NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

Attachment 13 - Pan Am B707 Aircraft Operating Manual

OPERATIONAL FACTORS

DCA11MA075

A. ACCIDENT

Operator: Omega Aerial Refueling Services, Inc.
Location: Point Mugu Naval Air Station, California
Date: May 18, 2011
Airplane: Boeing 707-321B, Registration Number: N707AR

B. NATIONAL TRANSPORTATION SAFETY BOARD (NTSB) OPERATIONS GROUP

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C. SUMMARY

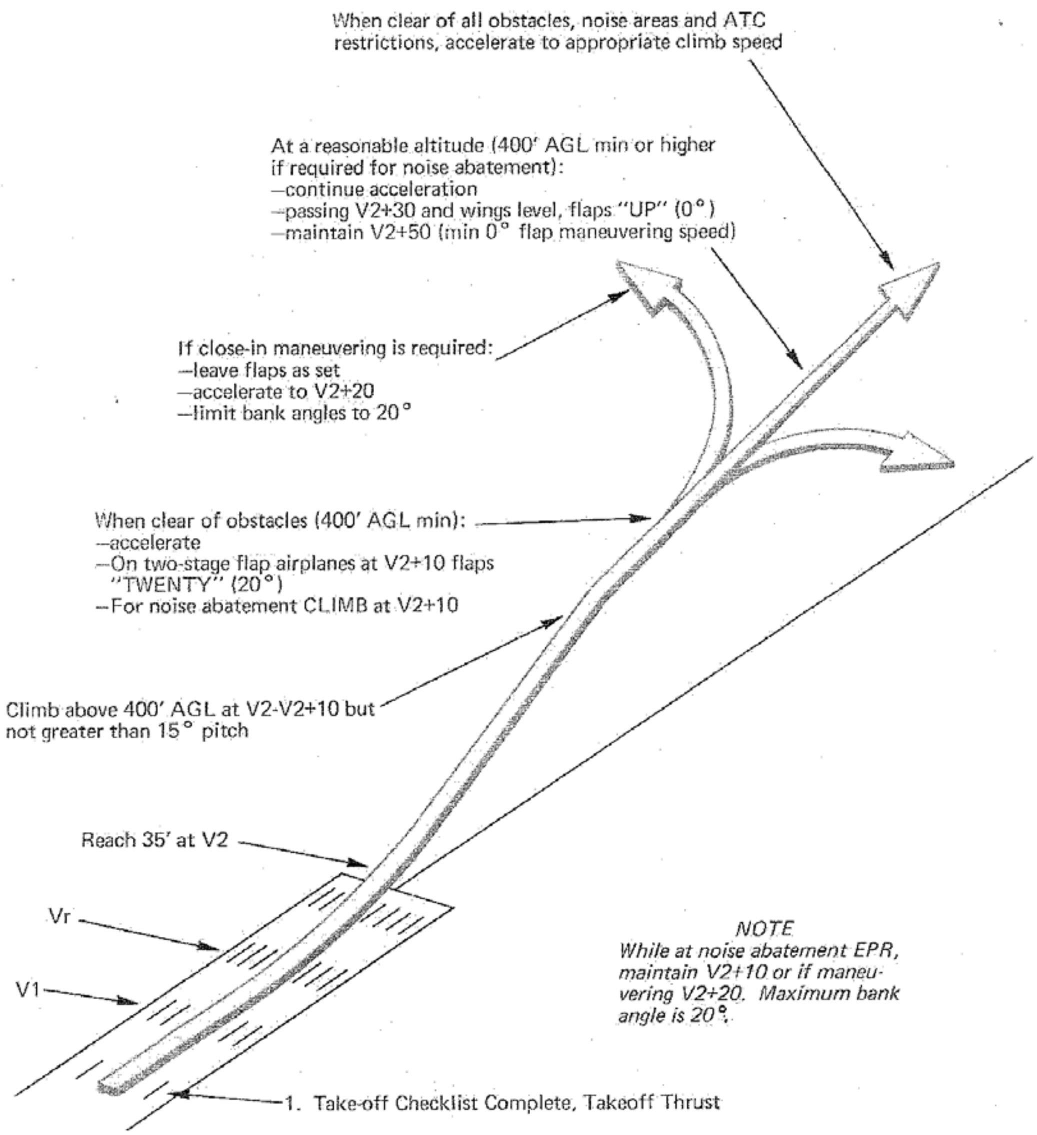
On May 18, 2011, at approximately 1727 pm local time (0027 UTC), Omega Air flight 70, a Boeing 707-321B (N707AR), crashed on takeoff at the Point Mugu Naval Air Station[1], Point Mugu, California. The airplane impacted beyond the departure end of runway 21 and was destroyed by post-impact fire. All three flight crewmembers aboard escaped with minor injuries.

[1] Naval Base Ventura County.

D. NORMAL OPERATION

P.A.A.
B–700

NORMAL OPERATION
TakeOff



NORMAL AND NOISE ABATEMENT

TAKEOFF PATTERN

8/1/69 704.012 pg. 3

WARNING

The take-off warning horn is armed by movement of the throttles to take-off thrust. An improper configuration should be immediately indicated by the intermittent horn sounding. Once the take-off roll has been started, if the horn sounds before V1 the cause may be difficult to determine. Do not attempt to assess the problem. Retard the throttles and stop the take-off.

Maximum acceleration is obtained by leaving the nosewheel on the runway until Vr is reached. Drag goes up rapidly if the body angle is not level. Thus, considerably more runway will be required if the airplane is rotated too soon.

"80 KTS"
At 80 KTS the Captain releases the nosewheel steering and the pilot making the take-off controls the yoke and rudder pedals.

Throughout the take-off the Engineer monitors the engines to insure full take-off performance and to avoid exceeding engine limits. At about 80 KTS he should check the engine oil gages and make a visual check of the FEO panel.

"V1"
Take-off may be aborted prior to reaching V1 with the assurance that a safe abort capability exists. Normally, once V1 is passed the take-off should be continued.

Under low visibility and ceiling conditions, the pilot making the take-off will go on instruments just before V1 and remain on instruments throughout the take-off. The other pilot will continue to include an outside scan until contact is lost.

"Vr"
At Vr rotate the airplane to the initial take-off attitude (8-10 deg.) with smooth, positive back pressure so as to reach V2 at 35 feet. Take-off attitude is always the same, regardless of TOGW. Once airborne, adjust attitude to maintain programmed speeds. Limit pitch attitude to 15 degrees.

!! CAUTION !!

During acceleration to take-off and climb speeds, the horizon spheres are subject to error and may indicate a higher than actual pitch attitude. To assure the desired climb after take-off you must crosscheck attitude with airspeed, altimeter and vertical speed. This error disappears several minutes after take-off.

Early or excessive rotation can activate the attitude warning stick shaker. If this occurs, smoothly lower the nose to the normal attitude.

Retract the landing gear after the airplane is definitely airborne and you are positive that a rate of climb is established. The brakes are automatically applied as the gear comes up.

There is no benefit to immediate gear retraction as drag is increased while the gear doors are open.

!! CAUTION !!

Do not apply the brakes prior to gear retraction. If pedals are inadvertently depressed a maintenance inspection is required.

INITIAL CLIMB
Climb to 400 feet Above Ground Level (AGL) at V2 minimum, 15 deg. pitch up maximum. At higher gross weights limit speed to V2 + 10. At lower gross weights limit pitch up to 15 deg. and accept higher speeds.

NOTE

When obstacle limited, maintain V2 (V2 + 10 max) and take-off flaps until clear of obstacle. Follow the Route Manual T-page procedures for that airport or runway.

On two stage flap airplanes when clear of obstacle (400 ft. AGL minimum) accelerate and at V2 + 10, flaps TWENTY (20 deg.).

If close-in maneuvering is required continue acceleration to V2 + 20 and limit bank angles to 20 deg.

At a reasonable altitude (400 ft. AGL minimum or higher if required for noise abatement) continue acceleration. Passing V2 + 30 and wings level, flaps UP (0 deg.) thereafter maintain at least V2 + 50 (minimum zero flap maneuvering speed).

NOTE

The 707 wing is efficient at high speed, but is less efficient at low speed with flaps up. The flaps greatly improve low speed characteristics. Consequently, the difference between flaps up and flaps down stall speeds is large; as much as 22 KTS with take-off flap and 36 KTS with landing flaps

WARNING

If the airplane rolls when the flaps are retracting, check the flap position indicators. If split, stop flap movement with the flap handle and attempt to realign the flaps.

If a fillet flap fails to retract, it will not show on the indicators and, on split fillet flap A/C, is not visible from the cabin. The rolling movement will increase with airspeed.

When clear of all obstacles, noise areas, and ATC speed restrictions accelerate to the desired climb speed.

SYSTEMS MANAGEMENT

ENVIRONMENTAL CONTROL SYSTEM

Environmental control system (ECS), before take-off, must be placed in the take-off configuration to prevent temperature and pressure surges and to stay within engine limits. Use the Engineer's individual check groups to verify settings.

FLAPS

Normally the flaps can be lowered during taxi. This allows the flight controls to be checked without causing a delay on the runway. However, in winds above 30 KTS, the lack of snubbers on the outboard ailerons, allows flight control limits to be exceeded if the airplane is not headed into the wind.

COMPASS

In checking the gyro compasses, make sure the indicators agree with each other and with the runway heading.

IGNITION

When the airplane is clean (5 min. max), the engine ignition switches should be turned off to conserve ignitor life.

YAW DAMPER

The series yaw damper is always ON. On parallel yaw damper airplanes the yaw damper should be turned on when comfortably airborne (1000 ft. suggested). Remember to trim and release rudder pedal forces before engaging so that the damper has the proper neutral point.

LANDING GEAR

When the gear has completed the up retraction cycle, the gear handle should be placed in the OFF position to depressurize the lines.

FLIGHT DIRECTOR

During take-off and initial departure the Flight Director may be selected to either No. 1 or No. 2 to permit the pilot not making the take-off to "bug" the desired heading.

OPERATIONAL VARIATIONS

CROSSWIND TAKE-OFF

Unless a strong wind exists, no unusual characteristics should be expected during take-off. Use the normal rolling take-off procedure, keeping the nosewheel firmly on the runway. Due to inlet distortions in high crosswinds, the engines may momentarily stall as thrust is applied.

NOTE

If the F/O is making the take-off the Captain should call for rudder inputs to keep the nosewheel steering unloaded. This will make a smoother transition when the Captain releases nosewheel steering at 80 KTS.

Be alert for any tendency of the upwind wing to rise. Keep the wings level with roll control. Stay on the runway centerline. As the controls become more effective with speed, displacements can be reduced.

At Vr rotate with smooth, positive back pressure. Liftoff cleanly, making sure not to settle back on the runway.
The airplane is in a sideslip with crossed controls at liftoff. Ease out the cross control inputs and establish a crab angle to maintain the desired track.

NOTE

When the crosswind component exceeds 15 KTS control may be difficult, especially on slippery or narrow runways. Use caution. Consider requesting a runway more into the wind.

OPERATIONAL VARIATIONS (con't)

NOISE ABATEMENT TAKE-OFF

Noise abatement procedures reduce noise levels by reducting EPR over selected areas, which often have noise measuring equipment. It is important to have the EPR reduced BEFORE overheading the measuring point. Be sure that all four engines are reduced - one engine above the reference EPR will produce as much measurable noise as all four. It is also possible to record excessive sound by reapplying power too soon after passing the measuring point.

THRUST SETTING

The noise abatement EPR is:
- 1.6 on fan a/c
- 2.0 on non-fan a/c

This EPR will produce 600-1000 fpm rate of climb at heavy gross weights. It is adequate to maintain at least level flight on 3 engines. Naturally, if an engine fails, use power as required.

PROCEDURES

There are two methods of determining the point of EPR reduction for noise abatement.
- Standard or altitude method. This method utilizes a take-off power climb to 1000 feet, and a reduced EPR climb to 2000 feet.
- Timed method. This method utilizes a take-off power climb for a specified time period, and then an EPR reduction. Time can be measured in the cockpit or by a ground observer. Procedures are contained in the Route Manual T-pages.

TECHNIQUES

Use the normal take-off procedures, climbing above 400 feet at V2 + 10 and flaps 14/17/20° but not to exceed 15 deg. pitch attitude.

At 1000 feet or when the countdown begins, as appropriate, ease the nose down while reducing EPR to the noise abatement setting.

Maintain V2 + 10 and remain at reduced EPR for the time specified in the Route Manual (10 sec minimum) or while climbing to 2000 feet, as appropriate.

Normally, the EPR is held until the time or altitude specified is reached, and if still over the noise critical area increase thrust gradually as altitude is gained (0.1 EPR per 100 feet.)

If turns are made increase speed to V2 + 20 and do not exceed 20° bank.

After completing the noise abatement profile, reset thrust and resume desired climb schedule.

E. ABNORMAL OPERATION

TAKE–OFF

The possibility of an engine failure during the takeoff run should always be considered and planned for prior to the time the takeoff run is started. Usually airplane yaw will be the first indication of engine failure.

LOSS OF ENGINE BEFORE V1

If an engine fails before V1, the takeoff is normally rejected. In this case, the Captain will announce " I HAVE THE AIRPLANE". Regardless of who is making the takeoff, the Captain will take physical control of the aircraft and accomplish the following:

- Throttles IDLE
- Speed Brake 60 degrees
- Maintain directional control with rudder, brakes and nosewheel steering.
- Reverse operating engines and use maximum thrust consistant with ability to maintain directional control.
- Use appropriate wheel braking.

Copilot will hold yoke forward and keep the wings level.

Complete engine fire and shutdown procedures as appropriate.

LOSS OF ENGINE AFTER V1

Normally the takeoff will be continued if an engine is lost at or after V1.

Maintain runway directional control by application of rudder. Keep the nosewheel firmly on the runway to aid directional control capability.

Rotate smoothly at Vr to normal takeoff attitude. A slower rotation rate should be used at high gross weights.

Retract the landing gear only after all indications confirm the aircraft is airborne and a definite climb profile is established.

NOTE

During the initial gear retraction sequence, when the gear doors open, aircraft drag is increased.

In climbing it is essential to maintain a minimum drag configuration. This will be the rudder and bank combination requiring the least amount of control wheel deflection.

Maintain V2 to 400' AGL. If the engine fails below 400' and airspeed is above V2 consider the requirements and utilize performance potential accordingly:

- to clear an obstacle maintain V2+10 until the desired altitude is reached. Then, flaps TWENTY (20°) on two-stage flap airplanes, accelerate, passing V2+30 flaps UP (0°), maintain V2+50 to 1500'.
- when not obstacle limited a lower pitch attitude can be held (approx. 10°) allowing the airplane to gradually accelerate. Passing V2+10 flaps TWENTY (20°) on two stage flap airplanes, passing V2+30 flaps UP (0°), maintain V2+50 to 1500'.
- At 1500' reduce thrust to rated.

Use best angle of climb speeds (2/3-Eng Climb) from Critical Speeds placard for continued climb.

Once the airplane is above 400' and control is stabilized, action can be considered for the failed engine. Utilize all indications i.e. control feel, vibration, noise and instruments in judging the type and timing of appropriate procedures. Indications of fire, impending engine breakup etc. should be dealt with immediately. With less severe problems such as low oil pressure, low fuel flow, throttle linkage failure etc. it may be desirable to utilize the available thrust to gain additional altitude and/or speed. Complete the checklist after the situation is stabilized.

ROUGH FIELD TAKEOFF

Use normal take-off procedures, except at 80 knots raise the nose to lighten load on the nosewheel so it is barely touching. This will increase lift and extend the main gear oleos more than normal to better absorb runway undulations. Be alert to avoid a nose-high attitude, high drag condition.

!!CAUTION!!

Do not start rotation prior to VR.

TAKEOFF WITH STABILIZER TRIM SET INCORRECTLY

If a take-off is made with the stabilizer set too far NOSE UP, an accelerated stall could result after takeoff. The first indication the pilot has when the stabilizer is too far nose up is that the nosewheel tends to ride lightly and forward elevator pressure is required to maintain proper pitch attitude. Retrim (as soon as possible) to lighten the elevator pressure.

If a take-off is made with the stabilizer set too far nose down, the take-off ground run may be appreciably lengthened. The first indication the pilot has when the stabilizer is set too far nose down is that the nosewheel tends to ride heavily. Retrim as soon as possible to lighten elevator pressures.

NOTE

Aircraft rotation on the ground requires higher control force than in flight because on the ground rotation is around the main gear while in flight it is around the center of gravity. The moment arm from the tail to the center of gravity is longer and thus less elevator deflection is needed to maintain attitude.

NOTE

Trimming of the stabilizer when the CG is near the FWD or AFT limit may induce actuation of the takeoff warning horn.

If a grossly out of trim condition requires a change in trim to complete the takeoff it may be necessary to unload the elevators so the electric trim clutch does not slip. The earlier this is recognized and corrected the less additional runway will be used.

REJECTED TAKEOFF

A rejected takeoff does not normally present any operational brake problems that are not covered in the Brake Energy chart. There is the possibility that serious problems could arise if an aborted takeoff is made at a heavy gross weight on a balanced field at or near V1 where maximum continued brake usage is required to stop. In that case there is the possibility the brake assemblies are very nearly molten metal. After an accelerate-stop of this nature, clear the runway and evacuate the passengers.

If aborting due to engine fire and the engine continues to burn, consider remaining in alignment with wind direction to keep flames from fuselage or wing tip vents.

Keep an engine running (as long as practicable) for communications and P.A. system use. (Evacuation command is best controlled by use of P.A. system). Notify the tower and request emergency equipment.

Do not apply fire extinguishing agent directly on tires and wheels. Approach wheels from the front or rear only. KEEP ALL PASSENGERS AND CREW AWAY FROM WHEEL AREAS UNTIL BRAKES ARE COOLED.

Refer to Brake Energy chart when maximum braking has been used to check any precautionary measures that may be required.

CLIMB

THREE OR TWO ENGINE CLIMB

Set rated thrust for either 2 or 3-engine climb. If maximum angle of climb for terrain clearance is required, use 2 or 3-engine climb speed as shown on Critical Speeds placard. Above 20,000′ add 1 Kt/1000′ to this speed.

Maximum rate of climb is obtained at speeds specified on 2 or 3-engine operating charts.

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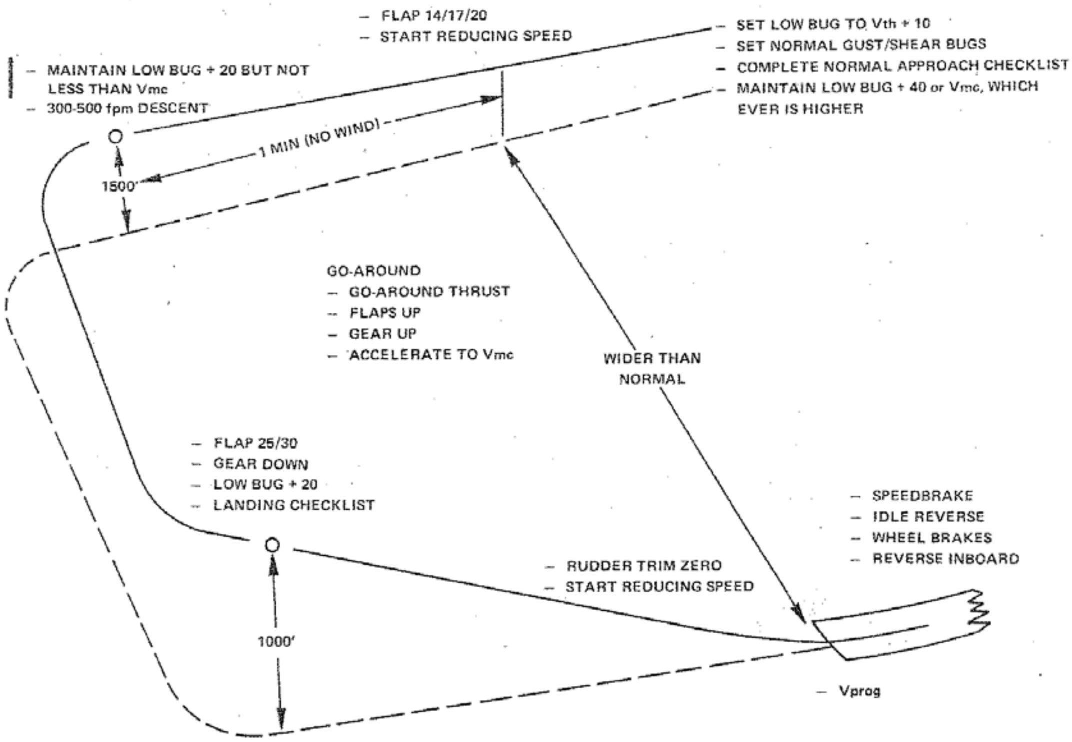
TWO ENGINE APPROACH PATTERN



Use the TWO-ENGINE PROCEDURE checklist as a briefing guide. Set the low airspeed bug to Vth + 10 (partial flap landing adjustment). Set normal gust and/or gradient bugs. Complete the normal APPROACH checklist.

Maintain low bug + 40 or 2-engine Vmc, whichever is higher. Make the pattern wider than normal. Maintain 1500' AGL.

Abeam the landing end of the runway, lower flaps to 14/17/20°. Begin slowing to low bug + 20. Fly downwind about 1 minute (no-wind).

Turning base, maintain low bug + 20 but not less than Vmc and start a 300-500 fpm rate of descent.

Turning final, altitude should be about 1000' AGL. On glide slope extend flaps to 25/30° and lower the landing gear. Maintain low bug + 20. Complete the normal LANDING checklist.

When a landing is assured, zero the rudder trim and begin slowing so as to cross the threshold at Vprog. Land in the touchdown zone; don't float.

NOTE

At heavy weights touchdown speed will be high and reverse thrust will be negligible so speed control is important. Don't be too fast.

After touchdown, extend speedbrakes as the nose is lowered. Put all throttles to idle reverse as you normally would. Brake as required. Reverse the inboard engine as desired. Be prepared to brake harder than normal.

A go-around should not normally be started below 500' AGL. This permits further descent during clean up and acceleration to Vmc.

To go-around:
- Apply go-around thrust (banking up to 5° towards the operative engines aids in directional control)
- Flaps UP
- Gear UP
- Level or descending acceleration to Vmc.
- Climb at Vmc until above obstacles (if any) then accelerate to 2/3 engine climb speed.

NOTE

This go-around procedure presumes an initiation at low bug + 20 with adequate altitude to begin an immediate acceleration. The normal rule of 50 maneuvering margins are not provided so acceleration time to Vmc can be minimized. Keep the wings between level and banked 5° toward the operative engines. Do not arbtravily rotate to the normal 10° go-around attitude. Thrust may be insufficient to both accelerate and maintain 10° attitude.

TWO ENGINE - ONE OUT EACH SIDE

If one engine on each side is inoperative use the normal 4-engine approach procedure. At landing weights, thrust available is adequate. Directional control should not be a problem.

NOTE

With no. 2 and no. 3 engines inoperative, landing gear and flap extension and retraction will be slower than normal due to reduced hydraulic flow.

After landing, reverse only if operating engines are symmetrical.

MINIMUM FUEL GO-AROUND

When making a go-around with less than 1,000 pounds of fuel in any main tanks,
- turn all main tank boost pumps ON and open all manifold valves.
- Engine start switches to FLIGHT START (ON).
- apply thrust slowly and smoothly to the extent consistent with gross weight, speed etc. Maintain minimum acceleration and limit body angle to 8° so as to prevent aft boost pumps uncovering. The forward boost pumps will uncover but should not be shut off. If aft boost pump lights come on, lower airplane nose. Re-adjust thrust smoothly as required.
- Retract flaps 25°/30°, Gear UP.

AIRSPEED INDICATORS INOPERATIVE

Speed should be held using the thrust values used on a normal approach and landing. Because thrust settings vary with weight, glide slope angle, aircraft configuration etc., no specific value can be suggested. Exercise best judgement in using thrust settings normally used with the airspeed indicator operative.

ICE ON WINDSHIELD

Use normal approach procedures. Try to keep field in view at all times from sliding windows. Open these windows if desired, but remember they cannot be opened if the aircraft is pressurized. Expect high noise level when open. With windows open, both pilots can assist in maintaining an accurate approach path.

FIRE

Judgement and precision are as important as speed when putting out an engine fire. Actuating a wrong control could cause more trouble than a few seconds delay in putting out the fire.

When the aircraft has experienced a fire warning inflight or on the ground, it should be definitely established that there is no fire before the aircraft is brought into any congested area on the ground.

PHASE I

1. Throttle – IDLE
2. Start Lever – CUTOFF
3. Bell Cutout – PUSH
4. Ess. Power Selector – SET.
   Engineer advise "Essential Power SET". The engine supplying essential power must not be announced since it may be misunderstood as the problem engine.
5. Engine Fire Selector – PULLOUT.
   The flight engineer will monitor the engine fuel valve transit light. This action shuts fuel off at the dry bay in the wing. If valve does not close:
   a. Push fire handle IN.
   b. Close valve with fuel valve switch at engineer's panel.
   c. Pull the fire handle OUT.

PHASE II

1. Autopilot/Yaw Damper - OFF
   (Leave Series Yaw Damper - ON) Since rudder trim will be necessary, disengage parallel yaw damper/auto-pilot until any trimming of the aircraft is done. The aircraft can be trimmed with the series yaw damper ON. After the aircraft has been trimmed, the parallel yaw damper and the autopilot may be re-engaged. Whenever practicable, this item should be accomplished simultaneously with phase I.
   VISUAL INSPECTION OF ENGINE
   A visual inspection of the engine shall be made from the cockpit to ascertain the presence of fire. This could be done during Phase I, time permitting. If visual sighting from the cockpit is inadequate or does not indicate fire, then the engineer shall visually inspect the engine from the main cabin for indications of fire or smoke. On cargo aircraft, it will not be possible to make a visual inspection from the main cabin.
2. Use 1st Charge - IF REQD.
   Check the transfer switch to be in NORMAL. Depress the fire extinguisher button under affected engine fire selector and hold for two seconds to assure operation of the engine selector valve and discharge of the bottle. (On 121B, Hold to 1st Charge for two seconds. No transfer switch.)
3. Engine - CHECK VISUALLY
4. Fire Ext. Sel. - TRANSFER. (121B no transfer switch)
5. Use 2nd Charge
   If fire light persists and visual inspection indicates fire, depress the discharge button under the affected engine fire selector again for two seconds. (On 121B Hold to 2nd Charge for two seconds. No transfer switch.)

   When the fire is out, complete the engine shutdown check list.

ENGINE DAMAGE

When an engine has sustained damage, Phase I of the engine fire check list is to be accomplished, including the pulling of the fire selector handle. This is to prevent a potential engine fire. Afterwards, complete the engine shutdown check list.

ENGINE FAILURE

Reference Operating Technique Section .053 for failure prior to or after V1. Circumstances must dictate the action taken. Normally, however, the aircraft should be "cleaned up" (gear and flaps up), prior to shutting down an engine. An engine that has failed could be still producing significant thrust. Primary concern should be given to speed control. This is mandatory if guaranteed performance is to be obtained. Use Engine Shutdown Procedure for shutting down the engine.

!! CAUTION !!

All engines which have windmilled as a result of a shutdown in flight must be inspected on landing, the type of inspection depending upon the circumstances as defined in Maint. Manual section 72-00-1. A notation must, therefore, be made in the Aircraft Flight Report, stating how long the engine windmilled and whether or not the engine decelerated to windmilling rpm before the oil pressure dropped to zero. Also, if the engine windmilled more than 15 minutes without a positive indication of oil pressure, a notation to this effect must be made.

TWO ENGINE FAILURES

For better understanding of two engine failure procedures, the following engine configuration list is presented:

Engine No. 1
A.C. Generator
Eng. Air Bleed
(when installed)

Engine No. 2 and No. 3
A.C. Generator
Turbo Compressor
Hydraulic Pump
Air Bleed (when installed)

Engine No. 4
A.C. Generator
Turbo Compressor
or
Eng. Air Bleed
(when installed)

As shown, a failure of any two engines will reduce available electrical power 50%. During certain conditions this remaining power may not be sufficient to operate all electrical systems simultaneously. Consequently, power consumption will have to be monitored to avoid overloading the remaining two generators.

When engines 2 and 3 fail, some hydraulic pressure will be available for the utility system from the windmilling engines. At speeds down to 160 knots (12% engine windmilling RPM) approximately 2 gallons per minute is available from each pump and is sufficient for normal spoiler operation and gear and flap operations at increased operating times.

FIRE – WHEELWELL

See Emergency (buff) check list.

FUSELAGE FIRE OR SMOKE – GENERAL

Any evidence of smoke or fire in the main cabin must be reported to the Captain immediately, even though it may be deemed of minor nature and is being adequately controlled by flight service personnel. Emphasis must be given to the fact that any procedure recommended as fire fighting practice cannot cover all contingencies. In the event the smoke or fire must be controlled remotely from the cockpit, immediately perform the steps given in the appropriate emergency check list.

PASSENGER CABIN SIDEWALL FIRE

Reduce the ventilation rate to the minimum required to hold cabin pressure by turning off the excess turbocompressors and/or engine bleeds. Experience has shown that excessive ventilation tends to aggravate the fire. If the fire cannot be reached remotely, remove the sidewall paneling by unsnapping the vertical trim molding and unscrewing the trim support. The fire ax and asbestos gloves may be used to pull any burning insulation into view. The portable smoke/oxygen unit is available in the cockpit if required.

LOWER CARGO COMPARTMENT FIRE

Both forward and aft lower cargo compartments are Class D.... fire resistant, air tight, no extinguishing system installed. In event of fire or smoke in these areas:

1. Inspect through viewer if loading conditions permit.
2. Oxygen Mask-AS REQUIRED.
3. Keep compartment-SEALED.
4. If situation warrants, proceed to nearest facility and land.

CLASS B MAIN CABIN FIRE

Class B compartments are ventilated and may be entered in-flight:

a) 300C aircraft in a combination cargo/pax configuration.
b) 300C aircraft in an all cargo configuration should be considered as CLASS B when an aisle is provided and the fire is accessible in flight.

Upon detecting smoke from a Class B compartment:

1. Portable 02 and Smoke Mask ON.
2. Enter Compartment - Inspect Fire.
   Dry Chemical Extinguisher located in attendants area aft of cockpit bulkhead (300C).
   Close cockpit door if smoke in Main Cabin area.
3. Extinguish fire with hand extinguisher.
4. If situation warrants - proceed to nearest facility.

CLASS E MAIN CABIN FIRE

These procedures apply to cargo aircraft utilizing 125 inch pallets and also for 88 inch pallet or bulk load when entry into the cabin area is not deemed advisable. The intent of the procedure is to smother the fire by depressurizing the cabin to a resulting performance deterioration. These requirements are intended to guarantee adequate performance to effect a safe landing after either a single or double engine failure.

ONE ENGINE INOPERATIVE

At all points along the route the airplane must have the ability to produce sufficient performance, after an engine fails, to clear all terrain and obstructions that are within 5 statute miles of either side of the intended track. This requirement must be met at the temperatures forecast to prevail at the required altitudes at the planned time of the flight.

One way to accomplish this is in limiting the takeoff gross weight so that fuel burnout will give an enroute weight light enough to assure the necessary performance over the most critical point on the route. When applying the rule in this way it must be shown that the airplane can at least fly level on three engines at an altitude at least 1000' above the terrain using "net" flight path data. In this case the "net" flight path is derived by subtracting 1.6% gradient from the actual climb performance the airplane can produce. Thus, the net climb gradient capability remains as a performance margin at the weight, altitude, and temperature prevailing at the critical point on the route.

When it is desired to operate at take–off gross weights higher than those limited as above, other means than fuel burnout must be used to show that the required performance is available. Fuel dumping and/or "drift–down" may then be assumed for this purpose. When applying the rule in this way it must be shown that the "net" flight path available after engine failure would permit the airplane to clear all terrain by at least 2,000 feet while cruising or "drift–down" to an alternate airport within range of the fuel remaining after dumping. Full account must be taken of the wind and temperature forecast to prevail in the area. And an enroute alternate airport to which the airplane is assumed to divert, and meeting the prescribed weather minimums, must be specified on the Flight Plan and Clearance form.

Appropriate limitations incorporating the TOGW and enroute alternate requirements are published for each route where applicable.

NOTE

Fuel dumping and/or diversion to a specified alternate are assumed only for the purpose of showing compliance with the regulations. They should not be construed as required procedure for any given flight on which an engine failure occurs.

TWO ENGINE INOPERATIVE

For any flights during which the airplane is not at all times with in 90 minutes of a suitable landing area it must be assumed that a double engine failure occurs at the most critical point along the route. Any airport that has sufficient runway length to accommodate the 60% alternate landing requirements may be considered suitable. This rule is usually only applicable to long overwater flights.

When establishing the weight limitations to comply with this rule account is taken of the weight reduction enroute due to normal fuel consumption of four engines. Then, at some point in the flight, two engines are assumed to fail simultaneously. If the airplane weight is excessive at this point it may be reduced by assuming that fuel is dumped, after the engine failures, to a weight that will provide the required "net" flight path. The "net" flight path is derived by subtracting 0.5% gradient from the actual performance of the aircraft.

–Net flight path must clear vertically by at least 2000 FT. All terrain and obstructions along the route within 5 statute miles (4.34 nautical miles) on either side of the intended track.

–Net flight path shall have a positive slope at 1,500 Ft. above the airport where the landing is assumed to be made after failure of two engines.

–Sufficient fuel to proceed to the airport and to arrive there at an altitude of 1500 Ft., and thereafter to fly to 15 minutes at cruise power.

The engine failure point used must be the point on the route most critical with respect to takeoff weight when considering that the airplane must be light enough to make the required flight path yet contain enough fuel to continue or return. Since the maximum failure point weight is limited, and since a minimum portion of that weight must be

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fuel for two engine operation, then the maximum weight of the airplane without fuel (maximum zero fuel weight) must be controlled for any given flight. Data incorporating the appropriate takeoff gross weight--zero fuel weight limitations are published in the Route Manual for each route where applicable.

APPROACH AND LANDING LIMITS

To establish the maximum allowable takeoff gross weight for any given flight the performance of the airplane after arrival at the intended destination or alternate airport must allow it to produce certain minimum climb gradients in an approach configuration and/or a landing configuration.

APPROACH CLIMB

The requirement is intended to guarantee adequate performance in a "go around" after an approach with an inoperative engine. The weight of the airplane must be limited so that the gradient of climb available will be 2.7% or better on three engines, at takeoff thrust for the temperature forecast to exist on arrival. The flap angle used to establish approach climbout performance must be chosen so that the stall speed with this flap setting does not exceed 110% of the stall speed with landing flap setting for the same gross weight. The climb speed used must not exceed 150% of the approach stall speed.

LANDING CLIMB

This requirement is intended to guarantee adequate performance to arrest the descent and "go around" from the final stage of landing when the landing gear is down. The weight of the airplane must be limited so that the gradient of climb available will be 3.2% or better, on four engines at the thrust available 8 seconds after initiating movement of the throttles from idle to takeoff position. The flap setting used to establish landing climbout performance is normally the full down position. And the speed used must not exceed 130% of the stall speed in this configuration.

LANDING DISTANCE

The maximum weight for landing on any given runway must be limited such that the landing distance required by the performance rules will match the effective landing length available.

EFFECTIVE LANDING LENGTH

—Is the distance from the far end of the runway to the point on the approach and where the obstruction plane touches down on the runway. The obstruction plane is a plane which is tangent to or clears all obstructions in the obstruction clearance area and which slopes downward toward the runway at a 1 to 20 slope from the horizontal. The area in which the obstruction clearance plane must clear all obstacles is 200 feet wide on each side of the runway center line at the touchdown point and expands to 500' wide on each side 1500' back from touchdown and beyond. The center line of the obstruction clearance area may curve at a radius of not less than 4000', however, the last 1500' from the touchdown point must be straight in.

REQUIRED LANDING DISTANCE

—Is the distance needed to land and come to a complete stop from a point 50' above the runway. In establishing the landing performance data the airplane must approach in a steady glide down to the 50' height at a speed not less than 1.3 times the landing stall speed. From this point to contact the airplane must not exhibit excessive vertical acceleration, a tendacy to bounce, nose over, or ground loop. After touchdown the stopping distance is based on the drag from the landing flap setting, fully extended speed—brake/spoilers and wheel braking that does not produce excessive wear of brakes and tires. Stopping distance is also based on a smooth, dry, hard surfaced, level runway.

LANDING LIMITATIONS

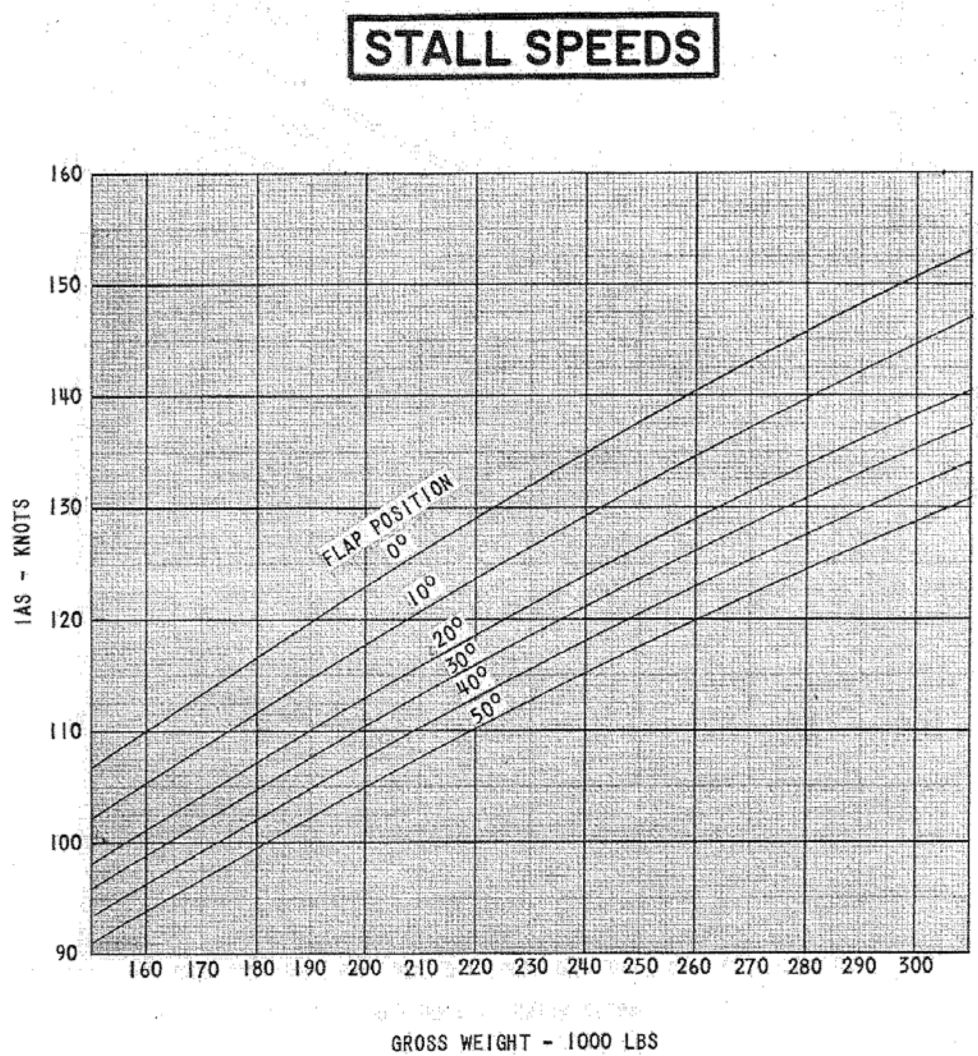
In application of the approach and landing limits to a given flight the take-off weight must be limited so that at the planned landing weights the required landing distance will not exceed 60% of the effective landing length available at the intended destination if destination runways are forecast to be dry, and/or 60% of the effective landing length available at the alternate (wet or dry). For runways forecast to be wet/slippery at destination, 15% must be added to the required effective landing length. Data showing required landing distance are based on performance in the standard atmosphere at the elevation of the landing airport. (Required landing distance is the only stage of F.A.R. performance standards for turbine transports that does not require full temperature accountability).

F. PERFORMANCE

PAA
B-707-300

300-JT4

CHARACTERISTIC AIRSPEED
STALL



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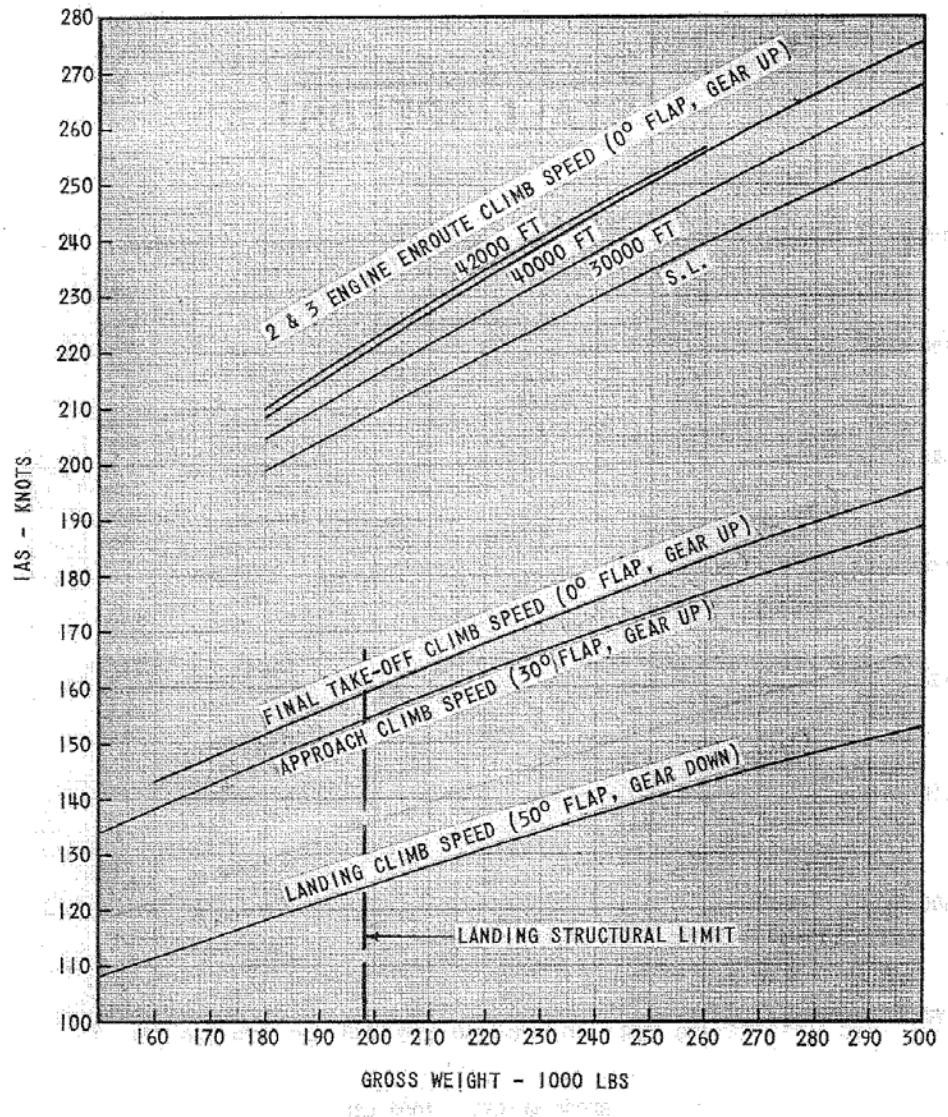
B.J. VANDER MARK

300-JT4

CLIMB SPEED



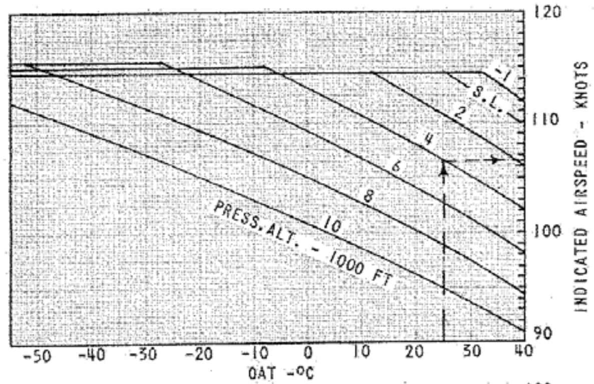
P.A.A.
B-707-300

300 – JT4

MINIMUM CONTROL SPEED
2 & 3 ENGINE
JT4A-11/-12 ENGINE

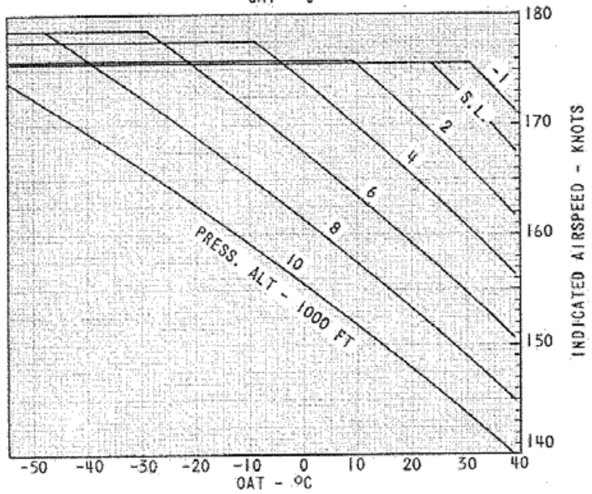
V_{MCA}, AIR MINIMUM CONTROL SPEED

TAKE-OFF THRUST
20° OR 30° FLAPS; GEAR UP



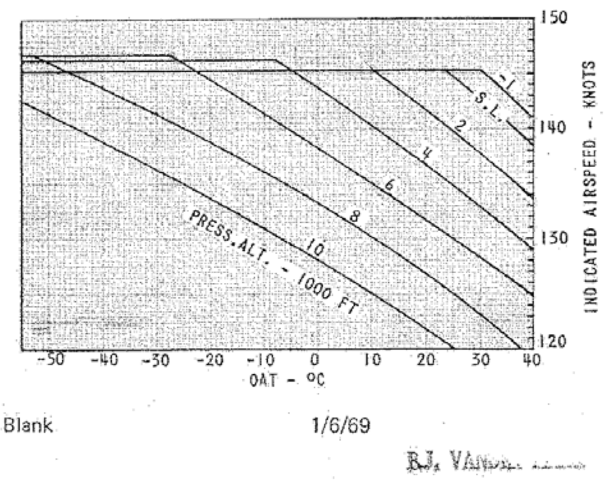
3 ENGINE

RUDDER
BOOST
ON



3 ENGINE

RUDDER
BOOST
OFF



2 ENGINE

RUDDER
BOOST
ON

Reverse Side Blank

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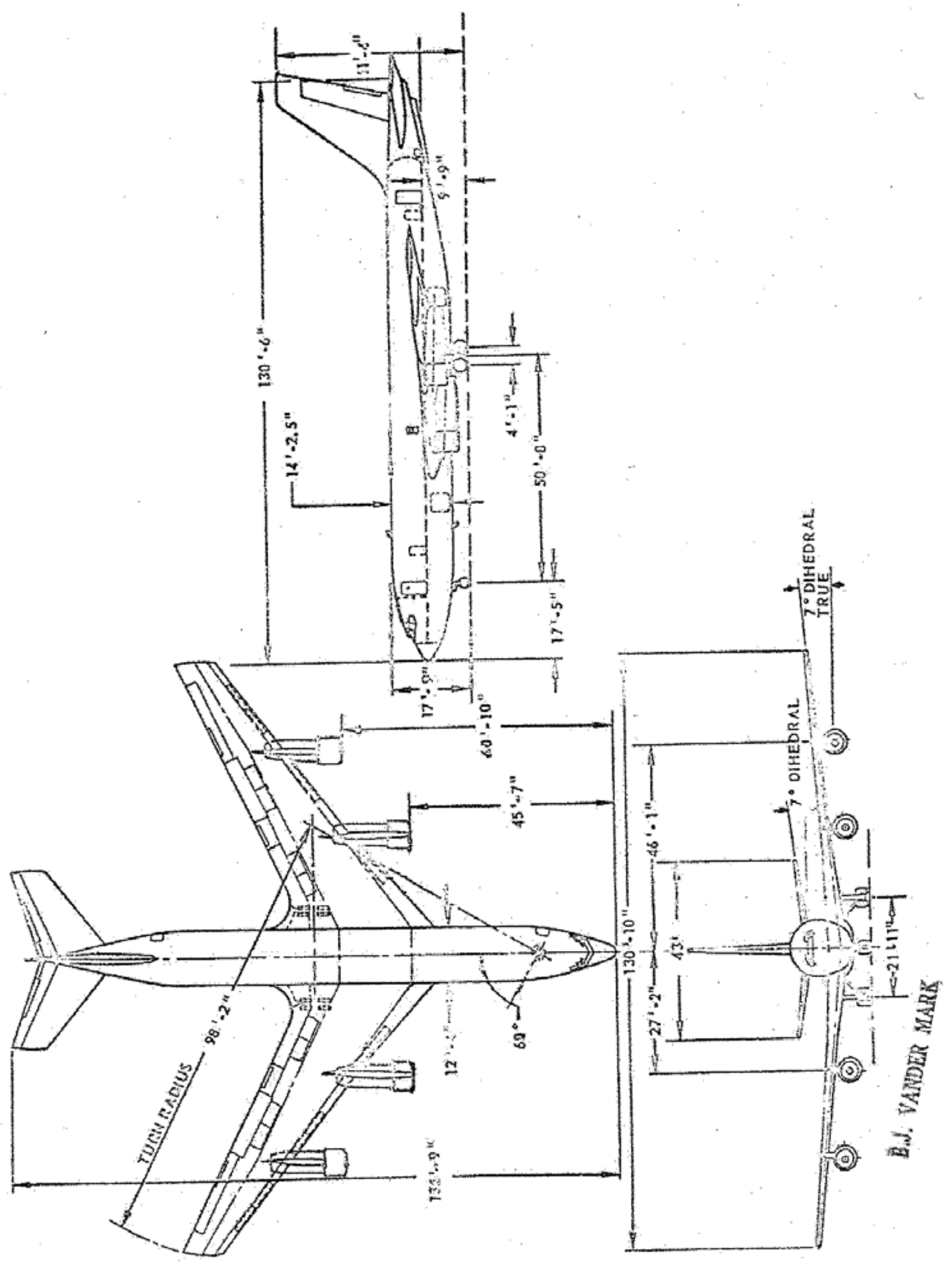
B.J. VAN...

G. AIRCRAFT DIMENSIONS

PRINCIPAL DIMENSIONS

720B

P.A.A.
B-700



PRINCIPAL DIMENSIONS

Reverse Side Blank

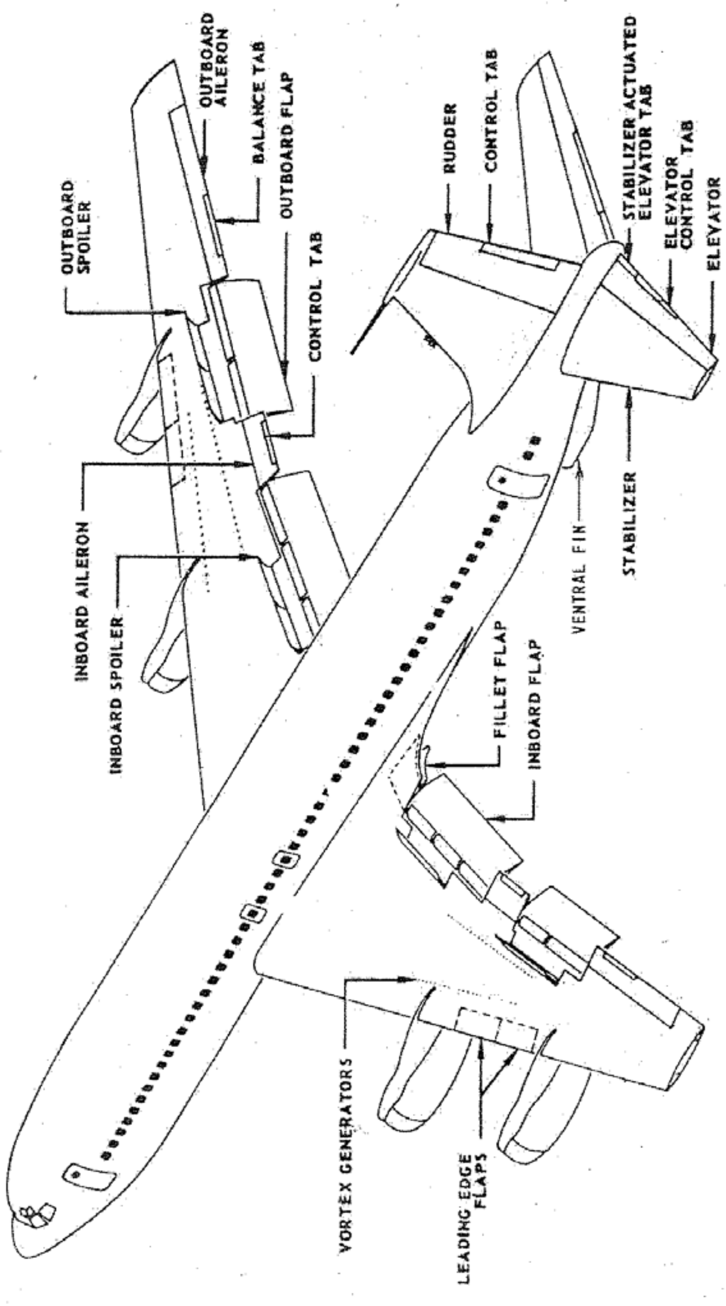
2/15/63

707.010(3)

P.A.A.
B-700

701-759
74613-74614

FLIGHT CONTROL SYSTEMS
ILLUSTRATION



CONTROL SURFACES

B.J. VANDER MARK

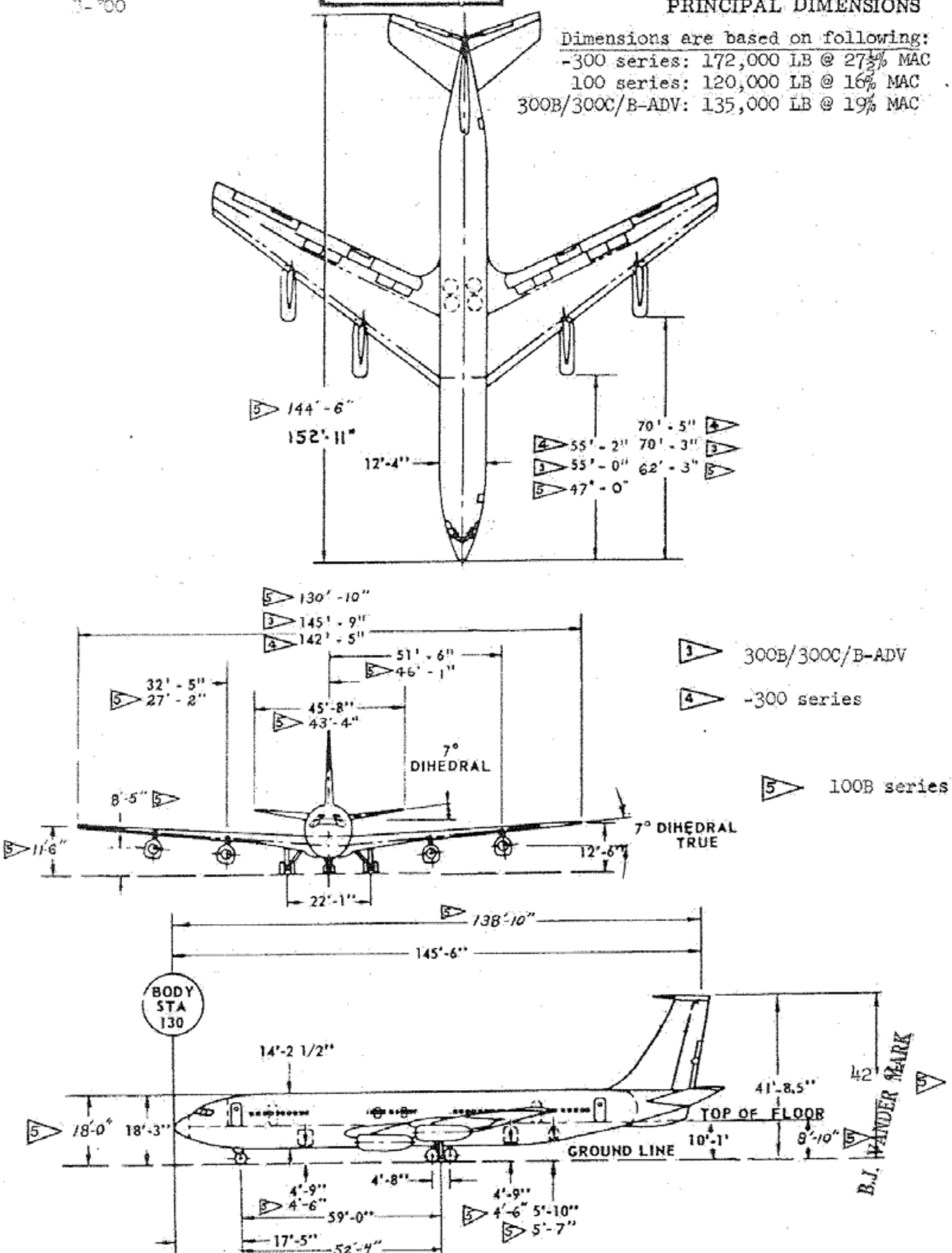
2/15/63

707.050 (1)

ALL EXCEPT 720B

AIRCRAFT DESCRIPTION
PRINCIPAL DIMENSIONS

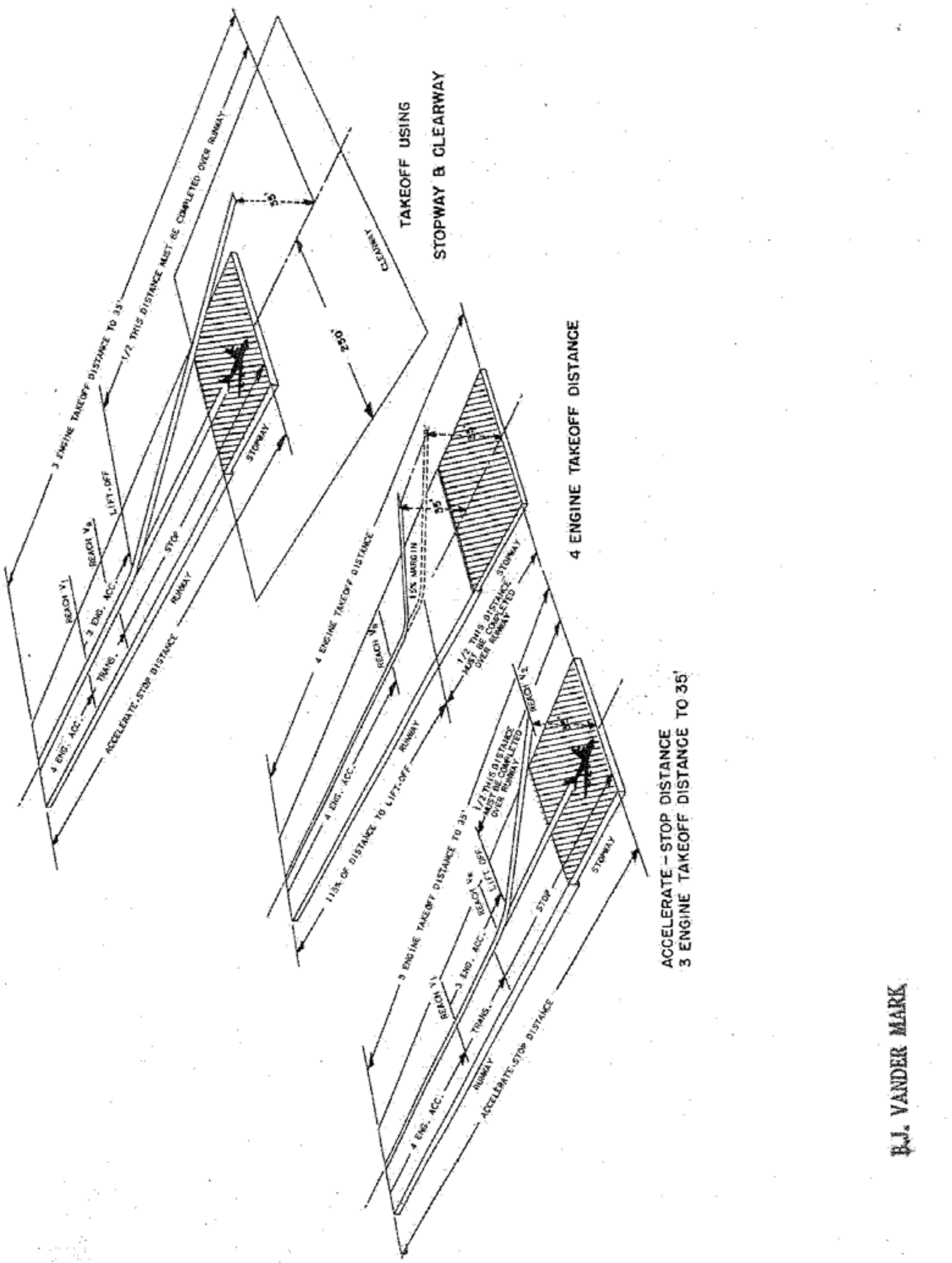
Dimensions are based on following:
-300 series: 172,000 LB @ 27½% MAC
100 series: 120,000 LB @ 16% MAC
300B/300C/B-ADV: 135,000 LB @ 19% MAC



3/7/66

707.010 (1)

TAKEOFF RUNWAY LIMITATIONS



B.J. VANDER MARK