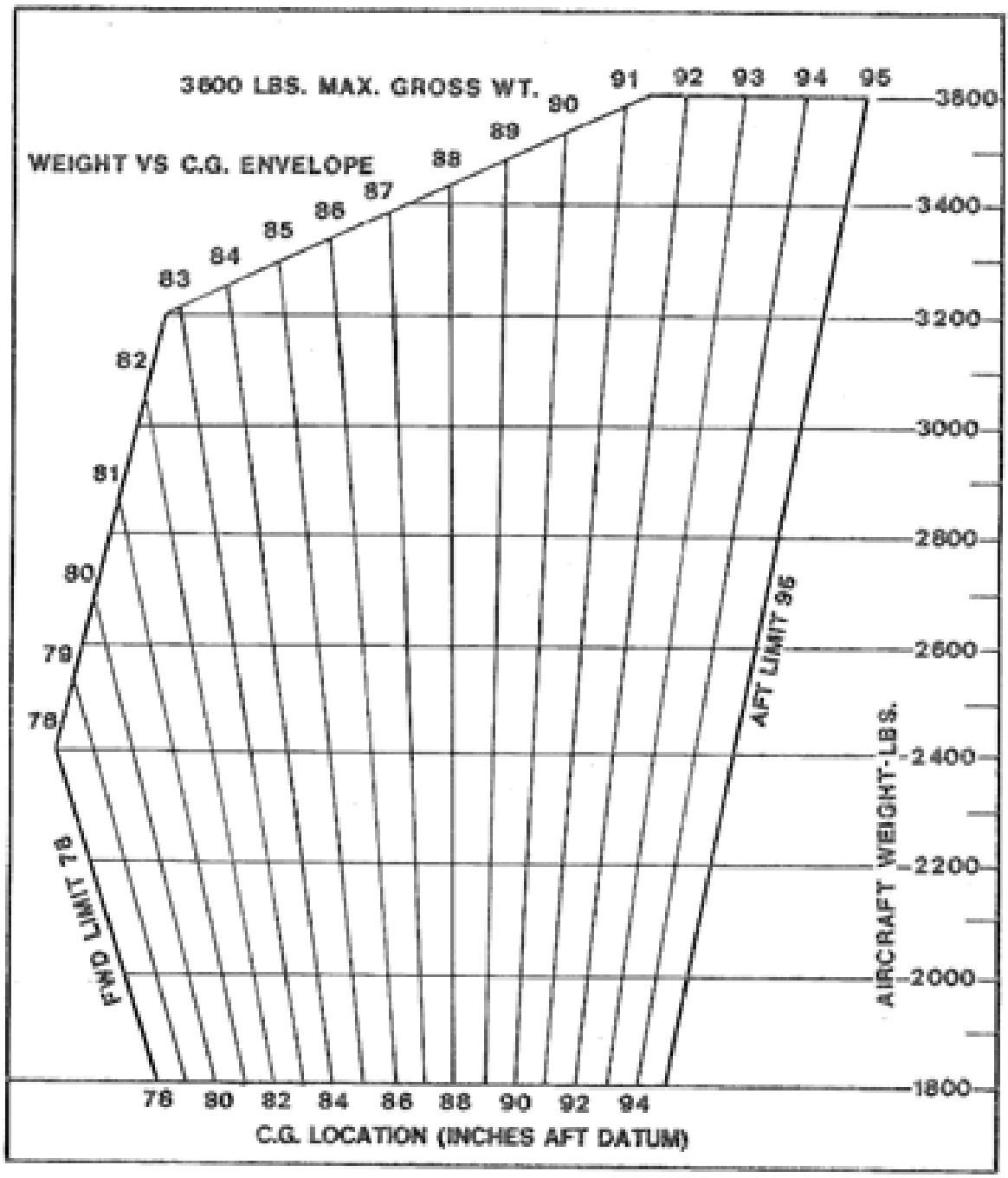


C.G. LIMITS GRAPH

Piper Cheyenne

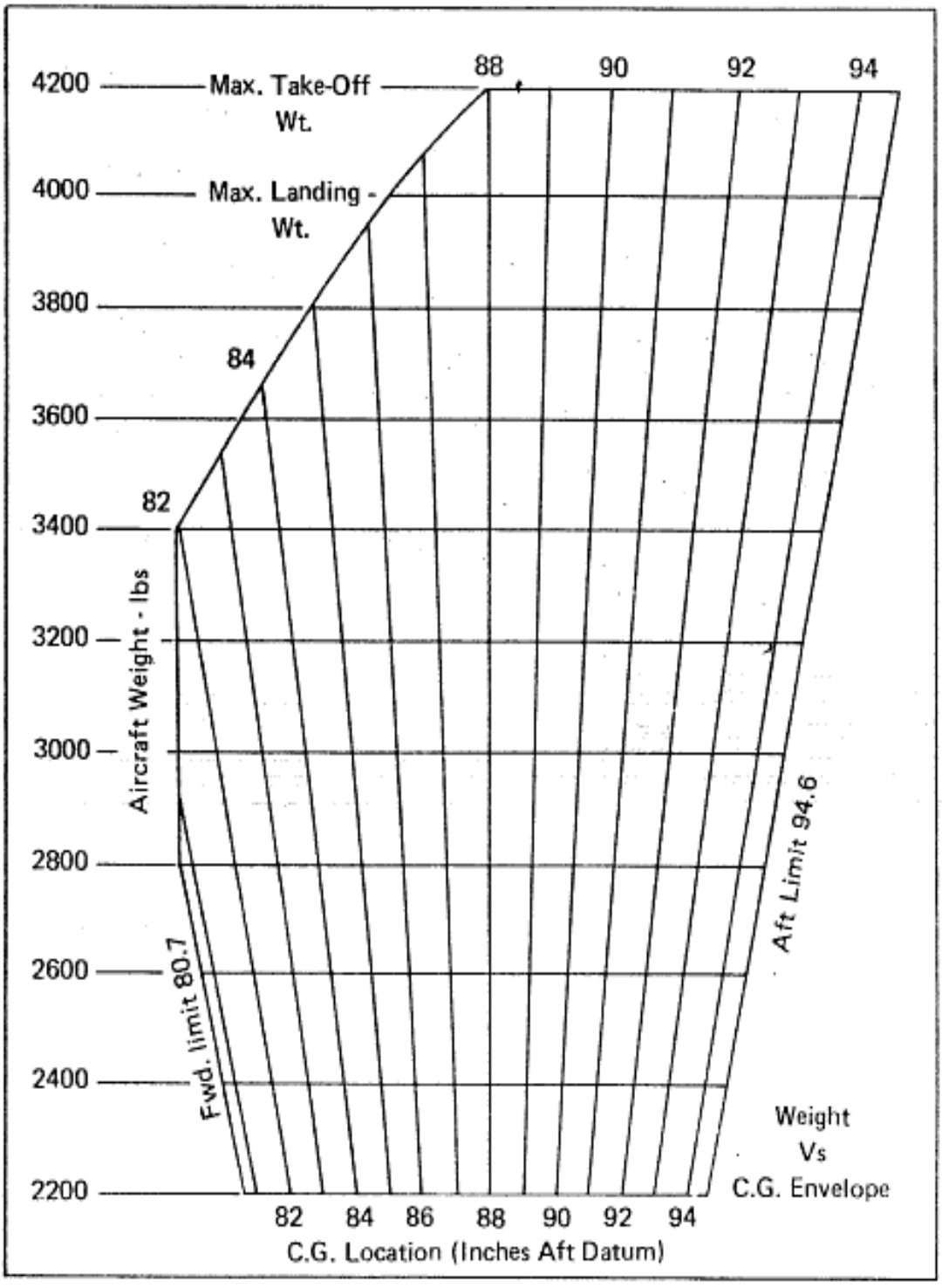
WEIGHT AND BALANCE

PIPER AIRCRAFT CORPORATION
PA-32R-301T, TURBO SARATOGA SP



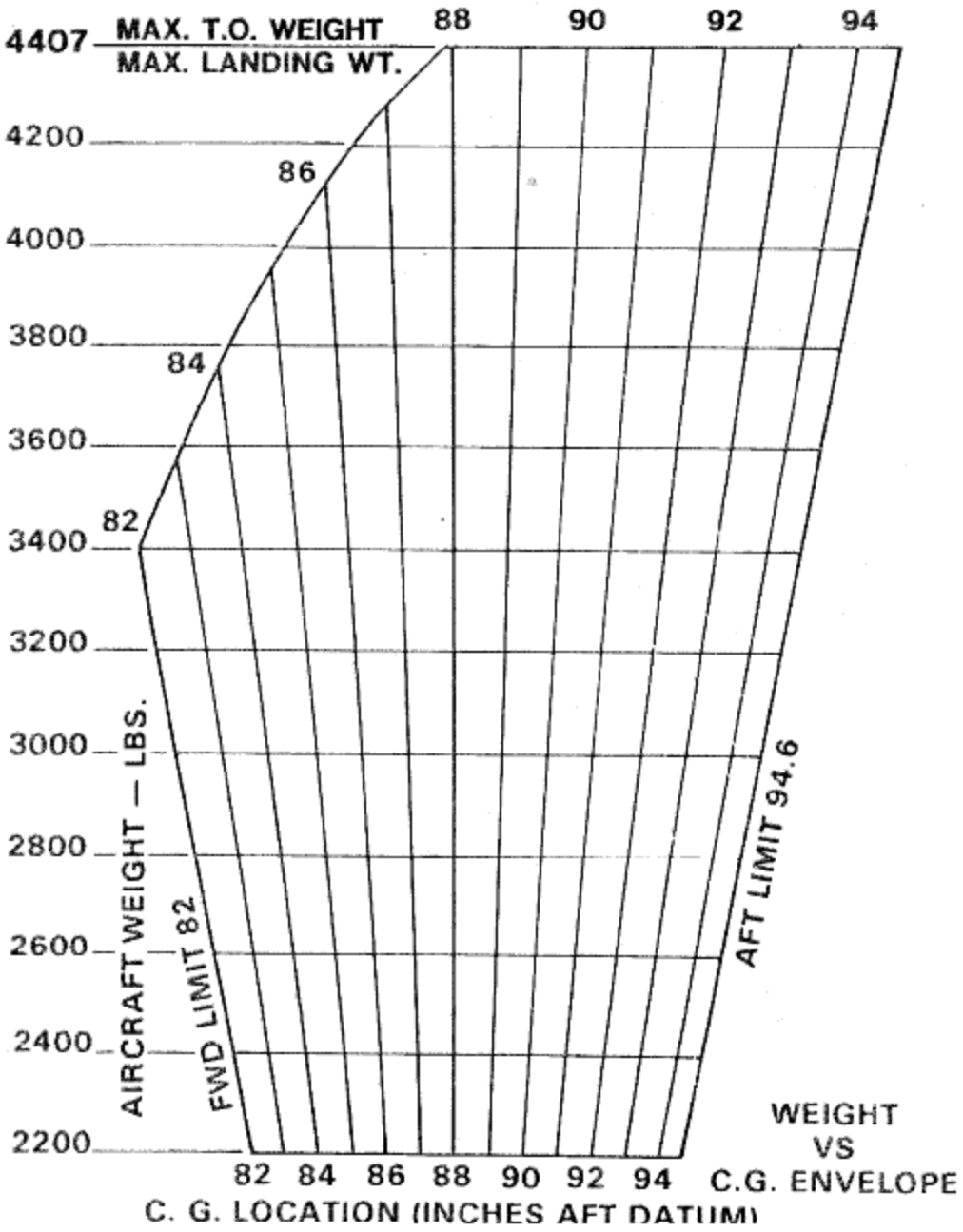
Piper Saratoga

Weight and Balance Charts (cont.)



Piper Seneca I

Weight and Balance Charts (cont.)



Piper Seneca III

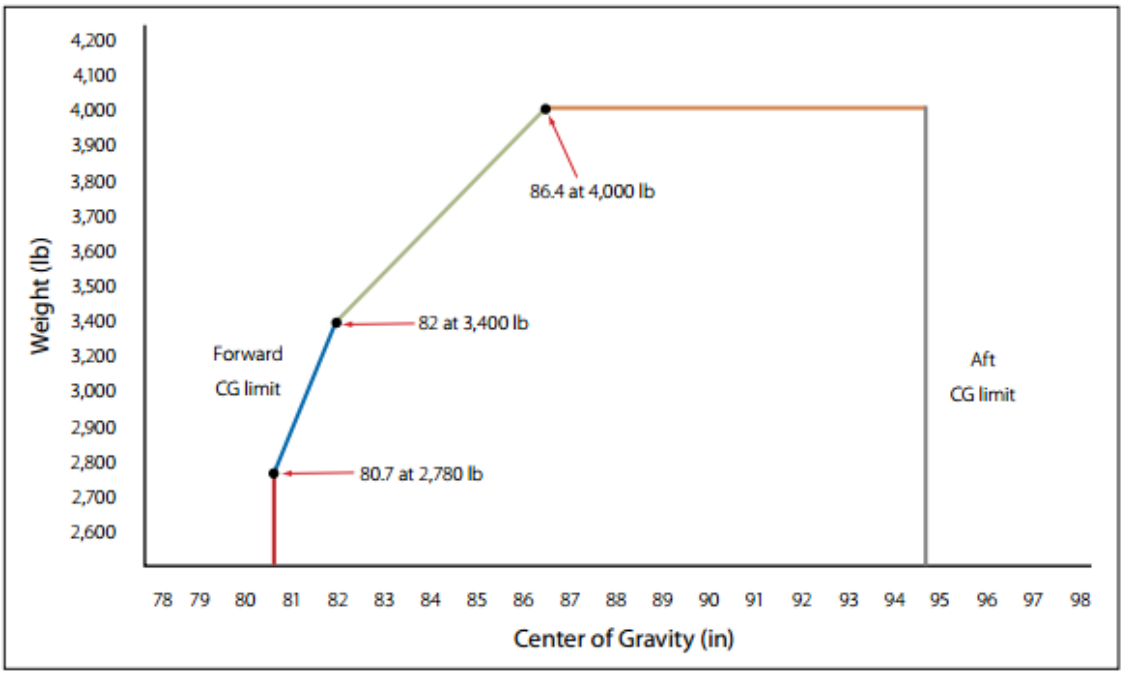
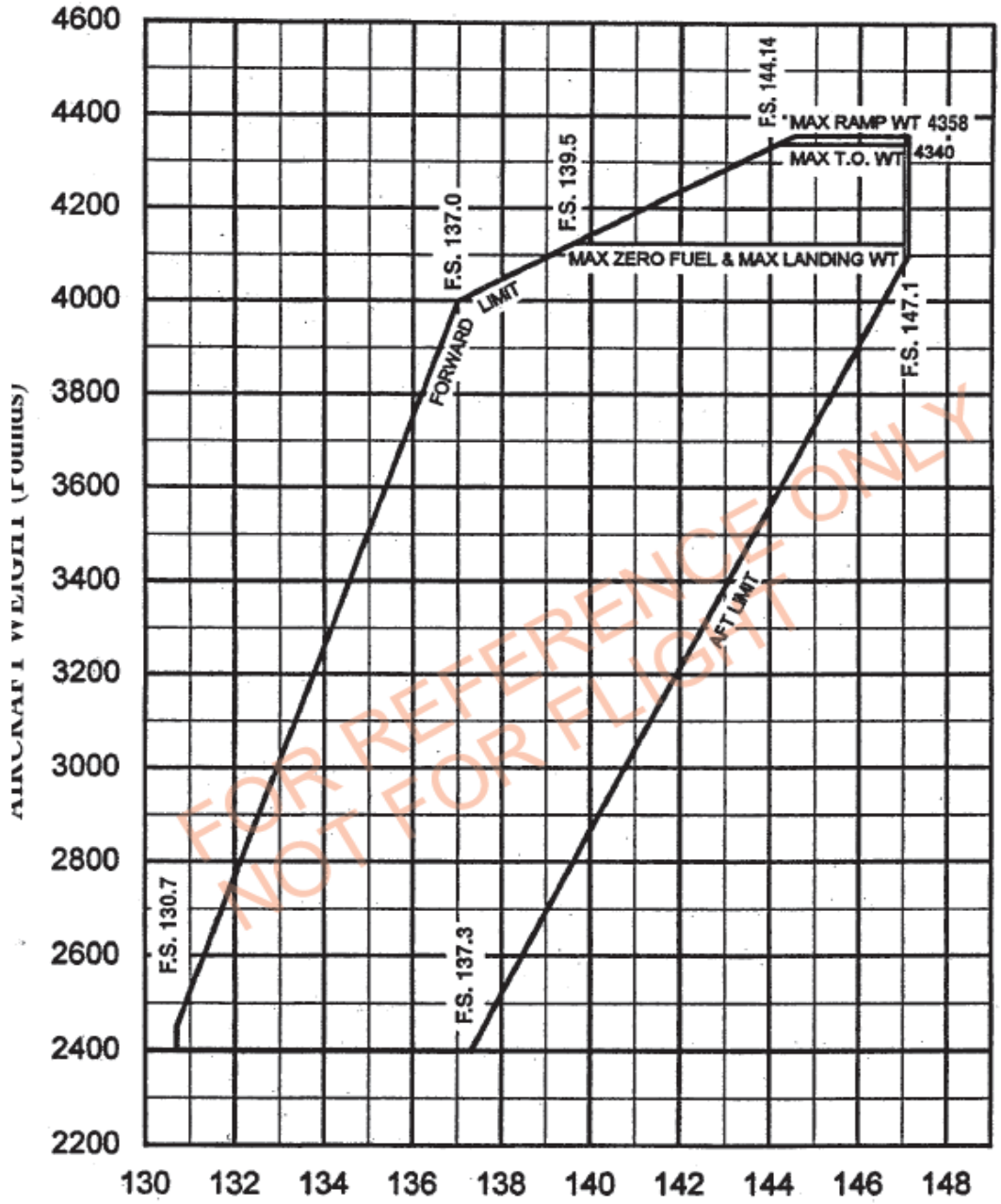


Figure 4-19. Center of gravity envelope for the Piper Seneca.

Piper Seneca V

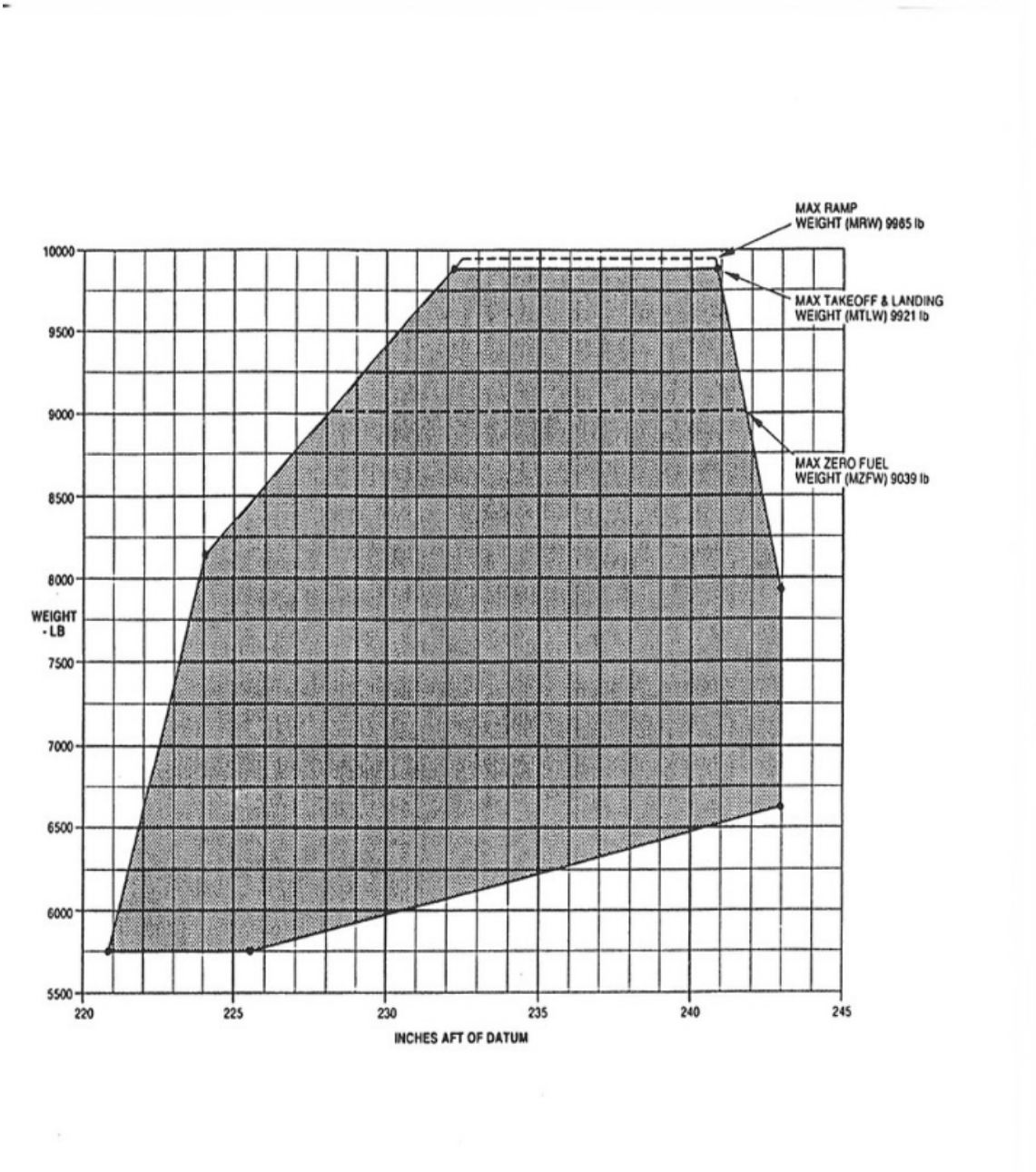
Weight and Balance Charts (cont.)

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (Continued)



Piper Malibu Meridian

Weight and Balance Charts (cont.)

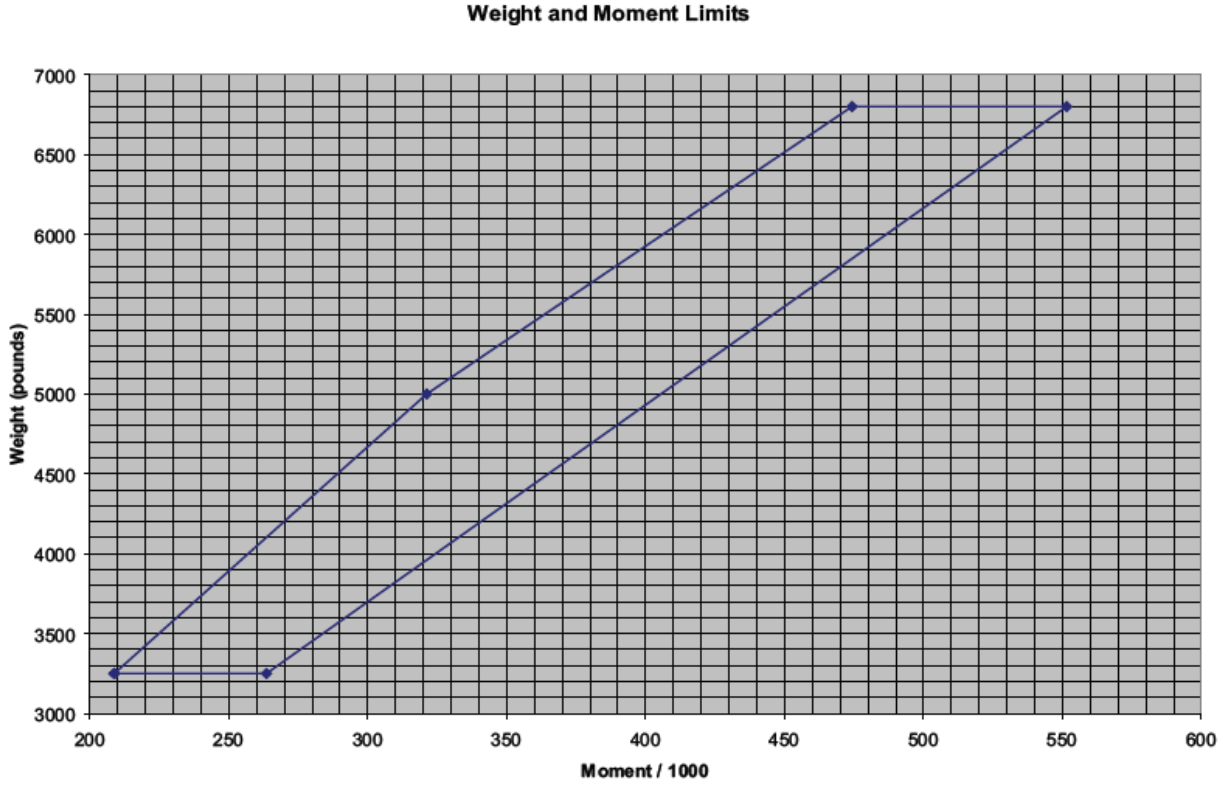


Pilatus PC-12

Weight and Balance Charts (cont.)

6-17 WEIGHT AND MOMENT LIMITS

Use the following chart or table to determine if the weight and moment calculations from the Weight and Balance Loading Form are within limits.

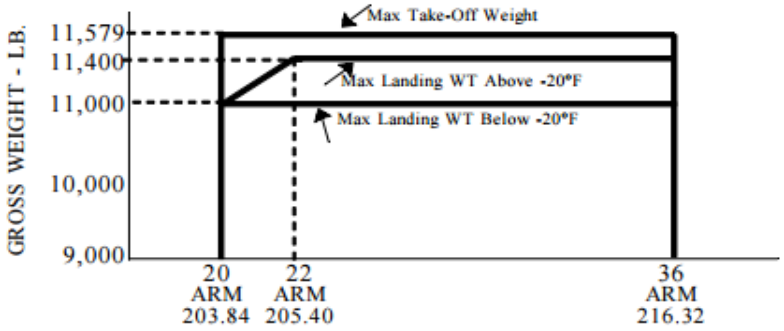


Weight and Balance Charts (cont.)

C.G. range (Landing gear fixed)

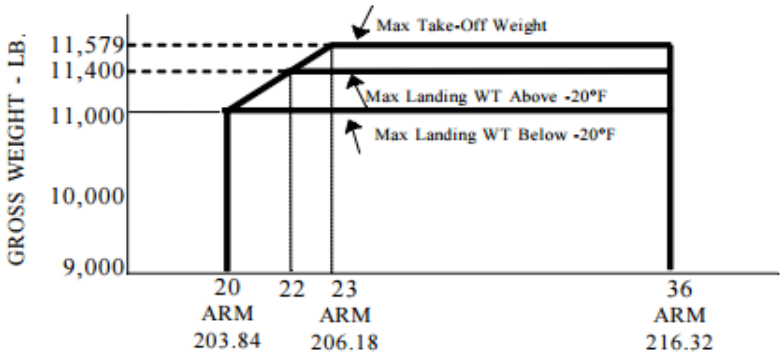
Without Mod. 6/1020 - Same as Model 1
With Mod. 6/1020 - "Fuselage Beam, Front Wing Spar Reinforcing"

LANDPLANE



HORIZONTAL C.G. LIMIT - % MAC

SKIPLANE



FLOATPLANE

Forward Limit — 25% M.A.C. (STA. 207.74) at all weights up to max. of 11,600 lb.

Aft Limit — 32% M.A.C. (STA. 213.20) at all weights up to max. of 11,600 lb.

Empty weight C.G. range: None

Maximum weights: With Mod. 6/1020 - "Fuselage Beam, Front Wing Spar Reinforcing"

	Landplane (lb.)	Skiplane (lb.) (With Item 201(a)&(b))	Floatplane (lb.) (With Item 202(a)&(b))
Take-off	11579	11579	11600
Landing	11400*	11400*	11600

**See NOTE 5 - Temperature Limitations Without Mod. 6/1020 - Same as Model 1.*

Minimum Crew: One (pilot). (+95.0 in.)

No. of seats: 21 (including two at Stn. +95.0 in.) - Limited by approved seating arrangement. (See Weight and Balance Handbook).

Max. 24 (including two at Stn. +95.0 in.) -Limited by emergency exit requirements. (Approval of seating arrangement is required).

Twin Otter

Performance References for Validation Standard Day Altimeter 29.92" Temperature

59°f / 15°c Note: SL=Sea Level / 5K=5,000ft Standard Lapse Rate of -2°C per 1000 ft

ELEV	Aircraft	T/O Weight	Speed(V_{NE})	Cruise Pwr 25 "HG 2500 RPM	Stall Speed Landing CFG	Power Climb Rate
	BEECHCRAFT					
SL	Beechcraft A36	3600 lbs	204 KTAS	165 KTAS	56 KTAS	1220 fpm
5K		3600 lbs	204 KTAS	176 KTAS	56 KTAS	910 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**75% Pwr Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Beechcraft A36TC	3650 lbs	246 KTAS	223 KTAS	66 KTAS	1165 fpm
5K		3650 lbs	246 KTAS	206 KTAS	66 KTAS	920 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr 22 "HG 2200 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Beechcraft Baron 55	5100 lbs	223 KTAS	154 KTAS	73 KTAS	1700 fpm
5K		5100 lbs	223 KTAS	167KTAS	73 KTAS	1240 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr Full Throttle 2300 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Beechcraft Baron G58/58A	5500 lbs	223 KTAS	195 KTAS	73 KTAS	1700 fpm
5K		5500 lbs	223 KTAS	203 KTAS	73 KTAS	1310 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**75% Pwr Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Beechcraft Travelair 95	4200 lbs	208 KTAS	154 KTAS	61 KTAS	1250 fpm
5K		4200 lbs	208 KTAS	162 KTAS	61 KTAS	910 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr 24 "HG 2300 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Beechcraft Duchess 76	3900 lbs	194 KTAS	143 KTAS	60 KTAS	1275 fpm
5K		3900 lbs	194 KTAS	154 KTAS	60 KTAS	950 fpm
	CESSNA					
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**75%- 77% Pwr Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Cessna 152	1670 lbs	145 KTAS	100 KTAS	35 KTAS	715 fpm
4K		1670 lbs	145 KTAS	104 KTAS	35 KTAS	505 fpm
SL	Cessna 172P	2400 lbs	152 KTAS	112 KTAS	46 KTAS	700 fpm
5K		2400 lbs	152 KTAS	118 KTAS	46 KTAS	470 fpm
SL	Cessna 172S	2550 lbs	160 KTAS	117 KTAS	48 KTAS	730 fpm
5K		2550 lbs	160 KTAS	121 KTAS	48 KTAS	550 fpm
SL	Cessna 182T	2950 lbs	172 KTAS	150 KTAS	52 KTAS	890 fpm
5K		2950 lbs	172 KTAS	159 KTAS	52 KTAS	665 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr 24 "HG 2400 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Cessna T182T	3100 lbs	170 KTAS	129 KTAS	50 KTAS	1040 fpm

5K	Cessna T182T	3100 lbs	170 KTAS	138 KTAS	50 KTAS	963 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr 24 "HG 2500 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Cessna T206H	3600 lbs	180 KTAS	127 KTAS	57 KTAS	990 fpm
5K		3600 lbs	180 KTAS	140 KTAS	57 KTAS	705 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**75%- 77% Pwr Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Cessna 210M	3800 lbs	195 KTAS	158 KTAS	59 KTAS	860 fpm
5K		3800 lbs	195 KTAS	170 KTAS	59 KTAS	615 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr 24 "HG 2500 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Cessna T206H	3600 lbs	180 KTAS	127 KTAS	56 KTAS	990 fpm
5K		3600 lbs	180 KTAS	140 KTAS	56 KTAS	705 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr 31.5 "HG 2450 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Cessna 414A	6750 lbs	232 KTAS	174 KTAS	72 KTAS	1540 fpm
5K		6750 lbs	232 KTAS	182 KTAS	72 KTAS	1425 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**Cruise Pwr 32.5 "HG 1900 RPM**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Cessna 421C	7450 lbs	238 KTAS	166 KTAS	74 KTAS	1950 fpm
5K		7450 lbs	238 KTAS	195 KTAS	74 KTAS	1750 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**75% PWR Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
	Mooney					
SL	Diamond DA-20	1764 lbs	159 KTAS	130 KTAS	45 KTAS	930 fpm
5K		1764 lbs	159 KTAS	138KTAS	45 KTAS	633 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**92% PWR Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Diamond DA-40NG	2888 lbs	172 KTAS	154 KTAS	62 KTAS	777 fpm
5K		2888 lbs	172 KTAS	162 KTAS	62 KTAS	720 fpm
SL	Diamond DA-42NG	4407 lbs	188 KTAS	155 KTAS	59 KTAS	1337 fpm
5K		4407 lbs	188 KTAS	159 KTAS	59 KTAS	1200 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**75%Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
	Mooney					
SL	Mooney M20J	2900 lbs	195 KTAS	155 KTAS	56 KTAS	795 fpm
5K		2900 lbs		162 KTAS	56 KTAS	520 fpm
SL	Mooney Encore M20K	2900 lbs	196 KTAS	188 KTAS	58 KTAS	1080 fpm
5K		2900 lbs		196 KTAS	58 KTAS	800 fpm
	PIPER					
SL	Piper Warrior II	2325 lbs	153 KTAS	107 KTAS	50 KTAS	710 fpm
5K		2325 lbs		114 KTAS	50 KTAS	475 fpm

ELEV	Aircraft	T/O Weight	Speed(V_{NE})	75%Cruise Speed	Stall Speed Landing CFG	Power Climb Rate
SL	Piper Archer III	2550 lbs	148 KTAS	121 KTAS	52 KTAS	690 fpm
5K		2550 lbs	148 KTAS	126 KTAS	52 KTAS	490 fpm
SL	Piper Arrow III	2750 lbs	186 KTAS	133 KTAS	55 KTAS	825 fpm
5K		2750 lbs	186 KTAS	140 KTAS	55 KTAS	600 fpm
SL	Piper Arrow IV Turbo	2900 lbs	186 KTAS	132 KTAS	58 KTAS	950 fpm
5K		2900 lbs	186 KTAS	142 KTAS	58 KTAS	900 fpm
SL	Piper Seneca I	4200 lbs	189 KTAS	150 KTAS	60 KTAS	1350 fpm
5K		4200 lbs	189 KTAS	160 KTAS	60 KTAS	1000 fpm
SL	Piper Seneca III	4407 lbs	205 KTAS	160 KTAS	63 KTAS	1200 fpm
5K		4407 lbs	205 KTAS	168 KTAS	63 KTAS	1050 fpm
SL	Piper Seneca V	4750 lbs	217 KTAS	197 KTAS	60 KTAS	1350 fpm
5K		4750 lbs	217 KTAS	205 KTAS	60 KTAS	1000 fpm
SL	Piper Seminole	3800 lbs	202 KTAS	152 KTAS	59 KTAS	1350 fpm
5k		3800 lbs	202 KTAS	160 KTAS	59 KTAS	950 fpm
SL	Piper Navajo Chieftain	7000 lbs	236 KTAS	179 KTAS	66 KTAS	1150 fpm
5K		7000 lbs	236 KTAS	185 KTAS	66 KTAS	1025 fpm
SL	Piper Malibu	4340 lbs	200 KTAS	135 KTAS	60 KTAS	1300 fpm
5K		4340 lbs		149 KTAS	60 KTAS	1250fpm

TURBOPROP AIRCRAFT

ELEV	Aircraft Type	MGTOW	Speed(V_{NE})	Max Cruise Pwr Mid Wt	Stall Speed Landing CFG	Power Climb Rate
SL	Beechcraft A100	11500 lbs	226 KIAS	218 KIAS	73 KIAS	1963 fpm
5K		11500 lbs	226 KIAS	226 KIAS	73 KIAS	1850 fpm
SL	Beechcraft B200	12500 lbs	259 KIAS	249 KIAS	75 KIAS	2400 fpm
5K		12500 lbs	259 KIAS	258 KIAS	75 KIAS	2300 fpm
SL	Beechcraft C90	10100 lbs	226 KIAS	215 KIAS	78 KIAS	2100 fpm
5K		10100 lbs	226 KIAS	223 KIAS	78 KIAS	1900 fpm
SL	Beechcraft 1900C	16600 lbs	248 KIAS	247 KIAS	89 KIAS	2500 fpm
5K		16600 lbs	248 KIAS	244 KIAS	89 KIAS	2300 fpm
SL	Beechcraft 1900D	17120 lbs	248 KIAS	247 KIAS	89 KIAS	2625 fpm
5K		17120 lbs	248 KIAS	255 KIAS	89 KIAS	2450 fpm
SL	Cessna Caravan 208B	8750 lbs	175 KTAS	179 KTAS	61 KTAS	975 fpm
5K		8750 lbs	175 KTAS	183 KTAS	61 KTAS	865 fpm
SL	De-Havilland Twin Otter 300	12500 lbs	202 KTAS	166 KTAS	58 KTAS	1600 fpm
5K		12500 lbs	202 KTAS	161 KTAS	58 KTAS	1450 fpm
SL	Pilatus PC-12	10450 lbs	285 KTAS	285 KTAS	67 KTAS	1920 fpm
5K		10450 lbs	285 KTAS	293 KTAS	67 KTAS	1750 fpm
SL	Piper Cheyenne	9000 lbs	283 KTAS	269 KTAS	77 KTAS	2800 fpm
5K		9000 lbs	283 KTAS	278 KTAS	77 KTAS	2695 fpm
SL	Piper Cheyenne	9000 lbs	283 KTAS	269 KTAS	77 KTAS	2800 fpm
5K		9000 lbs	283 KTAS	278 KTAS	77 KTAS	2695 fpm

ELEV	Aircraft	T/O Weight	Speed(V_{NE})	1000 FT-LB Torque	Stall Speed Landing CFG	Power Climb Rate
SL	Piper Meridian	5092 lbs	260 KTAS	186 KTAS	61 KTAS	1100 fpm
5K		5092 lbs	260 KTAS	196 KTAS	61 KTAS	950 fpm
ELEV	**Aircraft**	**T/O Weight**	**Speed(V_{NE})**	**75% Cruise Speed**	**Stall Speed Landing CFG**	**Power Climb Rate**
SL	Quest Kodiak	7255 lbs	183 KTAS	172 KTAS	60 KTAS	1371 fpm
5K		7255 lbs	183 KTAS	180 KTAS	60 KTAS	1141 fpm
JET AIRCRAFT						
ELEV	**Aircraft Type**	**MGTOW**	**Speed(V_{NE})**	**Max Cruise Pwr**	**Stall Speed Landing CFG MGTOW**	**Power Climb Rate**
SL	Cessna Citation 501	11850 lbs	355KTAS	325 KTAS	82 KTAS	2900 fpm
5K		11850 lbs		335 KTAS	82 KTAS	2675 fpm
SL	Cessna Citation 550	14800 lbs	385KTAS	377 KTAS	82 KTAS	3370 fpm
5K		14800 lbs		389 KTAS	82 KTAS	3150 fpm

Notes regarding performance: The indicated airspeed at which a fixed-wing aircraft stalls varies with the weight of the aircraft but does not vary significantly with altitude.

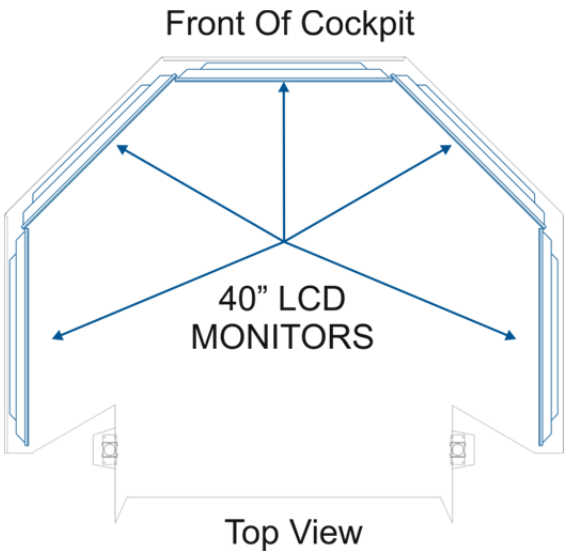
For light aircraft operating below 10, 000 feet, it can usually be assumed that Vne is a fixed IAS.

RULE OF THUMB: A normally aspirated aircraft engine loses approximately 3.5% hp per 1,000 feet increase in density altitude.

Visual Systems

The Modular Flight Deck Visual system comes standard with an integrated 225 degree x 40 degree (vertical) Ultra High Definition 120 Hz LED monitors that is docked to the flight deck.

Panoramic Integrated Visual System (Five 40” 1080 40 Inch Monitors)



ATD Functions and Maneuvers

Functions and Maneuvers	Yes, No, N/A
a. Preparation for Flight	
(1) Flight Deck Preflight	Yes
b. Pre-Takeoff	
(1) Engine start	Yes
(2) Brake operation	Yes
(3) Taxi operations and markings	Yes
c. Takeoff	
(1) **AIRPLANE Takeoff**	
(i) Power plant run-up and checks	Yes
(ii) Acceleration characteristics	Yes
(iii) Nose wheel and rudder steering	Yes
(iv) Effect of headwind/crosswind	Yes
(v) Instrument check	Yes
(vi) Landing gear, wing flap operation	Yes
d. In-Flight Operation	
(1) **AIRPLANE In-Flight Operation**	
Runway and Takeoff	Yes
(a) Normal and imum Performance Takeoffs	Yes
(b) Short and Soft Field Takeoff and Departures	Yes
(c) Normal and imum Performance Climbs	Yes
(d) Engine Failure and Emergency Procedures	Yes
Cruise	
(a) Performance Characteristics (speed vs. power)	Yes

ATD Functions and Maneuvers Checklist (cont.)	
(b) Normal, Climbing, and Descending Turns	Yes
(c) Performance Steep Turns	Yes
(d) Approach to Stalls, i.e. Stall Warning, Cruise, Takeoff & Approach and Landing Configurations	Yes
(e) In Flight Engine Shutdown (Multi-Engine only)	Yes
(f) In Flight Engine Start (Multi-Engine only)	Yes
Approach and Landing	
(a) Normal and Partial/No Flap Approach and Landings	Yes
(b) Short and Soft Field Approach and Landings	Yes
(c) Single Engine Approach and Landing (Multi-Engine)	Yes
e. Instrument Approaches	
(1) **Non-Precision**	Yes
(i) GPS- WAAS (optional)	Yes
(ii) GPS- LAAS (optional)	Yes
(iii) All Engines Operating	Yes
(iv) One or More Engines Inoperative (as applicable)	Yes
(v) Approach Procedures (NDB, VOR, DME Arc, LOC/BC, LOC, LDA, SDF, ASR, LNAV/VNAV, GPS and LPV)	Yes
(2) **Precision**	Yes
(i) ILS	Yes
(ii) Effects of Crosswind	Yes
(iii) With engine(s) inoperative	Yes
(iv) Missed Approach	Yes
(A) Normal	Yes
(B) With Engine(s) inoperative (as applicable)	Yes

ATD Functions and Maneuvers Checklist (cont.)	
(C) From Steep Glide Slope	Yes
f. Surface Operations (AIRPLANE-Post Landing)	
(1) Landing roll	Yes
(2) Braking Operation	Yes
(3) Reverse thrust Operation, if applicable	Yes
g. Any Flight Phase	
(1) **Aircraft and Power Plant Systems Functions and Simulated Failures**	
(i) Electrical	Yes
(ii) Flaps (Airplane)	Yes
(iii) Fuel & Oil	Yes
(iv) Landing Gear	Yes
(2) **Flight Management and Guidance Systems**	Yes
(i) Two Axis Auto Pilot (AATD only)	Yes
(ii) Flight Director (AATD only) / System Displays	Yes
(iii) Navigation Systems and optional display configurations	Yes
(iv) Stall Warning Avoidance (Airplane)	Yes
(v) Multi-Function Displays PFD/MFD	Yes
(3) **Airborne Procedures**	Yes
(i) Holding	Yes
(4) **Simulated Turbulence in Flight**	Yes
(5) **Engine Shutdown and Parking**	Yes
(i) Systems operation	Yes
(ii) Parking Brake Operation (Airplane)	Yes
h. Training device capable of replicating any emergency procedures provided in the Aircraft Flight Manual "checklists" for the model or aircraft configuration represented.	Yes

Important Notes:

Any changes or modifications to this device which have not been reviewed, evaluated, and approved in writing by General Aviation and Commercial Division, AFS-800 may terminate FAA approval of this aviation training device.

Any modification to this device without consent from manufacture will void the warranty.

Contact Information:

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