

3/14/6

Flight Controls
Hydraulic System

"Let me tell you what happened with my wife last night. We were talking and Vicky said 'What were you thinking the first time you met me?' I said 'I don't know.' And she said, 'No really, what were you thinking the first time you met me?' I said, 'Well, to be honest with you I thought 'Damn, she is so good looking I'd like to screw her brains out.' My wife said 'Man! So what do you think now?' I said 'I think I did it.'"

Left System (Driven by L-engine)

Yaw damper

Elevators

Ailerons

Rudder

Spoilers

Stall Barrier

Flaps

Gear

Ground Spoilers Servo Pressure

Brakes

L-T/R

Nose Wheel Steering

HMG

Right System (Driven by R-eng)

✓

✓

✓

✓

✓

✓

R-T/R

PTU

PTU (Driven by R-System)

Flaps

Gear

Ground Spoilers Servo

Brakes

Nose Wheel Steering

HMG

AUX (Driven electrically)

Flaps

Gear

Gear doors) on ground only

Ground Spoiler Servo

Brakes

Nose Wheel Steering

Rudder

Close air stairs / door

Charge Parking Brake

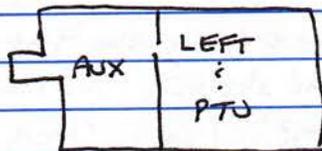
Nitrogen

2 bottles to blow
down gear

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Left System Reservoir



IF I lose left system fluid, the only thing I've lost is L-T/R

Aux Fluid returns to aux section and draws fluid from left system

IF lose R-Sys Fluid only loss is R-T/R

IF lose L-System and Fluid (Worst Scenario)

- Still have flight controls
 - stall barrier
 - ground spoilers
 - brakes
 - nose wheel steering
 - Flaps (will be very slow)
- Need to blow gear down
- No L-T/R

AUX Pump produces 2 GPM
not designed to run continuously

Normal engine start "0/3/3"

since start with PTU armed



HYD PRESSURE	
L	R
0	3000
PTU	AUX
3000	0

Reservoir Quantities

4.8 / 1.6

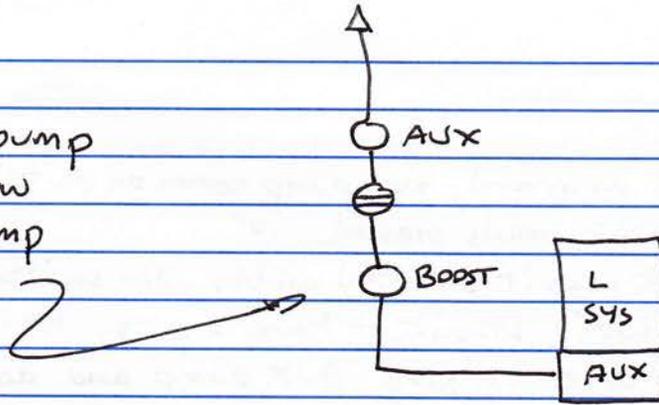
(Fully serviced with pressure on)

(without pressure add about 0.2)

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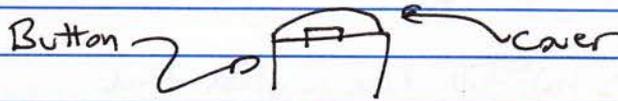
30

Aux Boost pump initiates flow into Aux pump then stops



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Left System has 5 Differential Pressure Indicators



Right System has 3

IF popped, push it down, run system if it stays down you are good to go.

PTU - Produces about 22 gpm

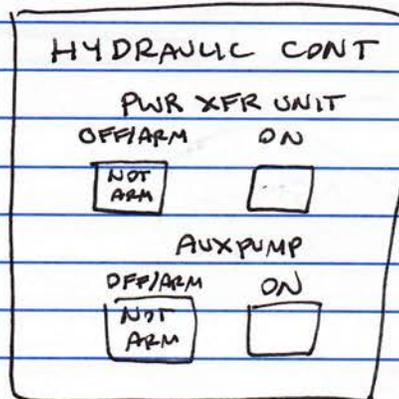
LESS DC

Needs at least 1.5g in L-SYS reservoir

R-SYS < 104°C

IF armed comes on when L-SYS < 1500 psi or - manual override

PTU DPI can be reset once then is good for 50 hours



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AUX Pump

- If armed on ground, aux pump comes on automatically when brake pedals pressed $\sim 100^\circ$
- Since it wasn't started with ON switch that switch won't stop it - have to press ARM switch once to stop AUX pump and again to re-arm
- This is only automatic function of AUX pump

All accumulators have 1200 psi charge

57 "When I see a glass that is half full, I see a glass that is twice as large as it needs to be."

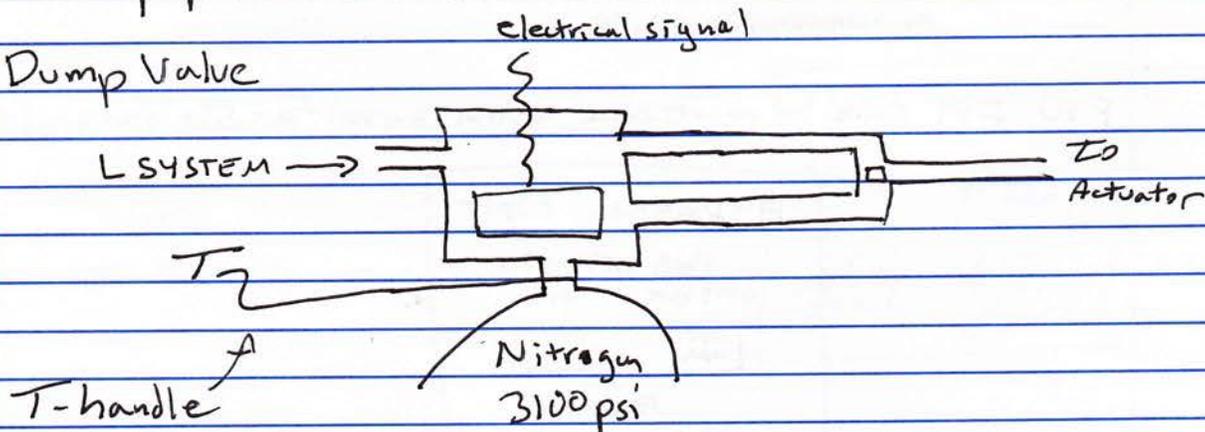
If Gear Up / Flaps Up and then lose fluid, source of leak may have been flaps

-- Aux pump at risk if you use it

← Landing Gear →

During alternate extension, gear handle must be down for proper indications and anti-skid

Dump Valve

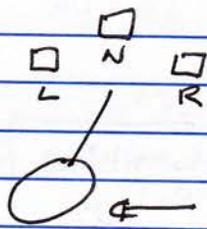


Blow Down

- Upside of U plates
- Downside of Gear
- Downside of Gear doors

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Gear handle is an electric switch



3 greens \rightarrow gear is down and locked

no 3 green \rightarrow not down and locked

2 lights in handle

UP position - light means one or more doors not uplocked

DN position - light means one or more gear not down locked

6 gear pins (3 gear, 3 door)

1:46

IF uplocks are closed on preflight and then gear handle up

- nose gear cycles up and down

- MLG retracts to uplock and stays

So... make sure uplocks are open

2:00

Gear Horn

- Below 350' AGL

Power Lever $< 5^\circ$

Gear not down/locked and Flaps $< 22^\circ$

Can be silenced

- Regardless of altitude

Flaps $> 22^\circ$

gear not down and locked

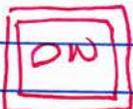
cannot be silenced

Partial Gear Landing - if you can get 2 land
if only 1, try to retract it

GPWS /

GND SPLRS

FLAP OVERRIDE

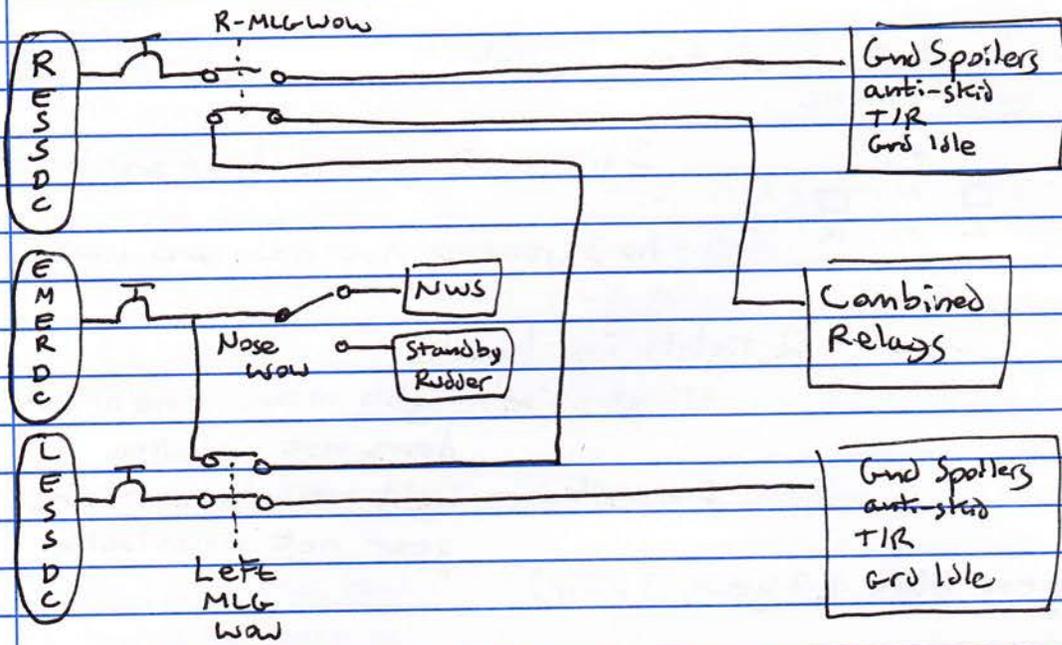


\rightarrow automatic ground spoilers even if flaps $< 22^\circ$
"TOO LOW, FLAPS" GPWS override

~~GPWS~~

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— WOW —



Also FWC > 150' air mode
a/s < 50 KCAS ground mode

IF FWC differs from WOW → CAS msg

WOW energizes to ground
deenergizes to flight (can pull CB to force air mode)

Combined relays need either MLG WOW to go to
Air mode

2:21 WOW PWR FAIL goes to air mode

WOW FAULT - Turn ground spoilers off, pull CBs

IF on landing you get a WOW fault with INHIBIT pressed
no aural warning only CAS

- wheel spin up permits Ground Spoiler ; T/R ; Brakes
- as wheels spin down lose " " "

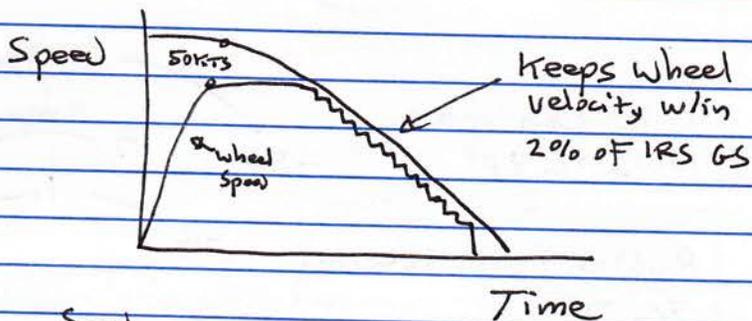
~~Need to turn anti-skid off or reset CBs
to get brakes back~~

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Anti-skid (all modes L-SYS, PTU, AUX)

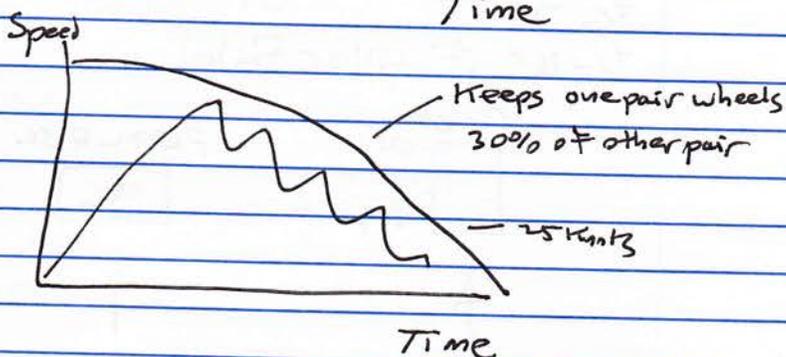
Primary System

IRS #1 - outboards
2 - inboards



Secondary System

Compares inboard
and outboard
wheels



2

Wheel Despin

Gear handle up a/s applies 3 sec brakes
If it fails

"WHEEL DESPIN FAIL" - means > 10 knts wheels
Put gear down immediately

Parking Brake needs > 1700 psi For a good application

Anytime AUX pump on, parking brake accumulator
will charge after all other needs met.

Parking brake meters First $\frac{1}{2}$ inch

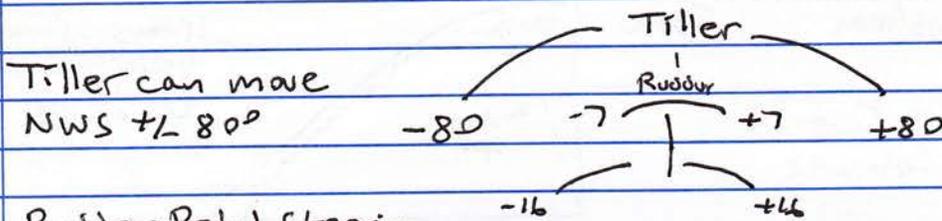
Technique: pull out until first feel it grab, then hold it
and see if that decel is good enough

Carbon brakes can get grabby if dusty.

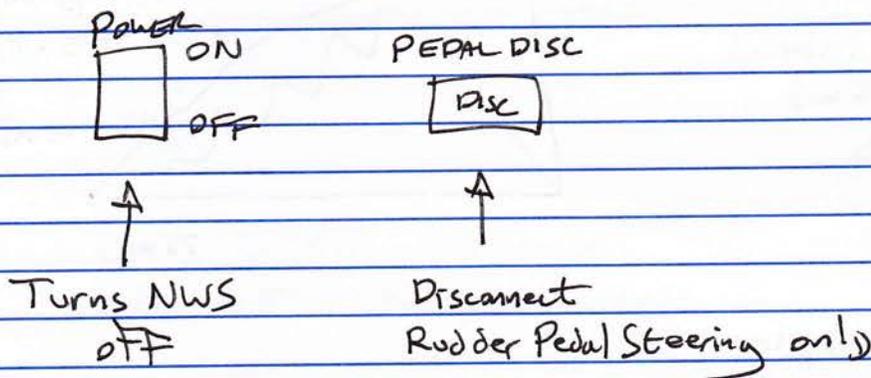
With a/skid off, suggest no more than 400 lbs pressure

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Nose Wheel Steering

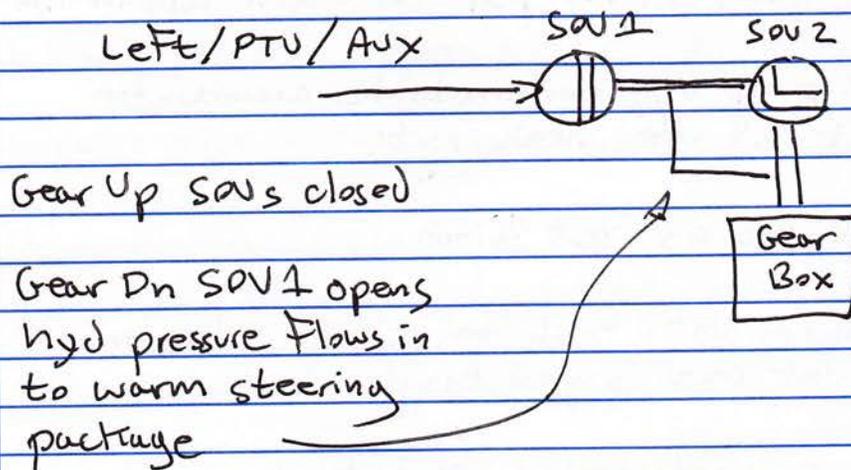


Rudder Pedal Steering
 $\pm 7^\circ$
 $\pm 16^\circ$ if tiller failed



Overtravel indicator pops up @ 82°

For tight turns don't use inside brakes to avoid overtravel - a big mx deal

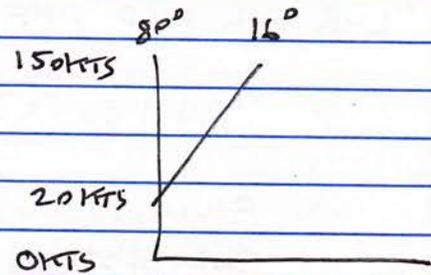


Nose wheel touchdown opens SAV2 after 0.8sec

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ASC 129 Variable Gain Steering

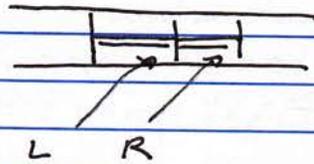
Reduces total authority as speed ↑



FLIGHT CONTROLS

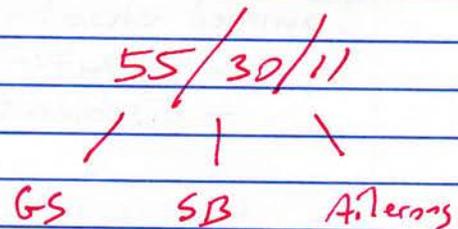
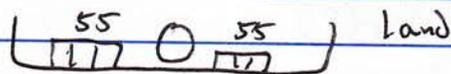
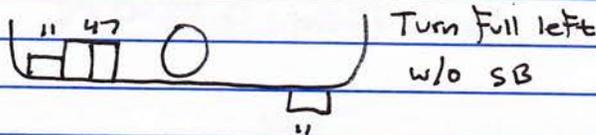
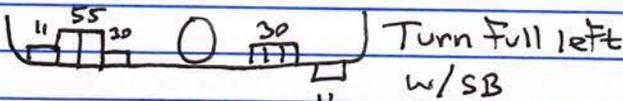
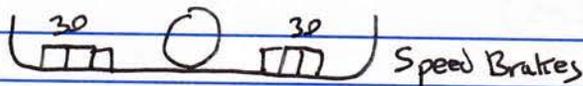
Actuators - dual chamber all heated

Loss of one sys still leaves Full 3000 psi From other



A/P disconnect stops all runaways (trim, Flaps, stab)

Flight Spoilers/Ground Spoilers/Ailerons



Hard Over Protection System (HOPS)



if input vs output differs > 1/2 sec removes all hydraulics

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"L-R AIL HYD OFF" \Rightarrow aileron HOPs

"Did I do it?" or "Did airplane do it"

Always removes hydraulics both sides

~~Both pilots had~~
4/5

Reset any HOPs w/ CB

Jammed ailerons (NO CAS)

- keep aircraft right-side up w/ rudder
- separate ailerons
- will be easier to turn in direction of good aileron
- if flight spoilers deflected, may need to turn spoilers off

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"L ELEV HYD OFF" \Rightarrow elevator HOPs

- only does one side
- other elevator good
- not a big deal

Jammed elevator (NO CAS)

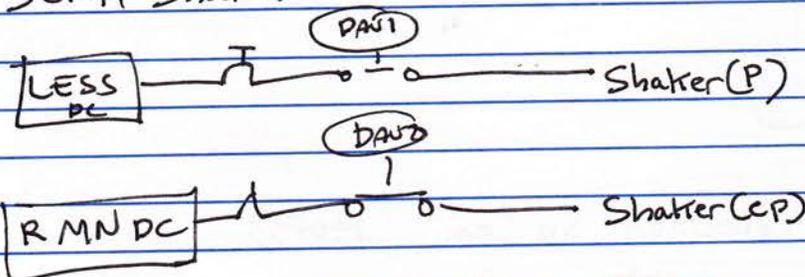
- fly a/c
- disconnect

Mach Tuck \rightarrow GV doesn't

Still has Mach Trim 0.82-0.85

1:20

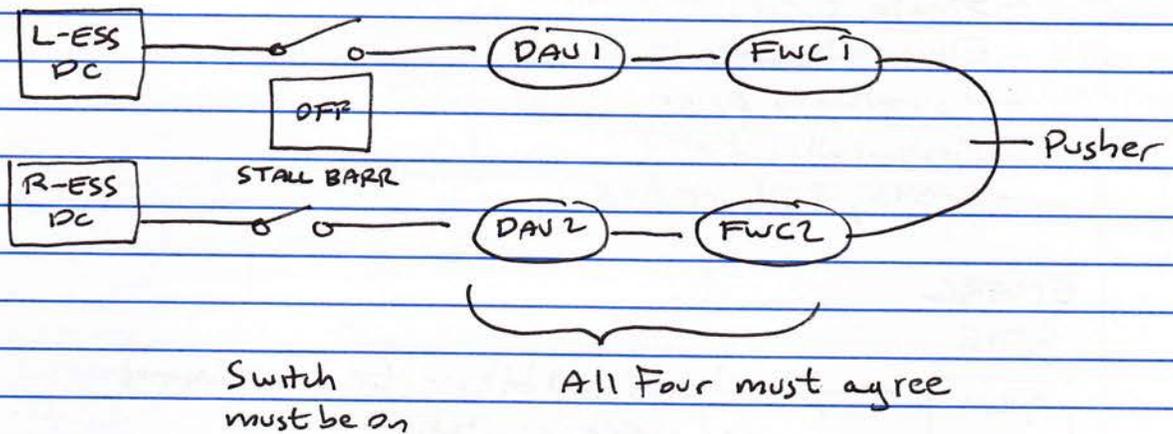
Stick Shaker



Either DAU sees 0.85 ADA

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Stick Pusher



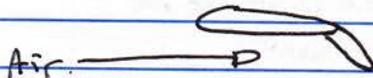
Deactivates @ $0.5G$ or $AOA - 3.6^\circ$ From push AOA

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Stall Barrier Test

- Press and hold DC STALL 1 TEST switch
- Watch PL1 & Verify shaker @ 0.85
pusher @ 1.00
- Press and hold A/P disc, verify controls free
- Release all
- Repeat For STALL 2 From right seat

Rudder



Force modulating valves reduce hydraulic pressure in reaction to air loads.

"RUDDER LIMIT" CAS means you are at that limit

"RUDDER HYD OFF" - Rudder HOPS

Gust lock \rightarrow don't engage or disengage unless pressure bled first.

"SINGLE RUDDER" and "SINGLE SPEED BRAKE" - only 1 hyd source

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Flaps-by-wire

- Single slotted Fowler
- Electrically controlled
- Hydraulically powered
- Mechanically actuated
- L-SYS, PTU, or AUX

EMERG

STAB

ARM

→ allows stabilizer to be trimmed w/ yoke switch

Ground Spoiler Test (SYNOPTIC PAGE)

OFF
ARMED

GND SPUR

- 1) OFF
- 2) Power Levers IDLE "UNARM" CAS
- 3) ARMED - deploy, NO CAS
- 4) Left Power Lever above IDLE - stow, CAS ON
- 5) Right Power Lever " "
- 6) Left Power Lever IDLE
- 7) OFF "UNARM"
- 8) TEST (Press and Hold) 2 lights, "W", 1 CAS
- 9) Release all lights, CAS out
- 10) IDLE "UNARM"

Ground Spoilers f

- Throttles IDLE

- Gnd mode on
- Wheel Spin Up

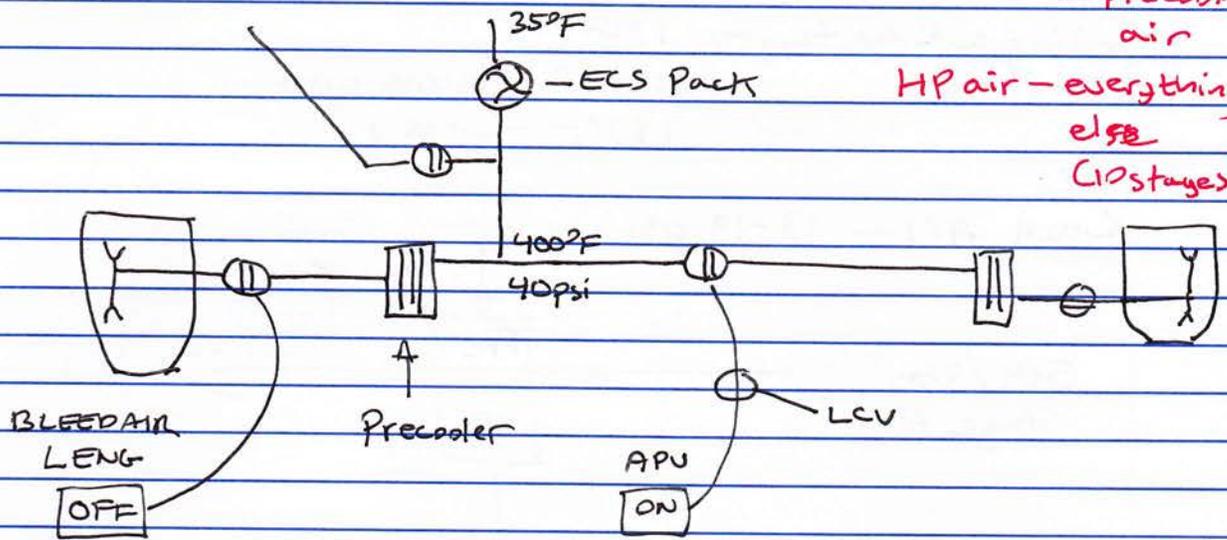
Stab powered by AC down to HMG

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————— Pneumatics —————

LPair - engine cooling
- Precooler air

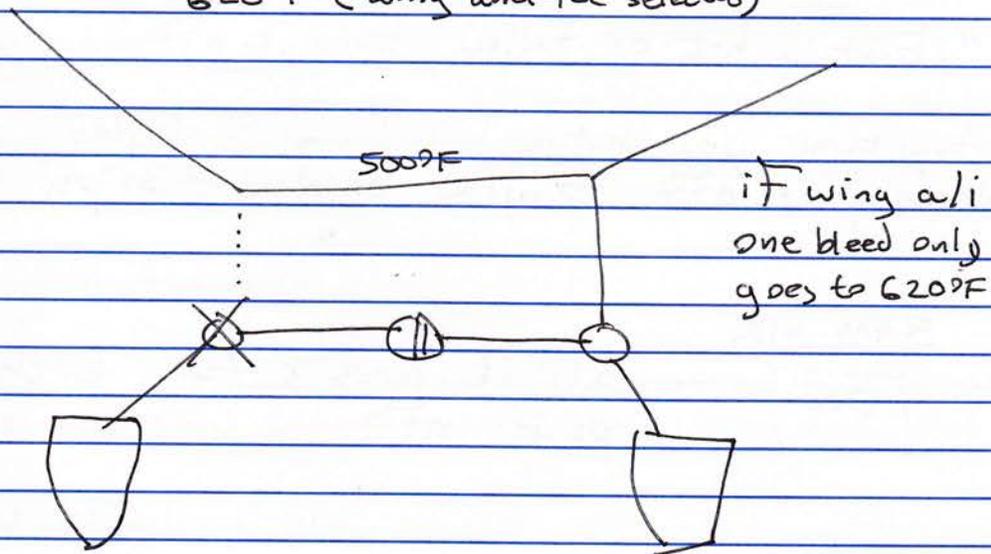
HPair - everything else
(12 stages)



- Isolation Valve opens automatically
- APU AIR
 - Crank Master
 - Start Master

Bleed Air Controller is responsible for all temperatures and minimum pressures.

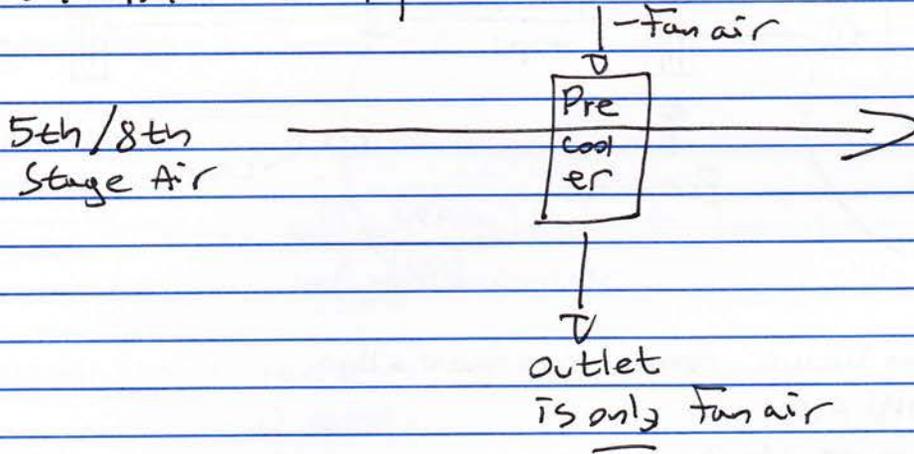
- 8th stage bleed air takes over 5th stage if 5th falls below...
- 14 psi (normally)
 - 22 psi (descent)
 - 35 psi (single pack)
 - 620°F (wing anti-ice selected)



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Wing anti-ice target 130°F
100°F - turns green
180°F - turns red

Cowl A/I - 13-19 psi



43: Engine Start

Start Master - ISOL VALVE opens

Right Pack off

Right Eng Start - Left Pack off

Starter Cutout - Left pack on

Left Eng Start - Left Pack off

Starter Cutout - Left Pack on

Start Master - OFF: Right Pack on

"IF it is hot or failed, turn it off"

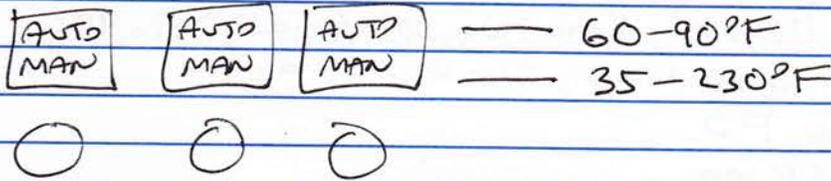
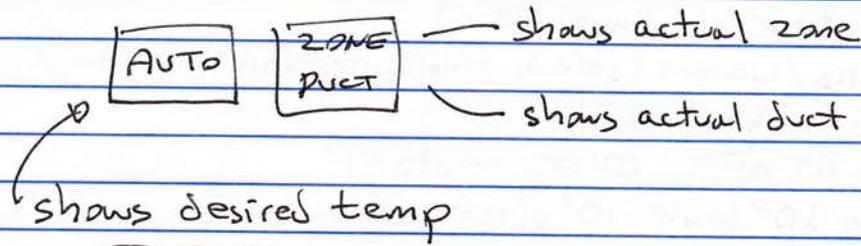
Any time you shut a bleed and isolation,
turn pack off to allow bleed + 35 psi

RAM AIR

ON

all it does is turn both
packs off

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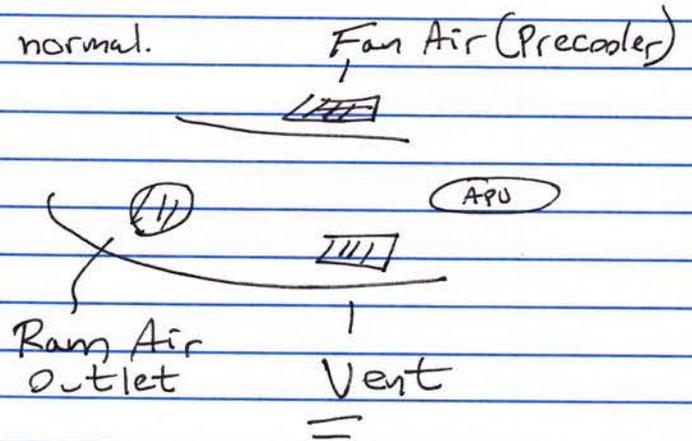
IF using MAN, bring rheostat to 11 o'clock first

126 Trim Air Valve in left wheel well is a new preflight item

Pressure bump @ 35,000' is normal.

On preflight 3 openings aft

"VFR"



Pressurization

AUTO) 2 AC motors	— Gets data From FMS — Pilot
SEMI		
MAN		

Differential Pressure

- 10.17 — normal maximum
- 10.28 — PRV (first chamber) "CABIN DFRW 10.28" Amber CAS
- 10.48 — PRV (second chamber) "CABIN DFRW 10.48" Red CAS

Normal climb A500 to 300

Cabin Press Low @ 8,000'	if LFE < 8,000'
10,000'	— 9,500'
14,500'	> 9,500'

Mastis @ 12,000'

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Emergency Descent (not EDM)

PIC - Masks / Comm (select mask, deselect HOT MIC)

"can you hear me?"

AP, AT OFF, IDLE - ASAP

Turn 30° bank 10° pitch - Slowly

SIC - Masks / Comm

FGP (15,000', Sync Hdg, ~~Spin~~ Selat, Spin 90°,
Speed MAN, 340 KCAS, FLC)

PIC - Follow FD

AT / AP on

When 340, Speed Brakes

SIC - 7700, ATC

Doors close pressurizes a little

28 Knots FLIGHT mode .25 psi