

Ground Lesson I

OBJECTIVE:

EQUIPMENT:

SCHEDULE:

ELEMENTS:

Section	Date	Score
Airframe		
Powerplant		
Propellers		
Landing Gear System		
Brake System		
Flight Control System		
Fuel System		
Pitot-Static System		
Heating/Ventilation System		
Stall Warning System		
Electrical System		
Vacuum System		

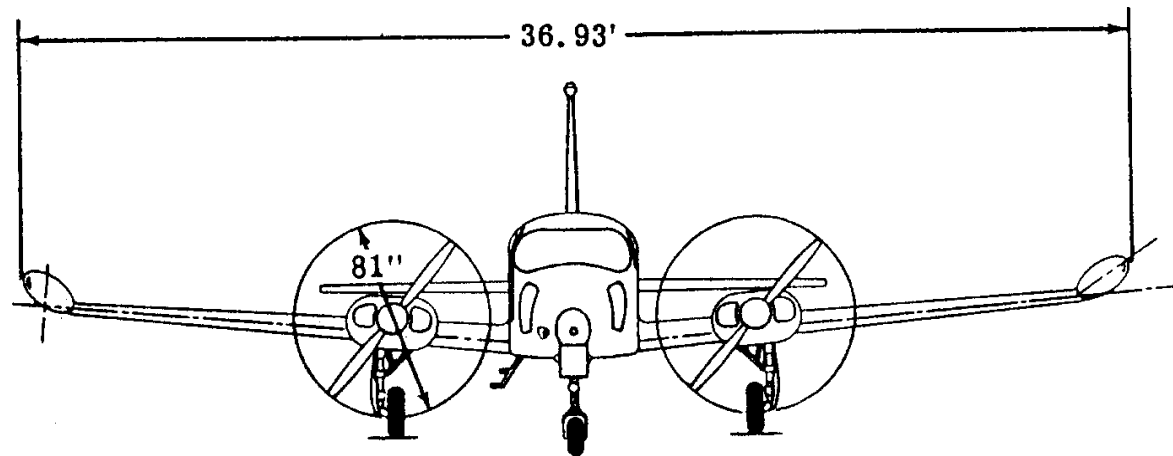
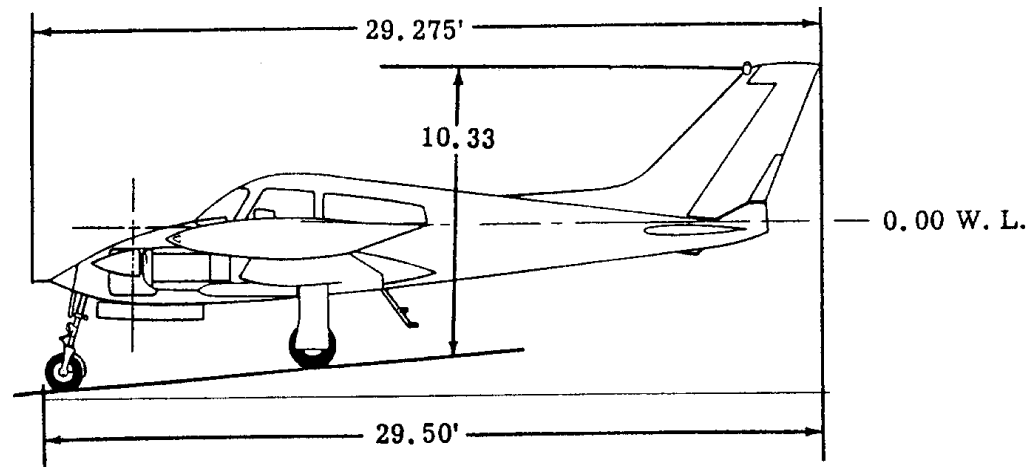
ACTIONS:

STANDARDS:

C-310L Systems

Airframe
Engine
Engine Oil System
Propellers
Landing Gear System
Brake System
Fuel System
Pitot-Static System
Heating/Ventilation System
Stall Warning System
Electrical System
Vacuum System
Flight Control System

Airframe



Airframe (Cont)

Semi-Monocoque Structure

All metal primary Structure

Composite Extremities

 Nose Cone

 Engine Cowlings

 Gear Doors

 Fairings

Wing Flaps - Variable position Split type

Engine

Type - Contental IO-470-VO

260 Horse Power @ 2650 RPM

Six Cylinders - opposed configuration

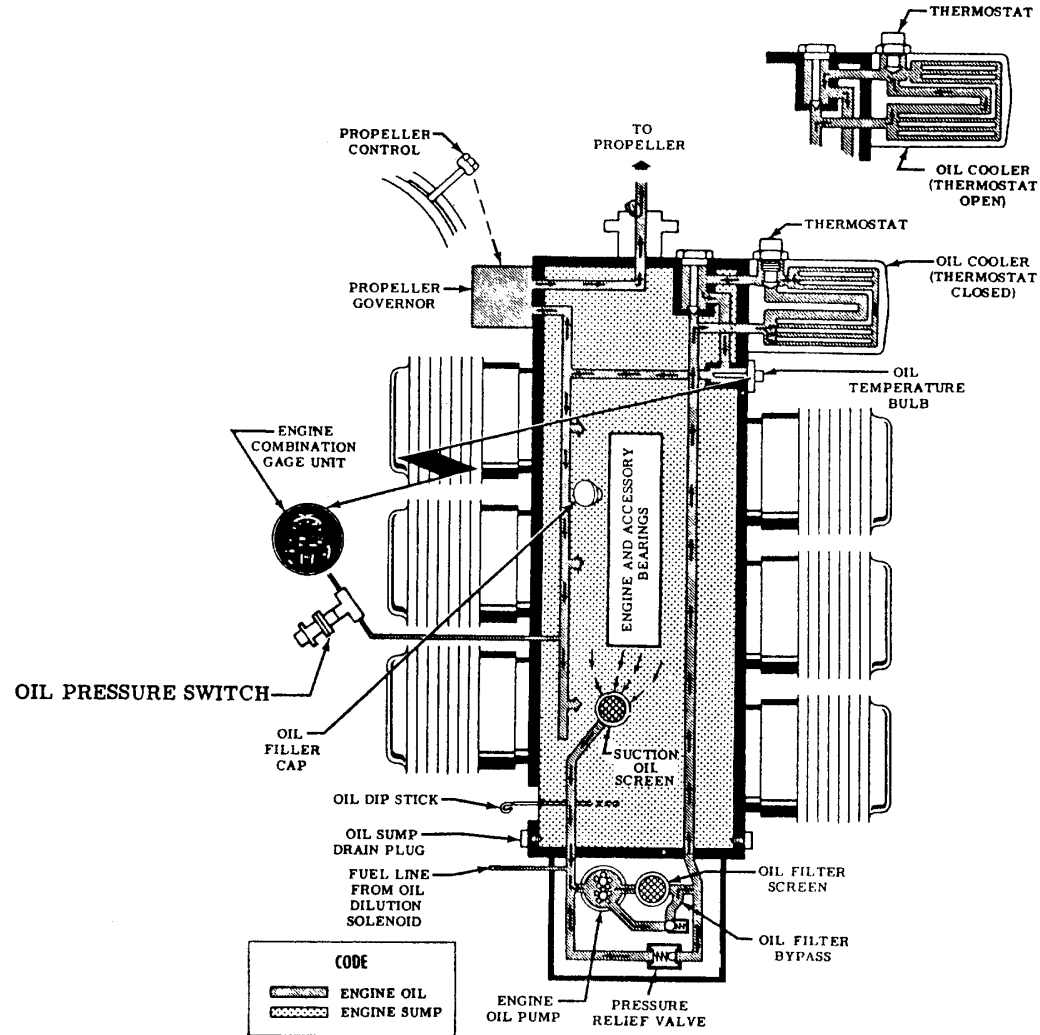
Fuel Injected

Direct Drive

Normally Aspirated

Air Cooled

Engine Oil System



Propeller

Type - McCauley D2AF34C81/84JF-3

Diameter - 81 inches

950 RPM Feather Lockout

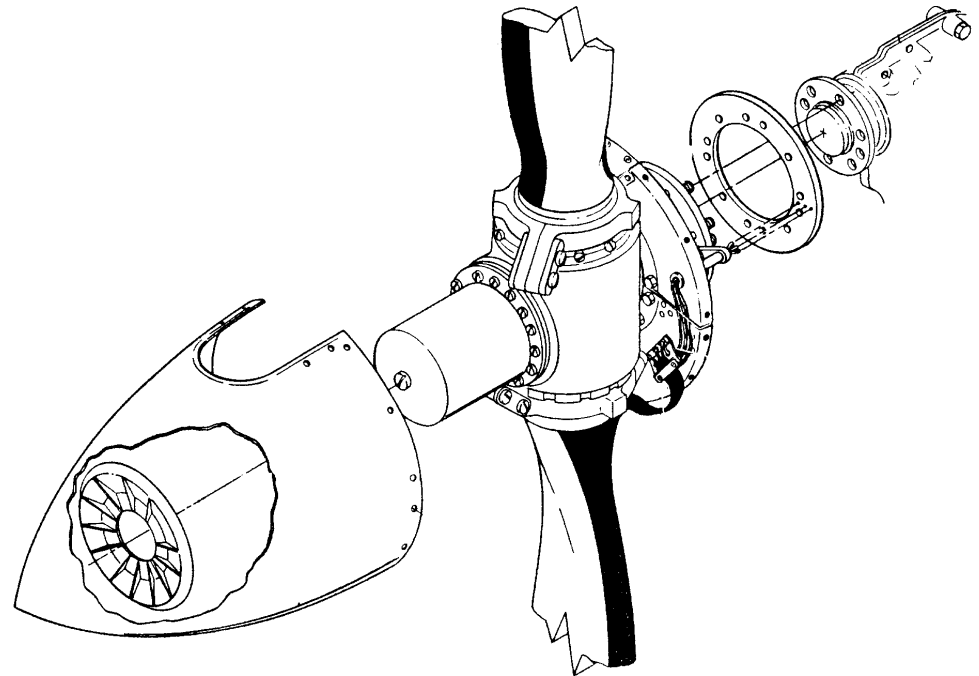
Feathering time - six seconds

Pitch -

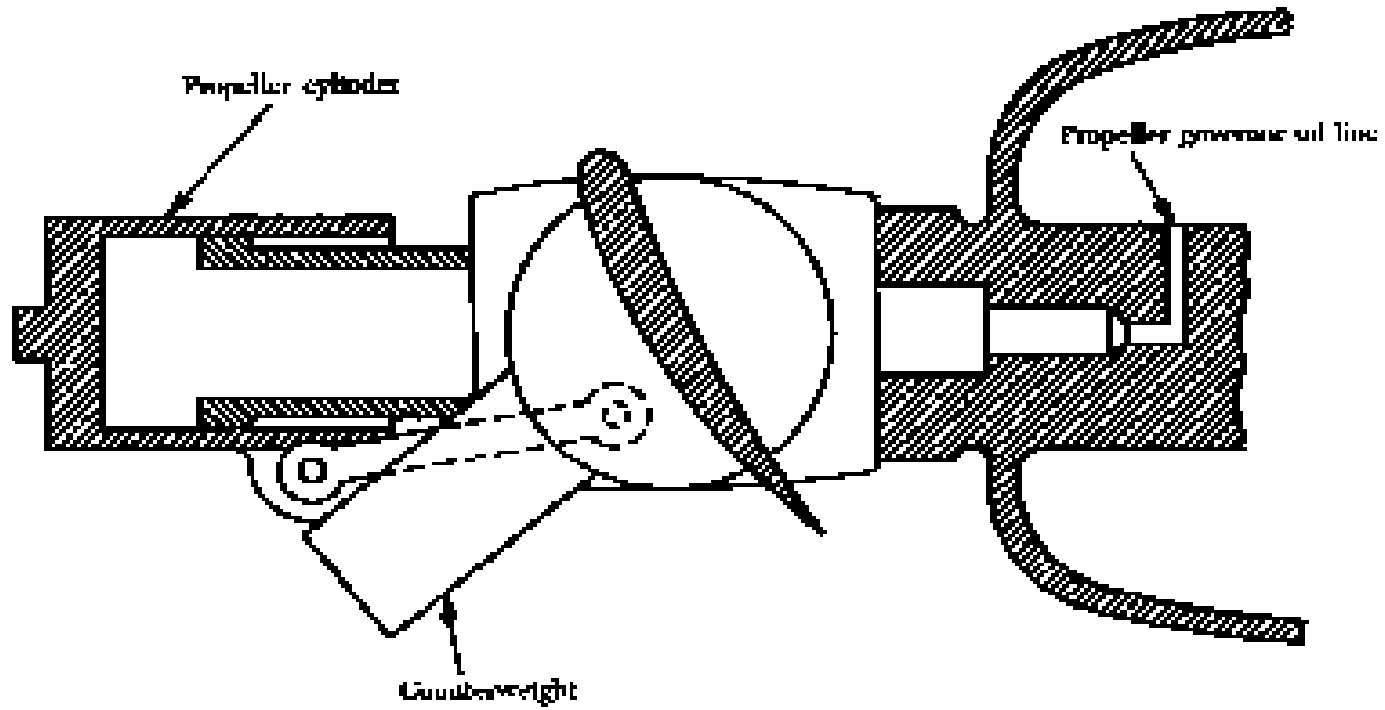
High Pitch - 82.6 degrees

Low Pitch - 12.8 degrees

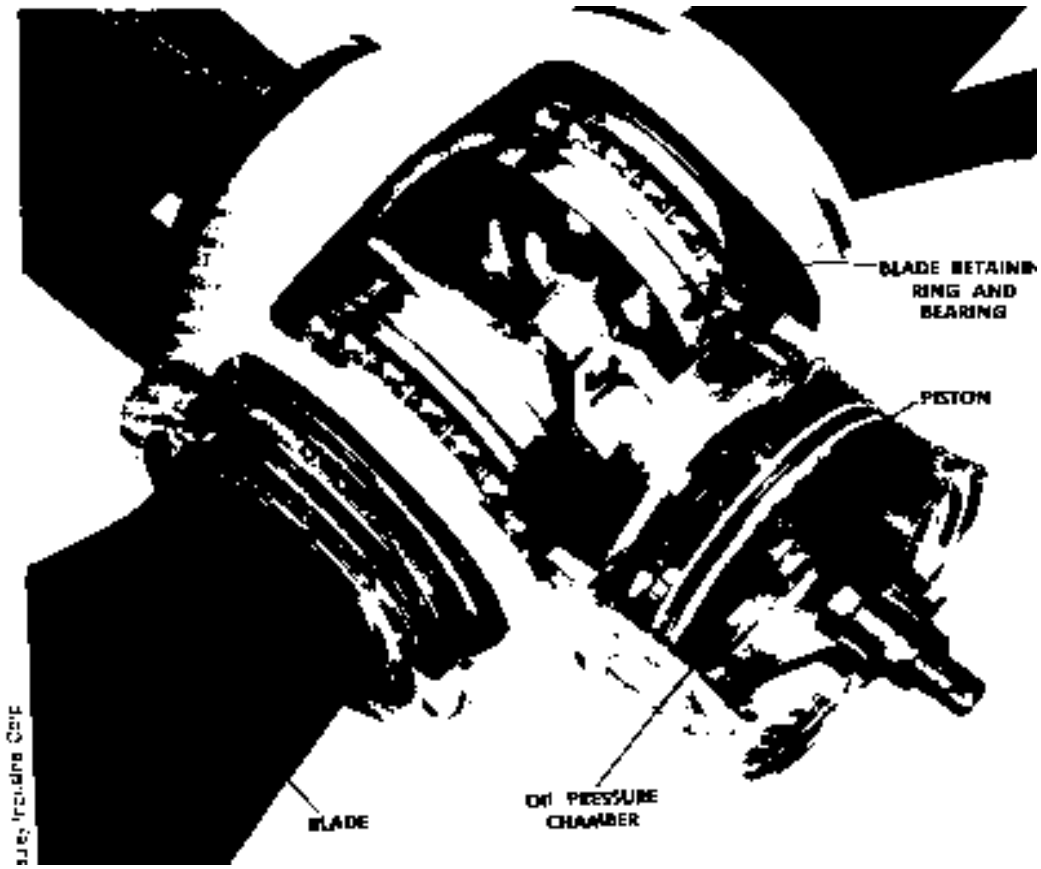
Governor - Woodward 0750101-69



Propeller Forces

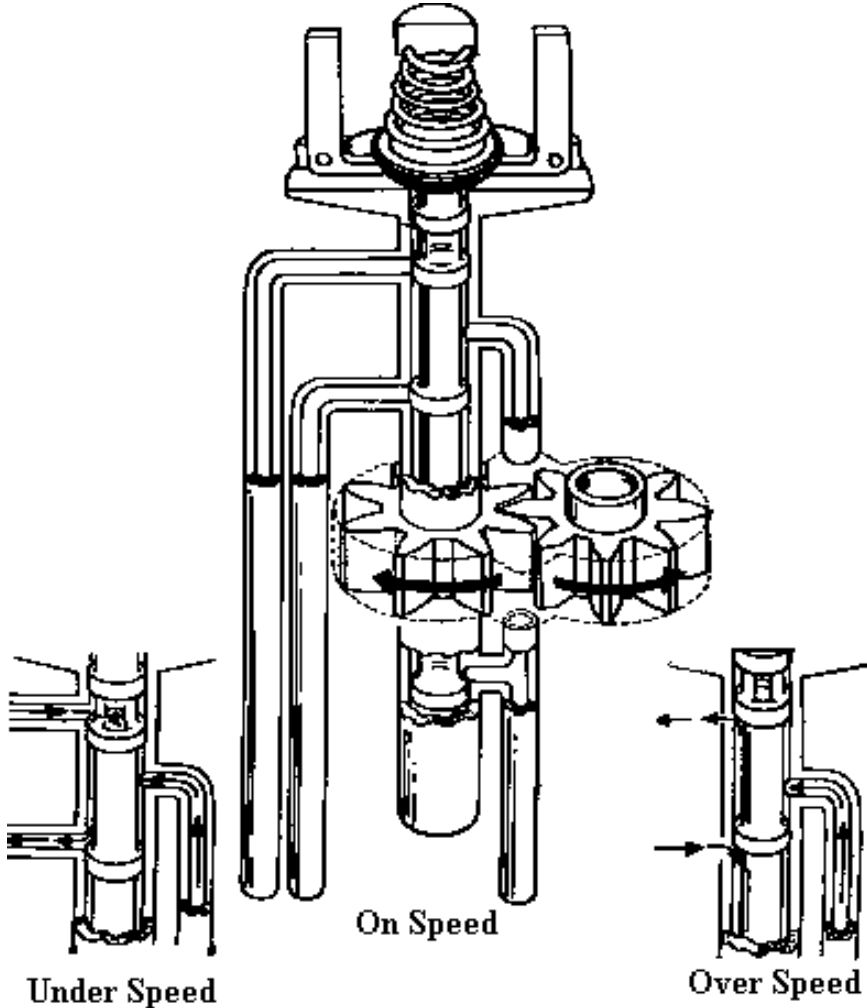


Propeller

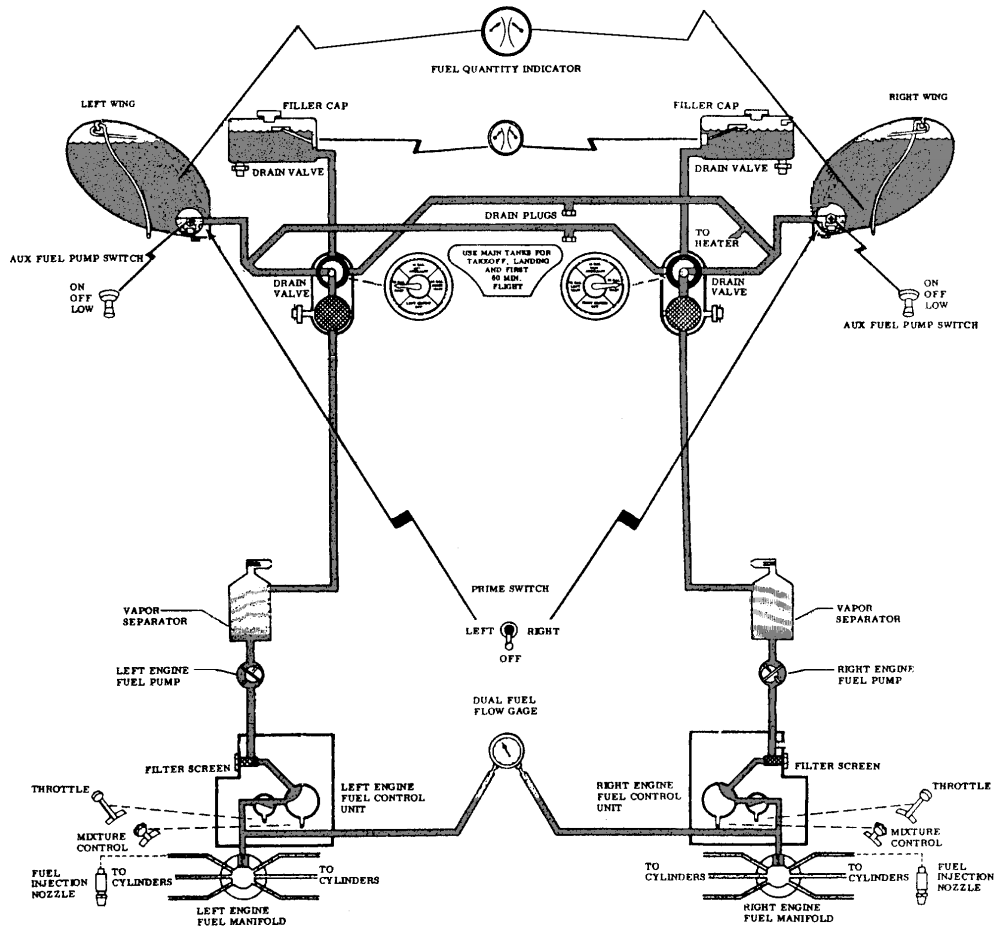


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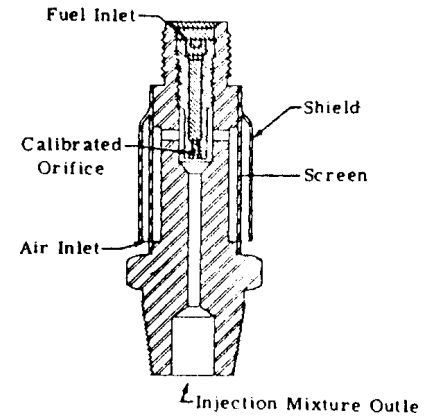
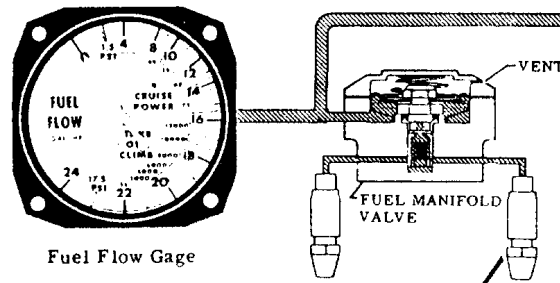
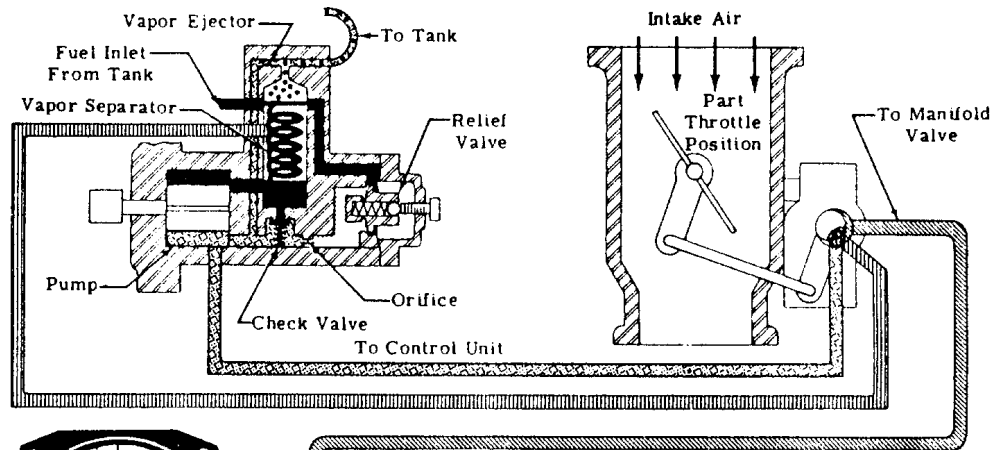
Propeller Governor








Fuel System



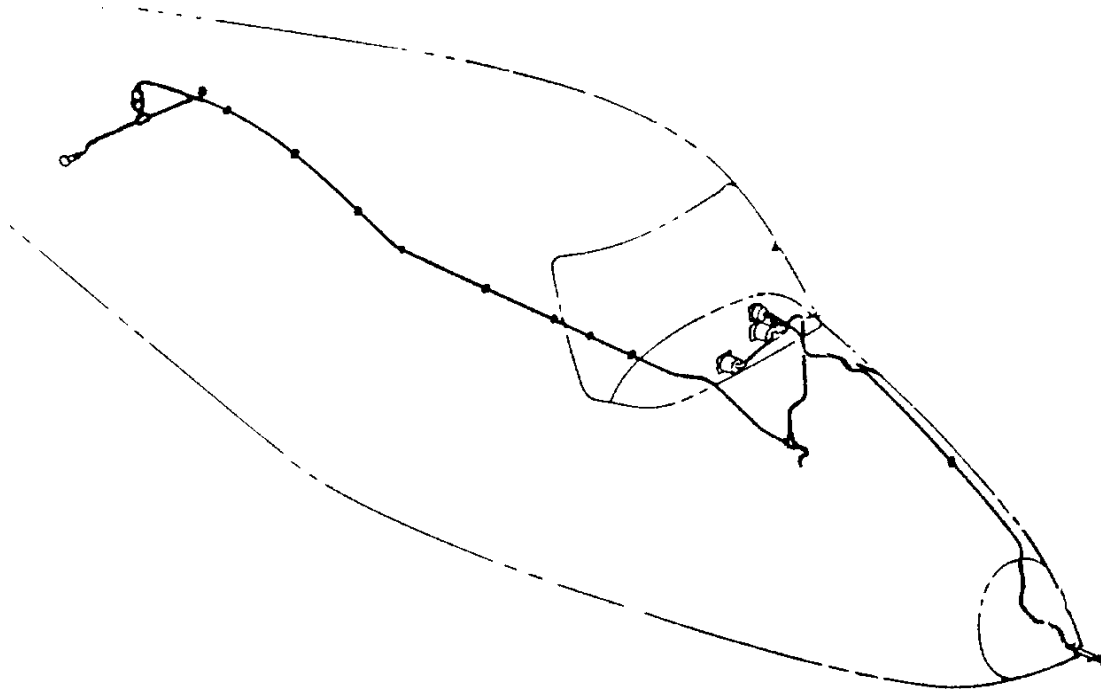
Fuel Injection System



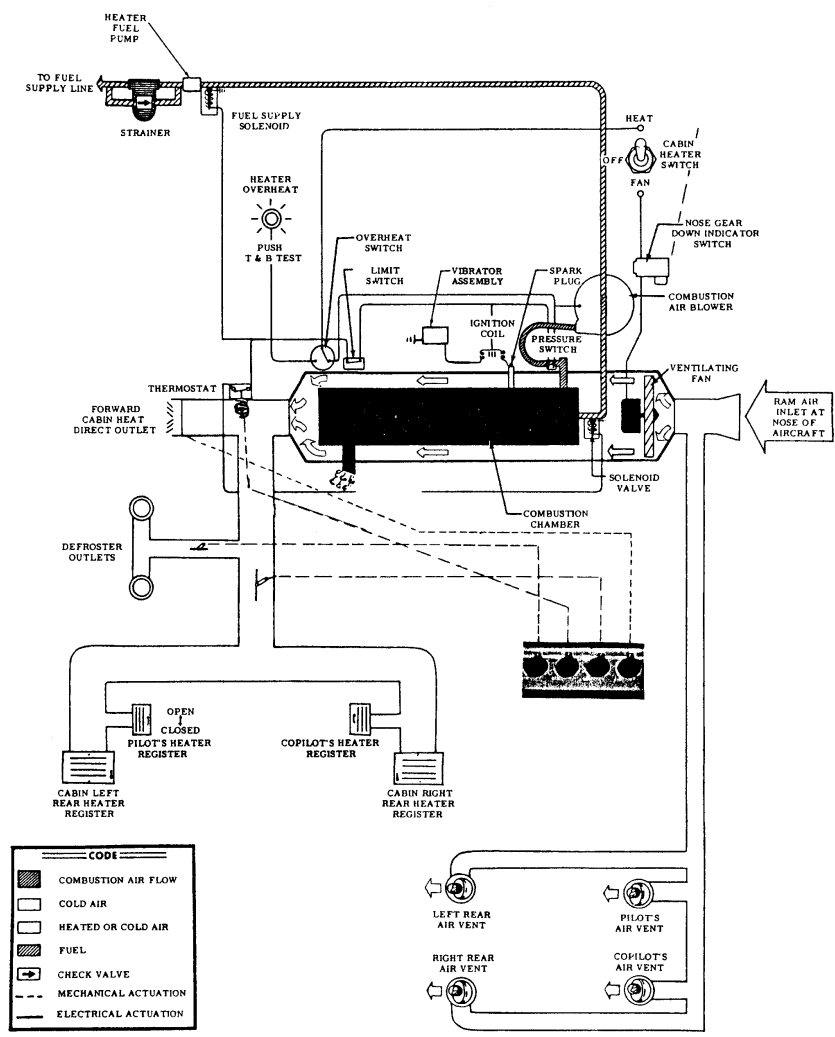
- LEGEND:
-  RELIEF VALVE PRESSURE
 -  METERED FUEL
 -  PUMP PRESSURE
 -  INLET PRESSURE
 -  RETURN FUEL

A

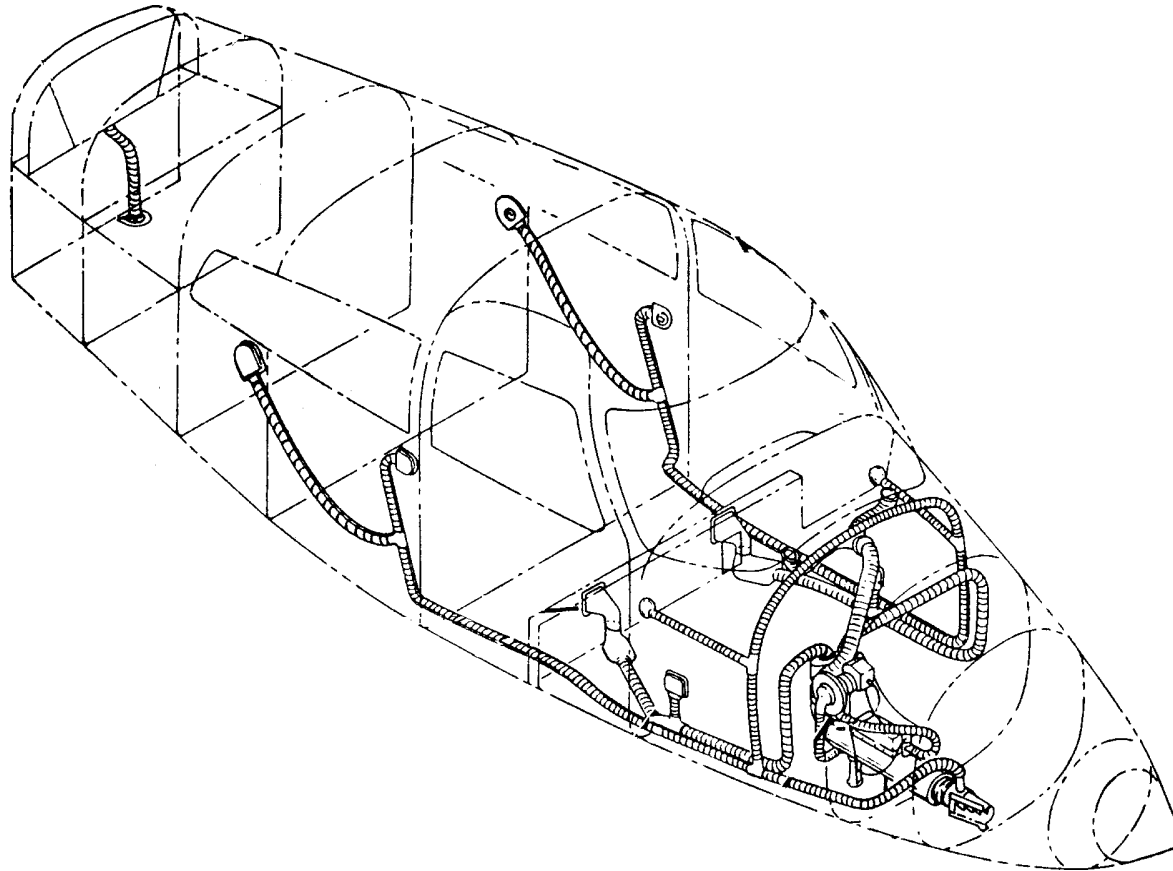
Pitot-Static System



Heating/Ventilation System



Heating Ventilation System (Cont)



Heating Ventilation System (Cont)

Janitrol Heater

Controls

Right Lower Instrument Panel

Temperature

Defrost

Front Seat Control

Rear Seat Control

Ventilation

Floor vents

Pilots/Copilots feet

Pilot/Copilot eyeball vents

Center vents under front seats

Center and aft seat eyeball vents

Stall Warning System

Horn Type Warning Indicator (90 Cycles)

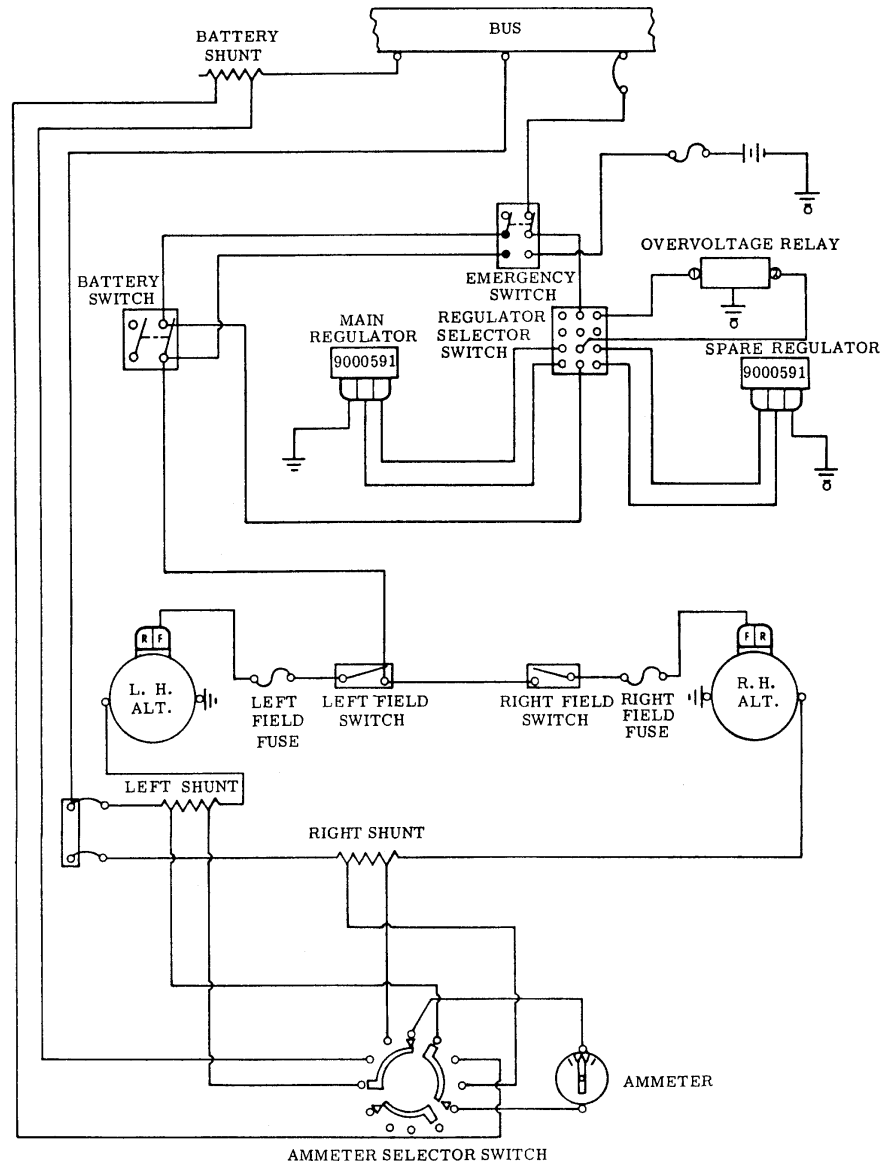
Activates 5 to 10 knots above stall

Sensor - 1 tab left side

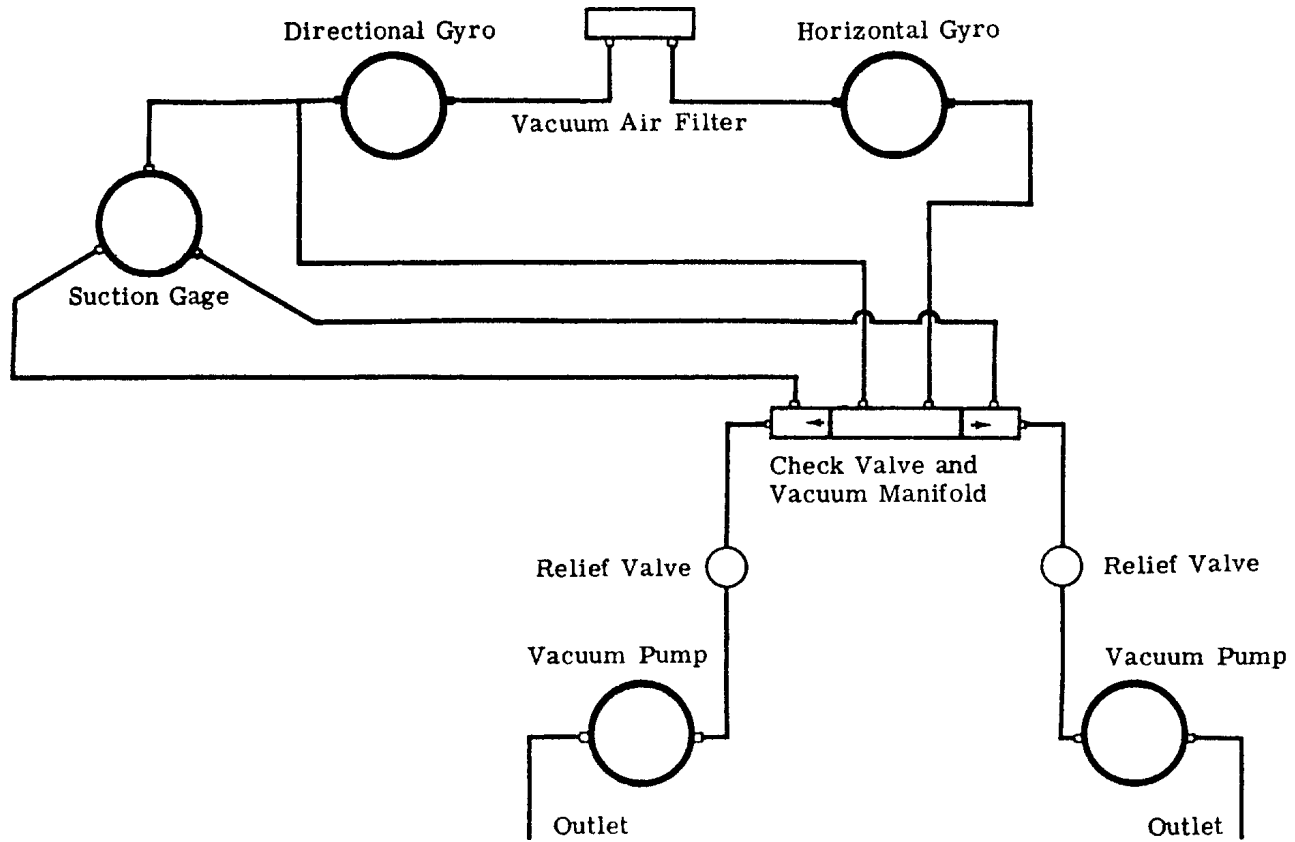
Squat switch on left gear deactivates



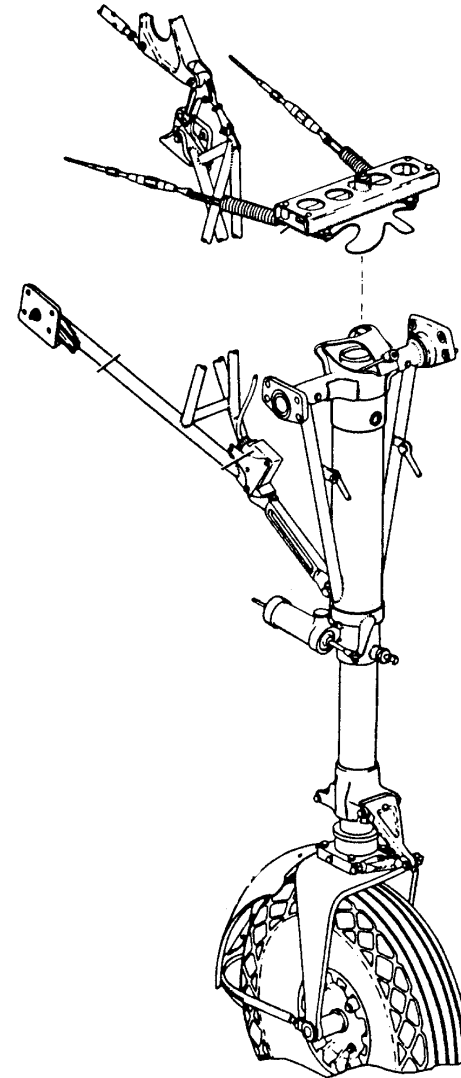
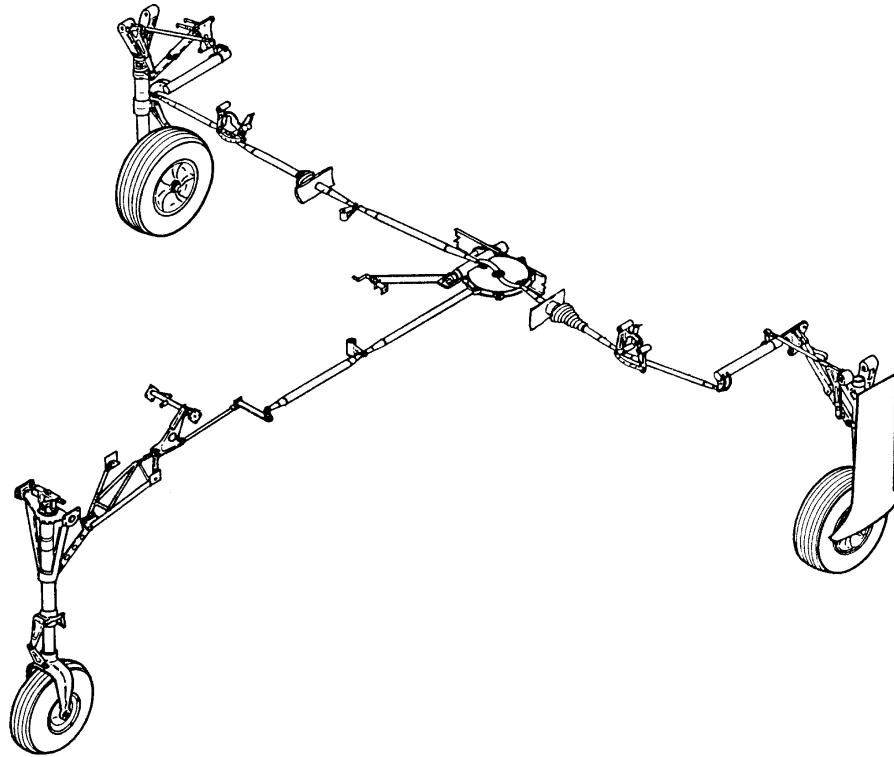
Electrical System



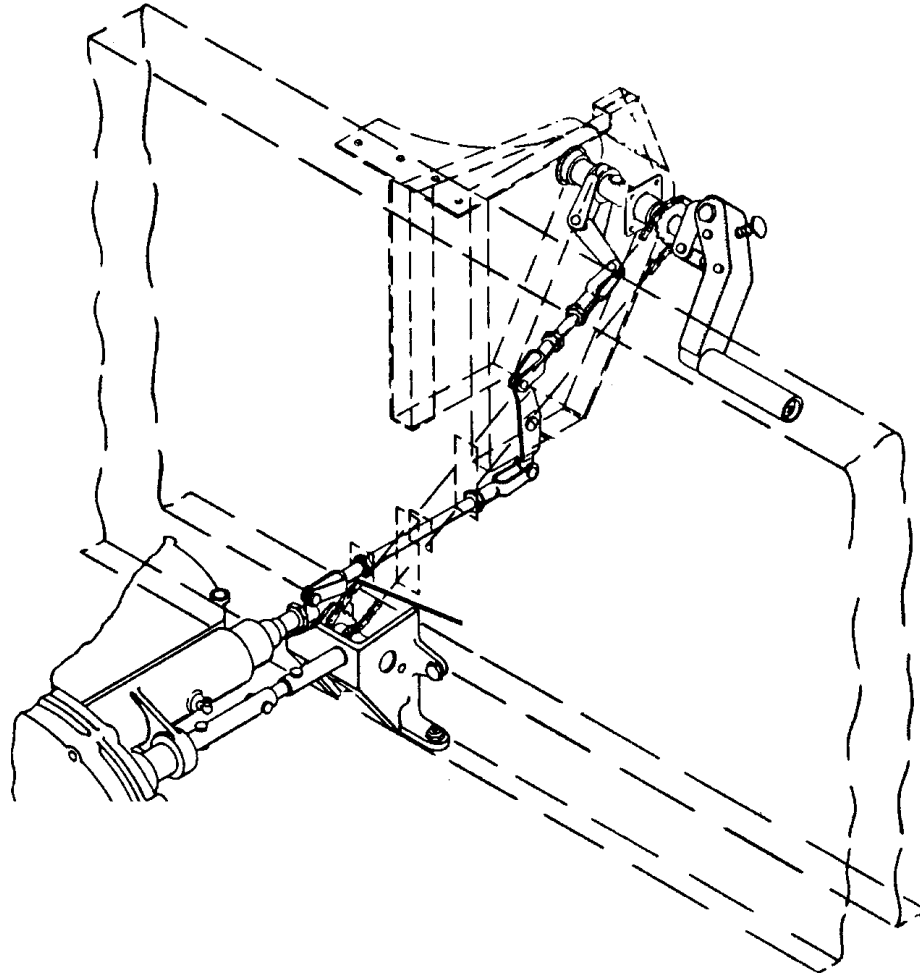
Vacuum System



Landing Gear



Emergency Gear Extension System



Brake System

Single Disk -Double Puck

Toe Actuation

Parking Brake - Installed (Pilots Left Knee)

One Reservoir - Four Master Cylinders

MIL - H - 5606 Hydraulic Fluid

Flight Control

Primary Flight Controls

- Cable operated

- Anti-servo tabs to assist

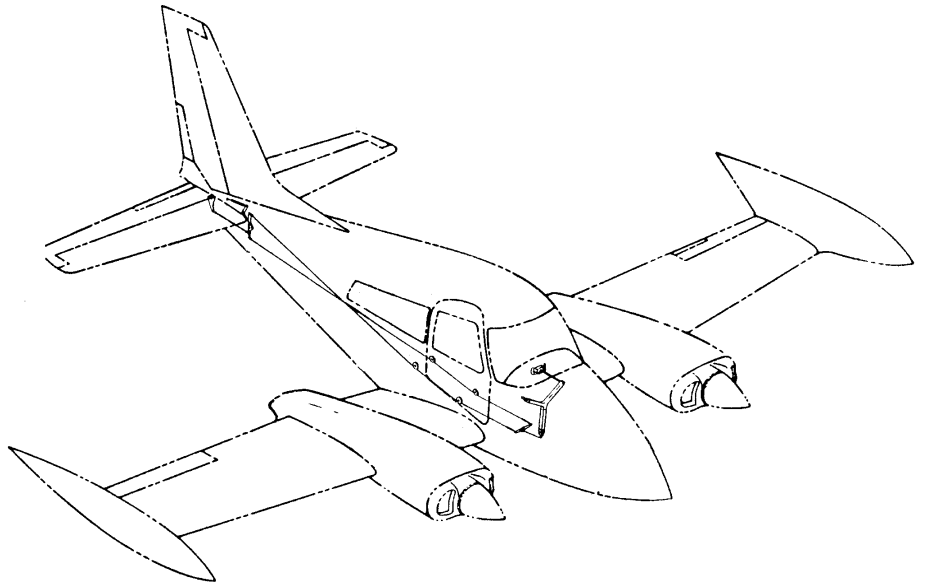
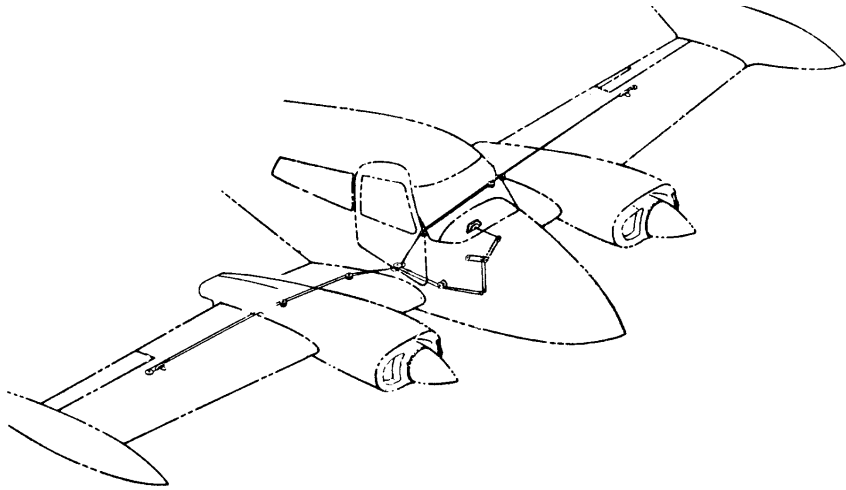
Secondary Flight Controls

- Cable operated

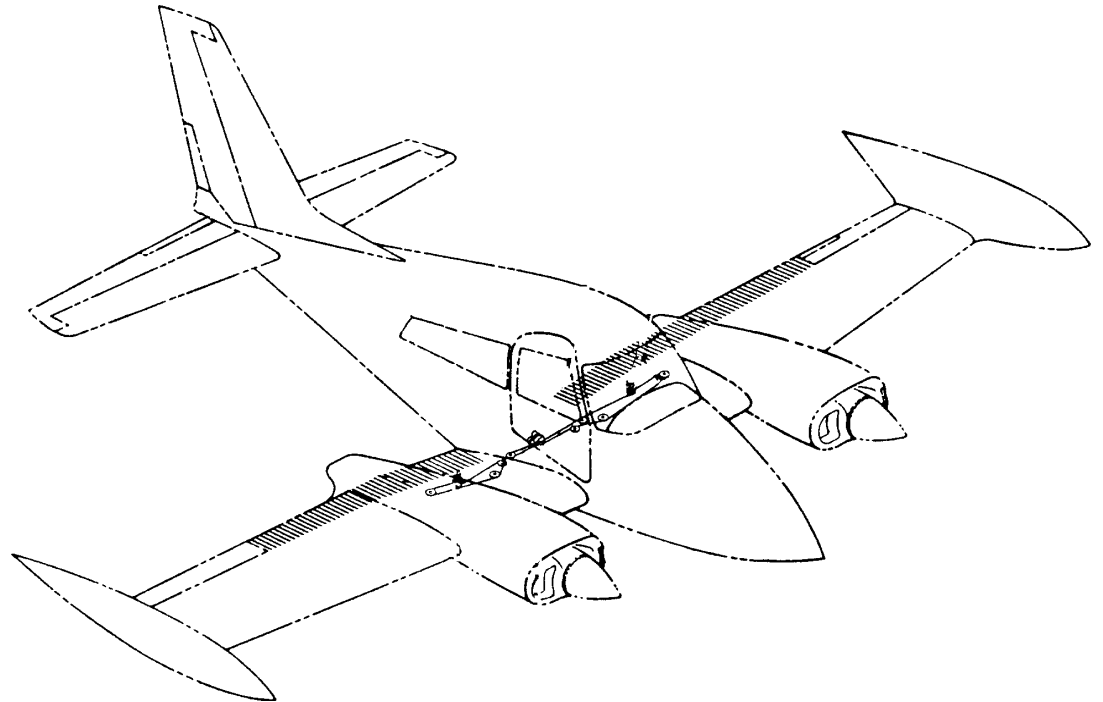
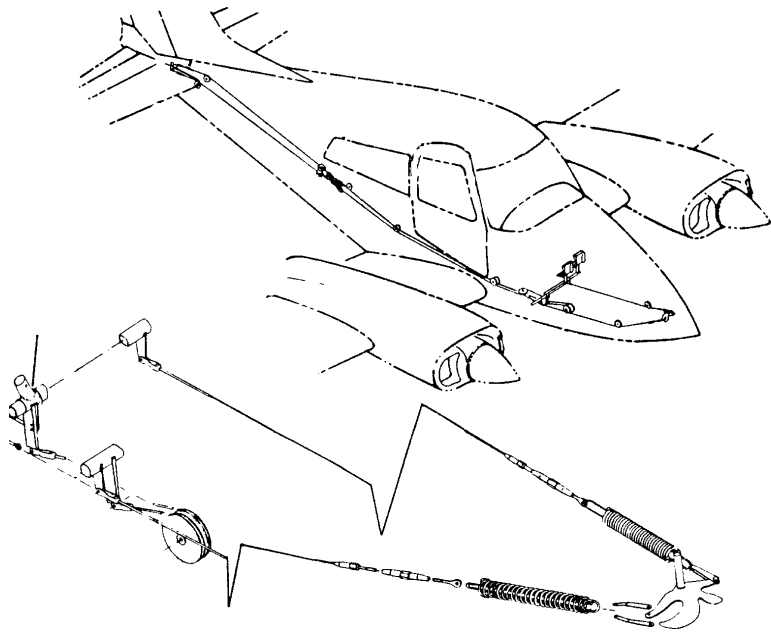
Flaps

- Electro-mechanical Actuation

Flight Controls (Cont)



Flight Controls (Cont)



Ground Lesson II

OBJECTIVES:

ELEMENTS

Section 1	Date	Score
Weight & Balance		
Performance		
Power Performance Relationship		
Accelerate Stop		
Take Off		
Climb		
S. E. Climb		
Cruse		
Descent		
Landing		
V Speeds		

SCHEDULE:

EQUIPMENT:

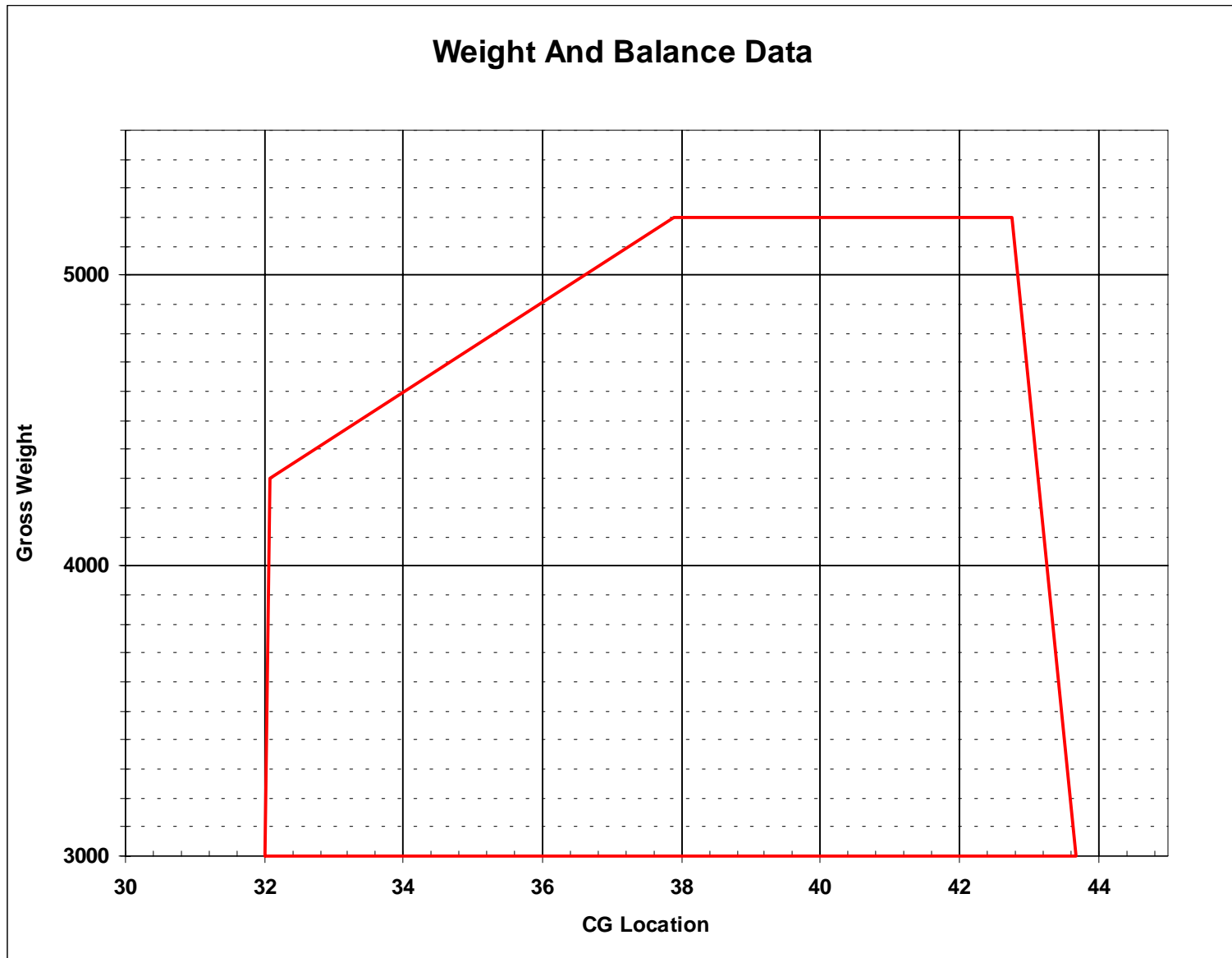
ACTIONS:

STANDARDS:

Weight & Balance

WEIGHT & BALANCE COMPUTATIONS			
A/C:		3274X	C-310L
Item	Weight	Arm	Moment
Empty Wt	3361	-	120020
Oil (7.5 #/gal) Qts Incl	0	-45	0
Pilot	0	37.1	0
Front Passenger	0	37.1	0
Passengers Row 2	0	70.9	0
Passengers Row 3	0	105.3	0
Baggage Area #1	0	96.0	0
Baggage Area #2	0	124.0	0
Baggage Area #3	0	66.7	0
Zero Fuel Weight Condition			
	CG :		
For Takeoff Condition			
Fuel (6 Lbs/gal) Gals 100		35.0	
Fuel Offload Gals	0	35.0	
Fuel Aux	0	47.5	
Takeoff Condition	100		
	CG :		
For Landing Condition			
Fuel (6 Lbs/gal) Gals 5		35.0	
Fuel Aux	0	47.5	
Landing Condition	3,391		
	CG :		

Weight & Balance



Performance Charts

Accelerate Stop

Take Off

Both Engines

Single Engine

Climb

Power Performance Relationships

Both Engines

Single Engine

Cruse

Descent

Landing

Power Performance Relationships

Does one engine out equal half the performance - **NO!**
310 has about 78% loss of performance

Demonstration Methods:

1. Performance charts

Both engine rate of climb 1,542 Feet/Min

Single Engine rate of climb 330 Feet/Min

2. (Excess HP) (weight)

$$\text{Climb} = \frac{\text{-----}}{3,300}$$

3. 150 Hp required for level flight

Both Engines	One Engine
400	200
<u>-150</u>	<u>-150</u>
250	50

$$1 - (50/250) = 80\%$$

Performance VS Control Engine Out Considerations & Performance

Control VS Performance - You have to decide which is more important!!!!

V Speeds

Speed	Meaning	Indications	C-310L
Vs	Stall Speed Landing Configuration	Bottom of White Arc	75
Vsl	Stall Speed Specified Configuration	Bottom of Green Arc	84
Vmc	Minimum Controllable Airspeed	Red Radial	85
Vr	Rotational Speed		90
Vx	Best Angle of Climb Speed		97
Vsse	Safe Single Engine Speed		105
Vxse	Best Angle of Climb Single Engine		108
Vg	Glide Speed		112
Vyse	Best Rate of Climb Single Engine	Blue Radial Line	119
Vy	Best Rate Of Climb		124
Vle	Landing Gear Extended Speed	Top of White Arc	160
Vlo	Landing Gear Operation Speed		160
Va	Maneuvering Speed		170
Vfe15	Flap Operating Speed 15 Degrees		180
Vfe35	Flap Operating Split 15 0 35 Degrees		160
Vno	Maximum Normal Operating Speed	Bottom of Yellow Arc	210
Vne	Never Exceed Speed	Bottom of Red Arc	257

V Speed Adjustments

From the lift equation $L = C_L(1/2) \rho V^2$

$$V_{\text{new}} = V_{\text{gross}} \left(\frac{\text{Weight}_{\text{New}}}{\text{Weight}_{\text{Gross}}} \right)^{-1/2}$$

This does NOT effect the horsepower based speeds

Ground Lesson III

OBJECTIVES:

ELEMENTS

Section	Date	Score
Aerodynamics		
Engine Failure Considerations		

SCHEDULE:

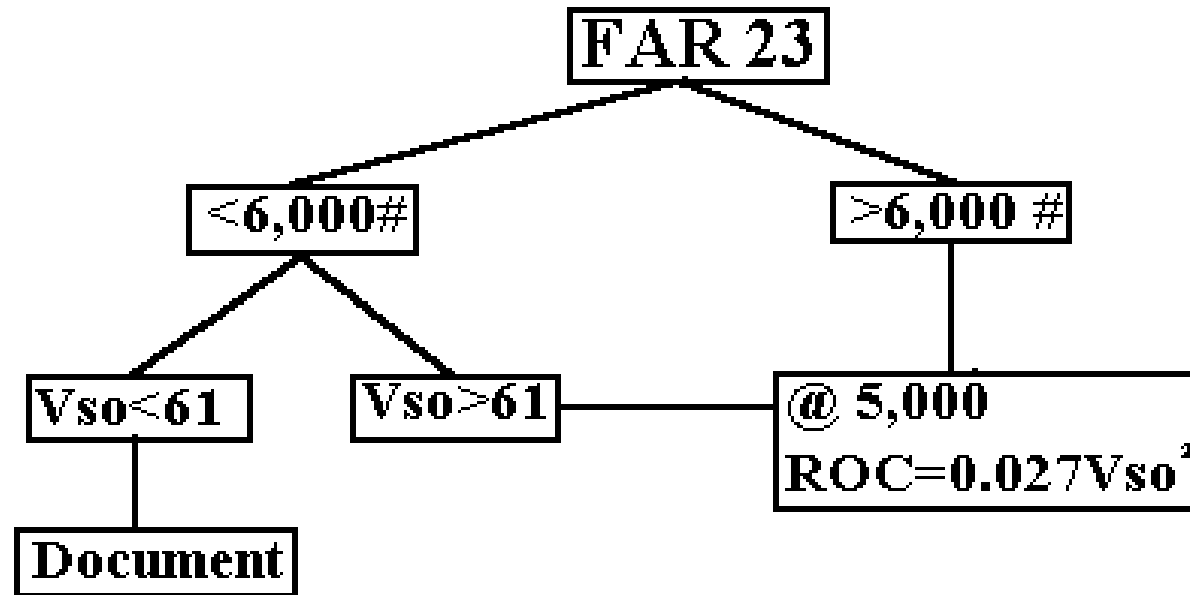
EQUIPMENT:

ACTIONS:

STANDARDS:

Aerodynamics

Multi-Engine Operation
FAR Part 23



Multi-Engine Operations

Vmc Operations

Minimum Controllable Airspeed - Vmc

Definition from FAR 23.149(a):

" Vmc is the calibrated airspeed, at which, when the critical engine is suddenly made inoperative, it is possible to recover control of the airplane with that engine still inoperative and maintain straight flight either with zero yaw or at the option of the applicant, with a bank angle of not more than 5 degrees."

VMC Criteria:

(FAR 23.149(b) & (d))

For reciprocating engine powered aircraft Vmc may not exceed 1.2 Vs1 with

Takeoff or maximum available power on the engines

Most unfavorable CG

Airplane trimmed for takeoff

Maximum sea level takeoff weight

flaps in takeoff position

landing gear retracted

Cowl flaps in normal takeoff position

Propeller of the inoperative engine

Windmilling

In the most probable position

Feathered if the aircraft has automatic feathering

Airplane airborne and the ground effect negligible

Rudder pedal force required not more than 150 pounds

Maximum of 20 degree heading change without a dangerous attitude

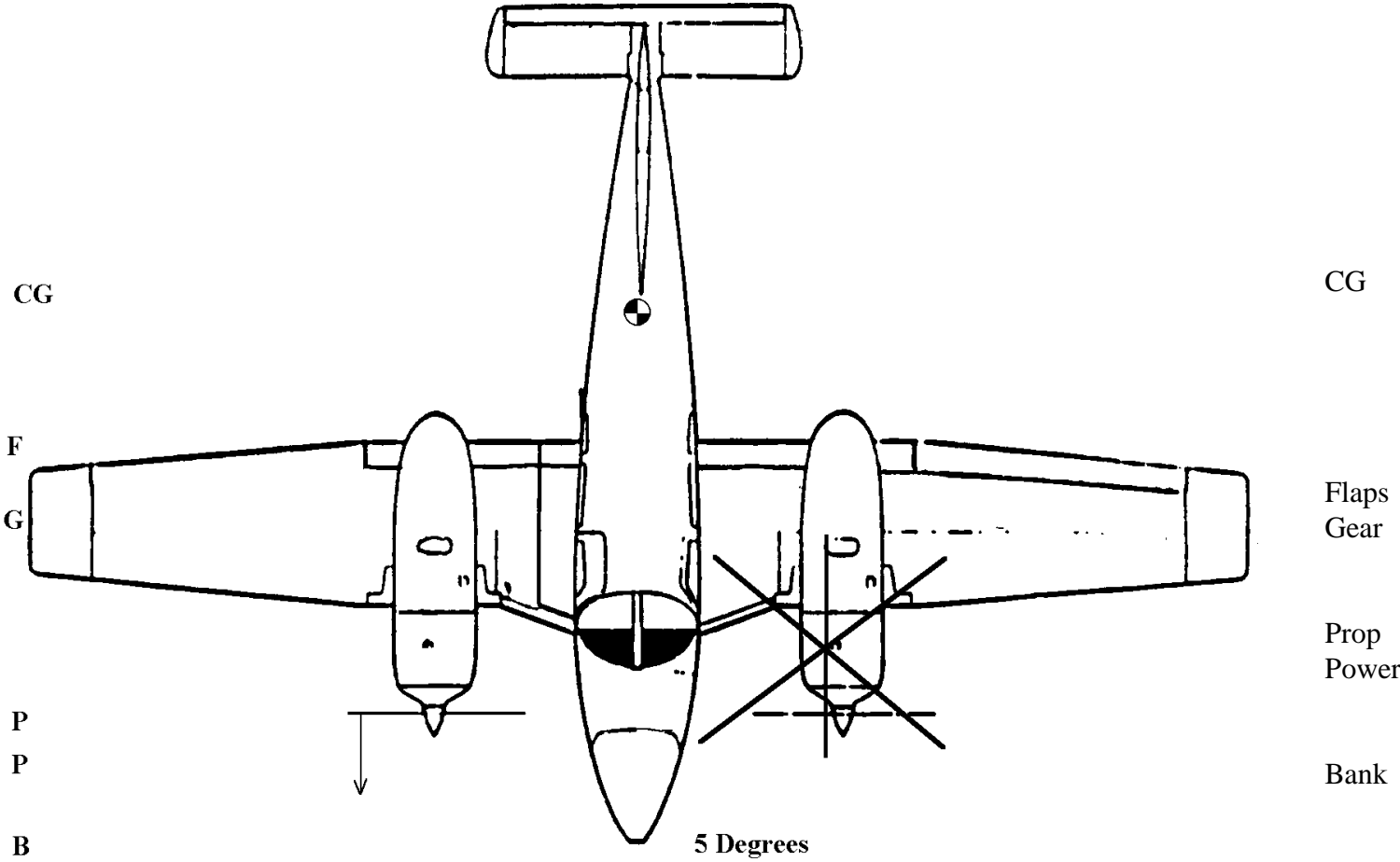
Multi-Engine Operations

Factors Effecting Vmc:

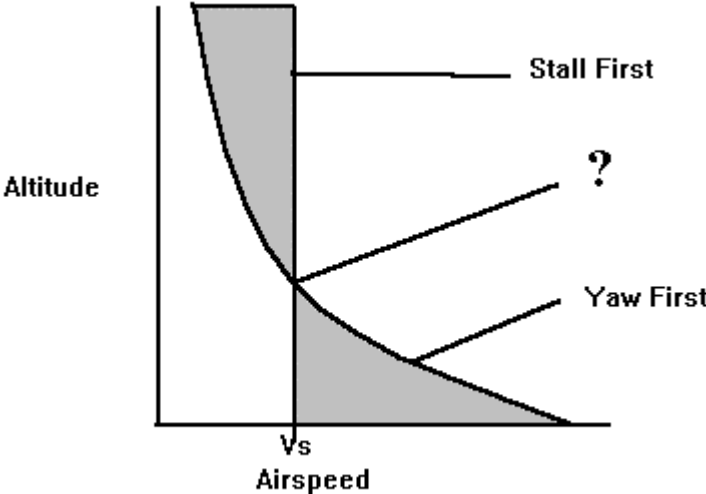
Factor	Factor Change	Vmc Effect
Pressure Altitude	D	I
Temperature	D	I
Power	I	I
Critical Engine windmilling		I
Gear up		I
Bank	D	I
Aft CG		I
Flaps more than Takeoff		I
Gross weight	D	I

Multi-Engine Operations

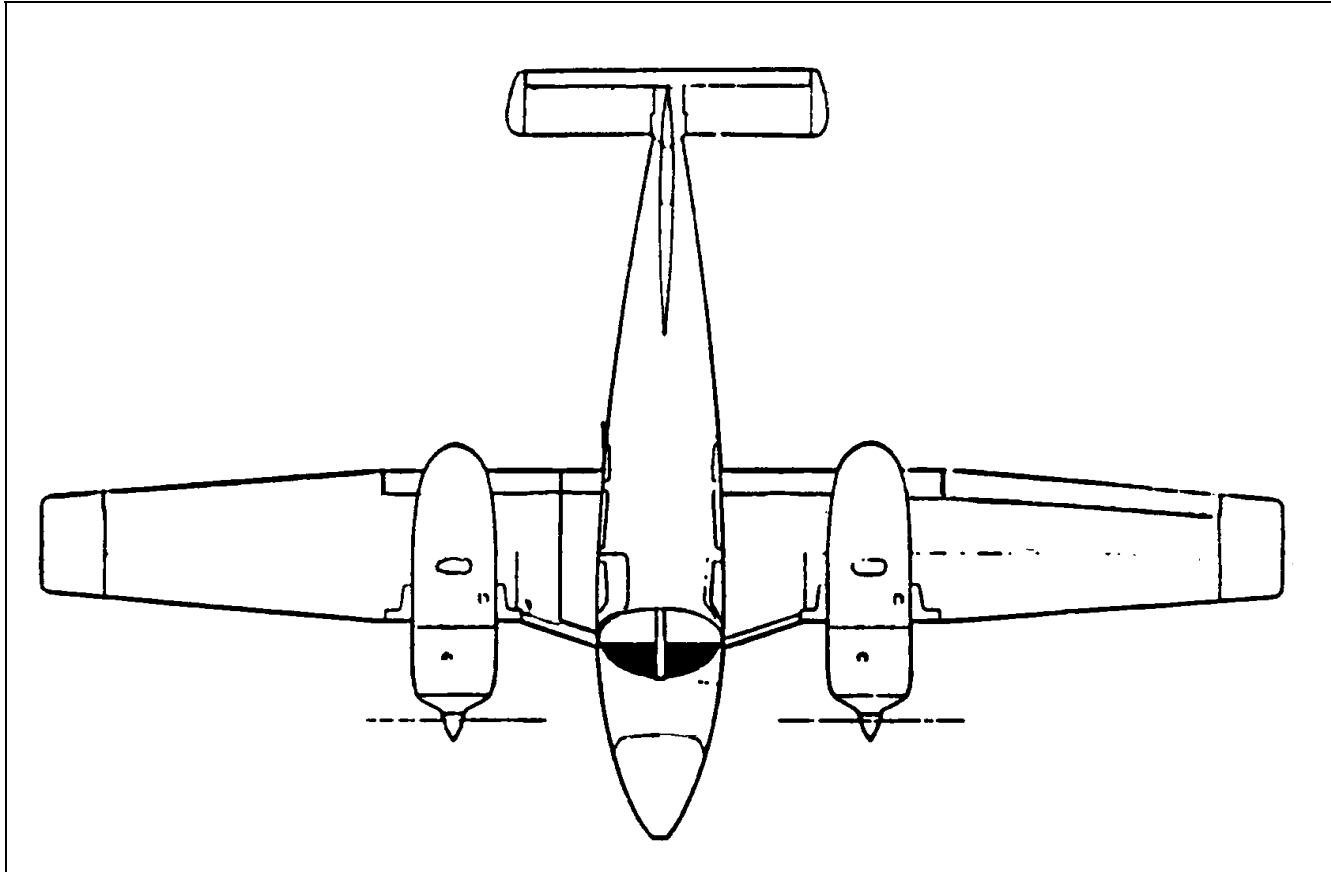
Memory Aids



Vmc Gambling Point



Factors Defining Critical Engine



P Factor

Torque

Spiraling Slipstream

Accelerated Slipstream

Engine Failure Chant

Aircraft Control

Blue Line

Forward

Forward

Forward

Gear up

Flaps up

Identify - Dead foot dead engine (Tap leg)

Verify - Throttle half back - listen for change

Feather - Throttle full back

Verify - hold & look at prop control

Feather - Move to feather position

Verify - hold & look at mixture control

Feather - Move to Idle Cut Off

Checklist

Ground Lesson IV

OBJECTIVES:

ELEMENTS

Section	Date	Score
Pre-takeoff Briefing		
Normal Take-off/Landings		
Short Field Take-off/Landings		
Slow Flight		
Steep Turns		
Stalls		
Instrument Approaches		
Emergency Procedures		
Single Engine Maneuvering		
Use of Vyse		
Effects of Configuration		
VMC Demonstration		
Engine Out Approaches & Landings		

Before Take Off Briefing

Out the Window

Type of Take Off - Normal/ Short Field procedures

Airspeed Indicator

Airspeed Calls

Airspeed Alive

Vmc - 85

Vr - 90

Vyse - 119

Vclimb - 120

Throttles

Ground Abort Procedure

Air to Landing Procedure

Feather Procedure

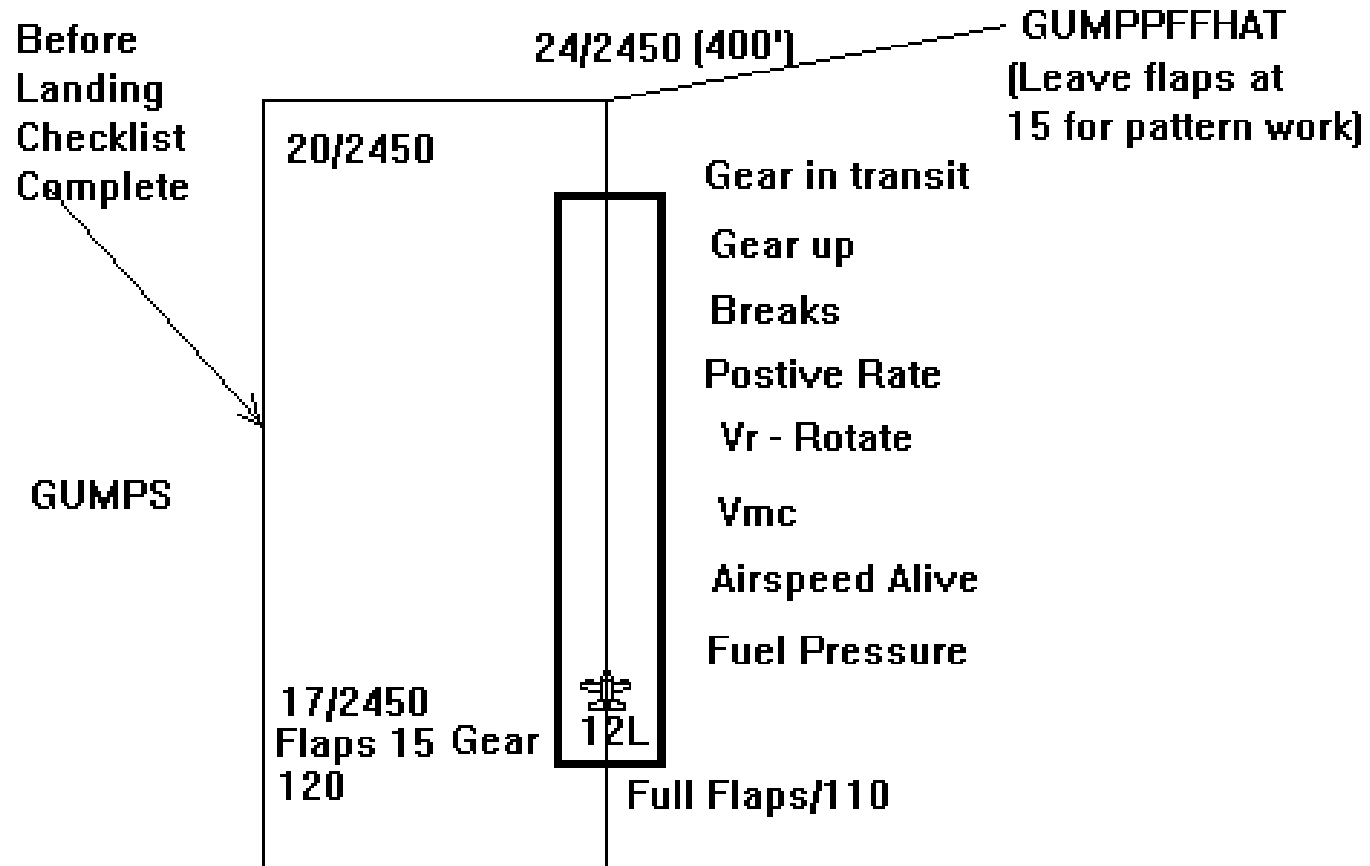
Left Leg

Training Procedure to be used

Right Leg

Departure Procedures

Normal Takeoffs/Normal Landings



Short Field Takeoffs/Short Field Landings

Flaps 15 (airplane will want to lift off early and flat)

Power verify 2623 RPM at full throttle

Lif nose wheel at 84

Break ground at 93 and hold until obstacles are cleared

Breaks applied and raise gear

There is an increase in drag as the gear doors open

Landing – POH does not indicate procedures

Pre-Maneuvering Procedures

1. Reduce Power to 15"
2. Fuel Selectors on Mains
3. Boost Pumps on
4. Mixtures Set
5. Clearing Turns Completed
6. Props Forward
7. Airspeed 140
8. Power to 17"

Slow Flight Procedures

Clean Configuration

1. Pre Maneuvering Checklist Complete
2. Reduce Power to 12"
3. Slow Aircraft to 100 MPH (+-10 MPH)
4. Power as Required to Maintain Altitude (+-100 FT) Approximately 14"
5. Recovery
 - A. Power to 20 "
 - B. Power to 17" at 140 MPH

Slow Flight Procedures

Dirty Configuration

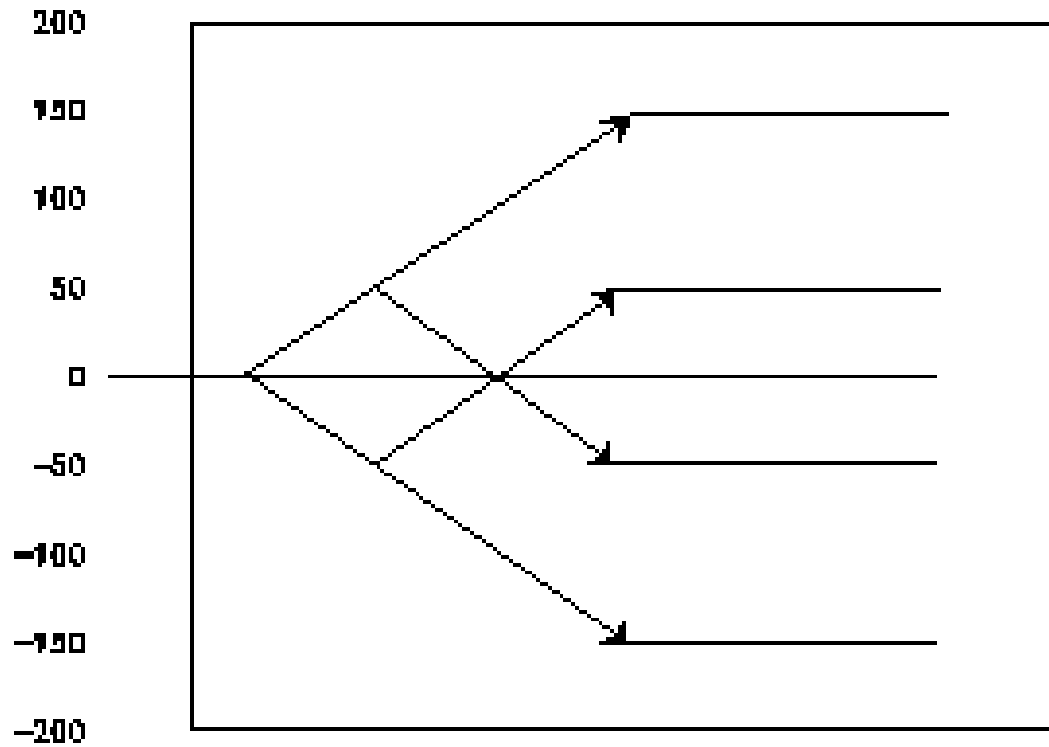
1. Pre Maneuvering Checklist Complete
2. Reduce Power to 14"
3. Extend flaps and Gear below 140 MPH
4. Slow Aircraft to 100 MPH (+-10 MPH)
5. Power as Required to Maintain Altitude (+-100 FT) Approximately 19"
5. Recovery
 - A. Power to 24 "
 - B. Flaps to 15
 - C. Gear Up
 - D. Flaps Up
 - E. Power to 17" at 140 MPH

Steep Turns - 45 Degree Bank

1. Pre Maneuvering Checklist Complete
 2. Passing through 30 degrees increase Power to 19"
 3. Maintain Bank (+-10), Airspeed (+-10), Altitude (+-100)
 4. Lead Rollout by 1/2 Bank Angle
 5. Level Aircraft on Entry Heading
 5. Power to 17"
- Repeat procedure for other direction

Multi-Engine Stalls

What are your limits? - The BOX



Approach to Landing Stall Procedures

1. Pre Maneuvering Checklist Complete
2. Reduce Power to 14"
3. Extend flaps and Gear below 140 MPH
4. Reduce Power to Idle
5. Slow Aircraft to 100 MPH
6. Recovery
 - A. Power to full
 - B. Flaps to 15
 - C. Gear Up
 - D. Flaps Up
 - E. Power to 17" at 140 MPH

Takeoff/Departure Stall Procedures

1. Pre Maneuvering Checklist Complete
2. Reduce Power to 12"
3. Slow Aircraft to V_y
4. Increase Power to 20"
5. Pitch up to Approximately 15 Degree
6. Recovery
 - A. Lower nose to level flight Airspeed 100 MPH
 - B. Power to 20"
 - C. Establish V_y Climb
 - D. Level off at desired Altitude
 - E. Power to 17" at 140 MPH

VMC Demonstration

1. Pre Maneuvering Checklist Complete
2. Reduce Power Left engine to Idle
3. Increase Right engine Power to Full
4. Maintain Bank into Good Engine and 1/2 Ball Deflection
5. Apply Back Pressure to Slow Aircraft to Vyse
6. Maintain Heading with Rudder Freeze rudder at Blue Line
7. Increase Back Pressure until loss of control or Imminent Stall Indication
8. Recovery
 - A. Reduce Power on Operating Engine
 - B. Lower Nose to Vyse
 - C. Increase Power on Left Engine
 - D. Power Both Engines to Full as Aircraft Approaches Vyse
 - E. Power as Required to Maintain Vyse and Level Flight

Vyse Demonstration (4,000' AGL)

1. Pre Maneuvering Checklist Complete
2. Reduce Power Left Engine to Idle
3. Retard Left Propeller Control to Detent
4. Adjust Left Power to Zero Thrust (12")
5. Right Engine to Full Throttle
6. Slow Aircraft to Vyse
7. Note Rate Of Climb
8. Reduce Airspeed to Vyse -10
9. Note Rate Of Climb
10. Increase Airspeed to Vyse +10
11. Note Rate Of Climb
12. Recovery
 - A. Reduce Airspeed to Vyse
 - B. Propeller to Approximate Right Engine
 - C. Left Throttle Adjust to Right Engine
 - D. Power to 17" at 140 MPH

Effects of Configuration Procedure (4,000' AGL)

1. Pre Maneuvering Checklist Complete
2. Reduce Power Left Engine to Idle
3. Retard Left Propeller Control to Detent
4. Adjust Left Power to Zero Thrust (12")
5. Right Engine to Full Throttle
6. Slow Aircraft to Vyse and Maintain Throughout Maneuver
7. Note Rate Of Climb
8. Extend Landing Gear
9. Note Rate Of Climb
10. Extend Full Flaps
11. Note Rate Of Climb
12. Left Engine Throttle to idle
13. Left Engine Prop to High RPM
14. Note Rate Of Climb
15. Retard Left Propeller Control to Detent

Effects of Configuration (Cont)

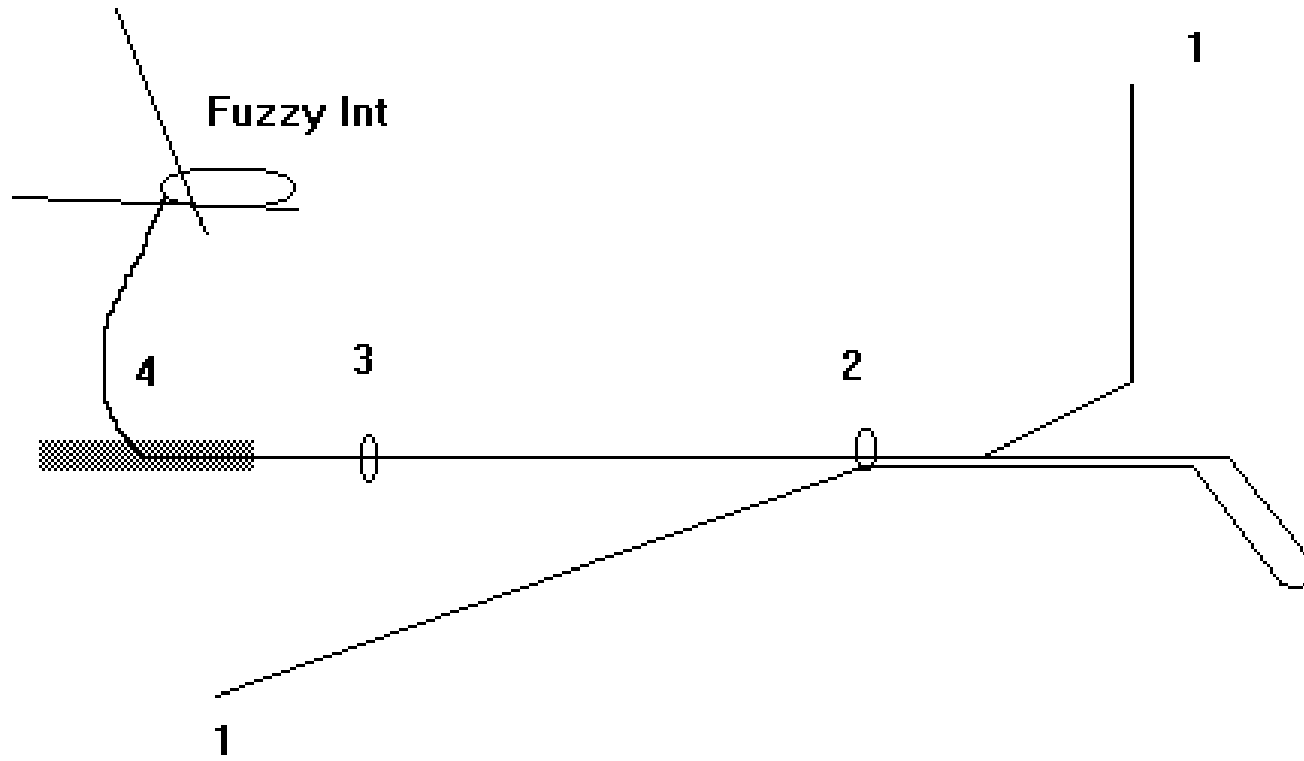
16. Adjust Left Power to Zero Thrust (12")
17. Retract Landing Gear
18. Note Rate Of Climb
19. Retract Flaps Incrementally
20. Note Rate Of Climb
21. Recovery
 - A. Reduce Airspeed to Vyse
 - B. Left Propeller to Approximate Right Engine
 - C. Left Throttle Adjust to Full
 - D. Power to 17" at 140 MPH

Effects of Configuration Demonstration

Configurations:

Engine	Gear	Flaps	Airspeed	VSI	Pitch
Left 0 Thrust/Right Full	Up	Up	Vyse-10	_____	/_____
Left 0 Thrust/Right Full	Up	Up	Vyse+10	_____	/_____
Left 0 Thrust/Right Full	Up	Up	Vyse	_____	/_____
Left 0 Thrust/Right Full	Down	Up	Vyse	_____	/_____
Left 0 Thrust/Right Full	Down	35	Vyse	_____	/_____
Left Windmill/Right Full	Down	35	Vyse	_____	/_____
Left 0 Thrust/Right Full	Up	35	Vyse	_____	/_____
Left 0 Thrust/Right Full	Up	20	Vyse	_____	/_____
Left 0 Thrust/Right Full	Up	15	Vyse	_____	/_____

Multi Engine Instrument Approaches



Action Point 1

Before landing checklist complete to landing gear down - 17" at Loc Intercept/Initial flaps

If engine fails between point 1 and point 2

Fly the airplane

Perform memorized check list

Notify approach

Action Point 2

Both Engines

One Engine

Time

Time

Gear down (@ 1 dot above)

Gear down (@ 1 dot above)

Flaps to 10

Flaps to 10

Power to 18"

Power to 21"

Slow to 120

Slow to 120

Look for 500 '/min decent

Look for 500 '/min decent

Notify approach

If engine fails between point 2 and point 3

Fly the airplane

Perform memorized check list

Notify approach

Action Point 3

Check Gear - Green - Props (or when coming out of clouds)

be sure you can stop decent (single or both) at DH/MDA

Action Point 4

Execute the missed approach

Both

One

Power up

Notify approach of engine fail

Clean up

Power up

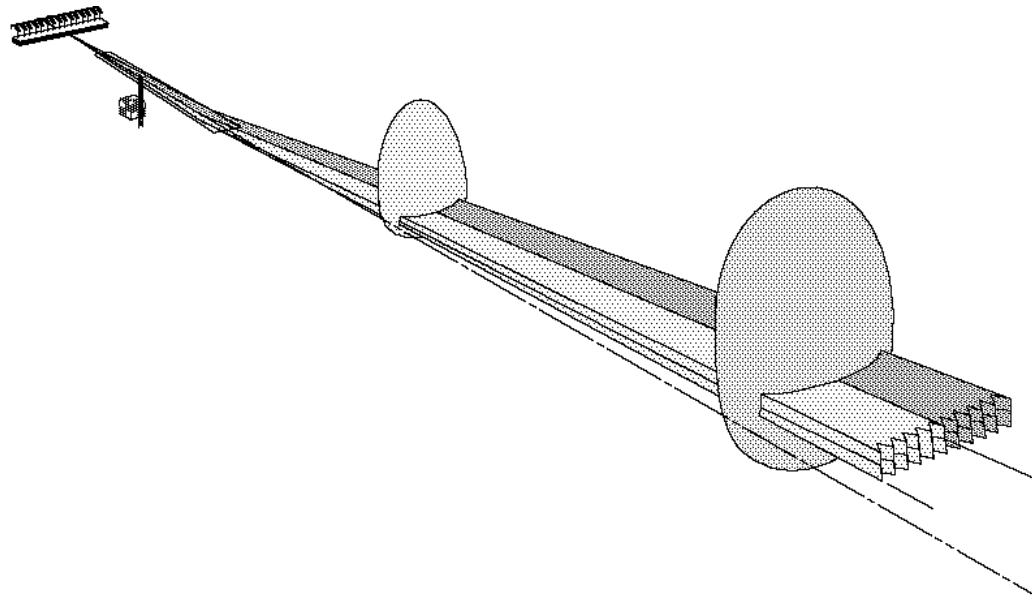
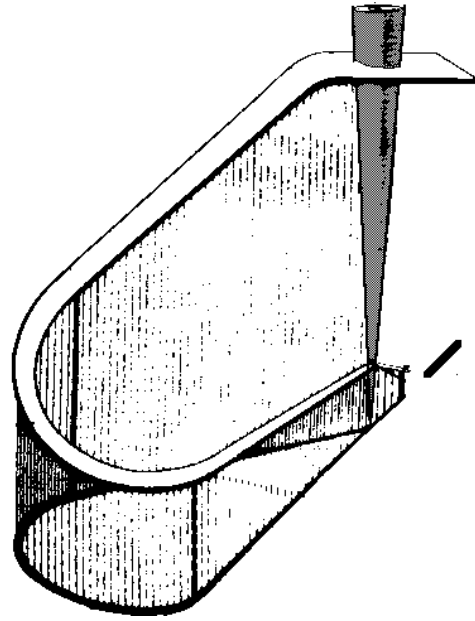
Climb to Circle Minimums

Clean up

Notify approach on missed

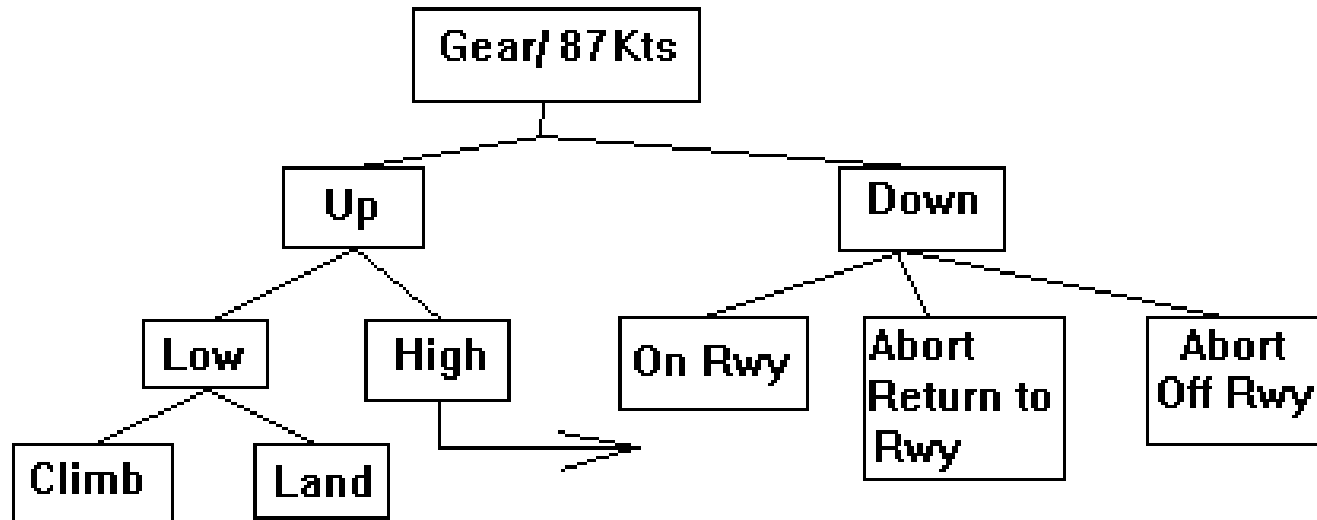
Climb to Circle Minimums

Notify approach on missed

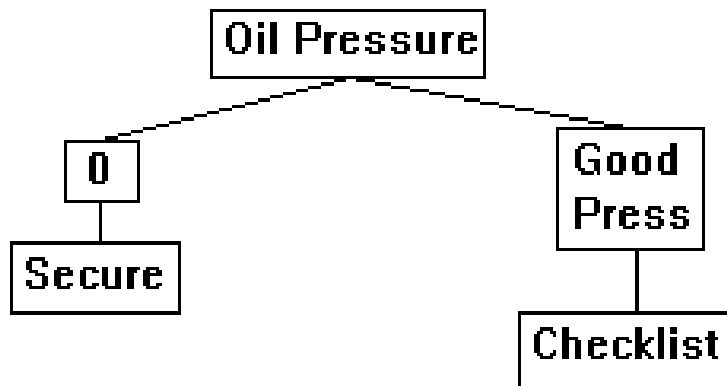


Single Engine Decision Tree

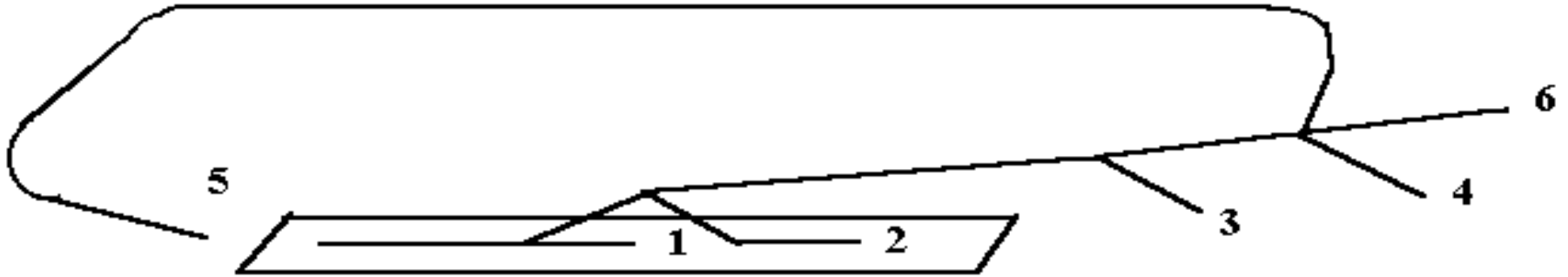
<1500'



>1500'



Emergency Procedures (Cont)



Options:

1. Stay on the ground
2. Re-land
3. Off airport landing Near
4. Off airport far
5. Return for landing
6. Continue on

Emergency Procedures (Cont)

ENGINE FAILURE DEMONSTRATION

Identify

Aircraft	Control
Airspeed	Blue Line
Mixtures	Both Rich
Power	2500 25"
Determine	dead engine
	Idle Foot = Idle Engine

Feather

Prop Control	Feather
Mixture Control	Idle Cutoff
Trim	3-5° Bank
Fuel Selector	Off
Carb Heat	Off
Magnetos	Off
Fuel Pump	Off
Alternator	Off

Emergency Procedures (Cont)

Unfeather

Fuel Selector	On
Mixture	Rich
Prop Control	Cruise
Throttle	open 1/4"
Magnetos	On
Fuel Pump	On
Starter	Engage
Throttle & Power	Reduce
Alternator	On

Flight Operations (Single Engine Maneuvering)

Maintain Bank and Ball

If altitude is limiting factor additional power on good engine is needed

How much is dependant on the gross weight

Engine Out Approaches & Landings

Increase good engine 2-4" of manifold pressure for descent rate

Maintain Ball and Bank in the approach

Which engine is up wind?

Wind on dead engine side is harder

As power is reduced in the flare flight transitions to normal landing

Approach at 110 with excess altitude

delay extension of gear until landing is assured

Avoid use of flaps until landing is assured

Decrease speed below 105 only if landing is a certainty