REGIONSAIR

AmericanConnection

July 22, 2005

VIA FEDERAL EXPRESS
Richard Rodriguez
Investigator-in-Charge
Flight 5966 Accident
490 L'Enfant Plaza East, SW
Washington, DC 20594-2000

Re: Submission to NTSB regarding Accident DCA05MA004; Flight 5966 on October 19, 2004

Dear Mr. Rodriguez:

On behalf of RegionsAir, Inc., formerly known as Corporate Airlines, please find its Executive Summary, Factual Information and Analysis, and Findings and Conclusions pertaining to the October 19, 2004 accident at the Kirksville Regional Airport.

Joe Travis, Senior Director of Operations, was the Corporate Airlines' NTSB liaison to this accident investigation. Unfortunately, Joe Travis suffered a heart attack on June 26, 2005, and passed away. Because of Joe Travis' untimely death, I am transmitting this submission on behalf of RegionsAir.

By way of background, Corporate Airlines had undertaken steps to change its name prior to the accident because of possible confusion with other carriers. Our Certificate was reissued in the name of RegionsAir, Inc. in February 2005 and, accordingly our submission is under the name of RegionsAir.

Thirteen individuals died and two persons were injured as a result of the Flight 5966 accident. Of the thirteen deaths, two were Corporate Airlines' crew members. We were very saddened by the loss of those who died or were injured in the accident, and also know that this accident has affected all of the families, friends, colleagues and acquaintances of those on board Flight 5966.

It is important for both RegionsAir and the NTSB to gain whatever insight or lessons that can be learned from this accident in hopes that in the future, other accidents will not occur under similar circumstances. RegionsAir employees have assisted and continue to be available to assist the NTSB in their investigation of the cause of this accident. On behalf of RegionsAir and our employees, we would like to express our appreciation for the time and effort expended by the NTSB in the investigation of this accident.

Please accept this Submission from RegionsAir for consideration as the NTSB Board concludes its investigation and proceeds with its findings, conclusions, determination, probable cause, and recommendations as a result of this accident. If there is any further information that we at RegionsAir can provide to the Board, please do not hesitate to contact us. In that regard, I would suggest that any questions pertaining to the operational issues addressed in the Submission be directed to either Adam Huskins, our Director of Flight Operations (615) 836-2021 or Captain Chris Hardee (615) 459-8602, our representative to the Operational Factors and Human Performance Groups.

Respectfully submitted,

[redacted]

Doug Caldwell
President and Chief Executive Officer

REGIONSAIR
AmericanConnection

SUBMISSION TO THE NTSB
REGARDING ACCIDENT DCA05MA004
FLIGHT 5966 ON OCTOBER 19, 2004

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I. EXECUTIVE SUMMARY[1]

On October 19, 2004, American Connection's Flight 5966, operated by Corporate Airlines[2], departed St. Louis with two crew members and thirteen passengers for a flight to Kirksville, Missouri. The aircraft, a BAE Systems Jetstream 3201 aircraft, U.S. Registration Number N875JX, operating in accordance with 14 CFR 121, crashed while on approach to the Kirksville Regional Airport in Kirksville, Missouri.

Flight 5966 departed St. Louis with a properly certified, equipped and maintained aircraft and a properly certified, trained and qualified crew. The flight crew did not suffer from any known preexisting medical or psychological conditions, and the flight crew was within Federal Aviation Administration ("FAA") flight and duty time requirements. The flight crew conducted normal and routine communications with Air Traffic Control ("ATC"), accomplished Corporate Airlines checklists, and commenced a non-precision Localizer Distance Measuring Equipment ("LOC/DME") approach to Runway 36 at Kirksville. While the weather at Kirksville was Instrument Metrological Conditions ("IMC"), the weather conditions were above FAA and Corporate Airlines' minimums necessary to conduct the non-precision approach into Kirksville. The approach was in compliance with Corporate Airlines' stabilized descent procedures and with Federal Aviation Regulations ("FARs"), and the Flight Data Recorder ("FDR") indicates the aircraft was on a stabilized descent after passing the Final Approach Fix ("FAF") on the localizer center line, until just prior to the aircraft impacting trees approximately 1.2 nautical miles south of Runway 36. The crew did not level-off the aircraft at the minimum descent altitude ("MDA").

[1] This Submission is based on the NTSB Factual Report released on March 18, 2005. RegionsAir has received no further modifications to this Report other than receiving the March 30, 2005 CVR Overlay Report and the May 9, 2005 Human Performance Report.

[2] As a result of business considerations before the accident, Corporate Airlines initiated a name change to RegionsAir, Inc. That name change was completed after the accident, and in February 2005 Corporate Airlines became RegionsAir, Inc. on its Air Carrier Certificate. RegionsAir will generally refer to itself as "Corporate Airlines" in this submission since it was operating as Corporate Airlines at the time of the accident.

The NTSB Cockpit Voice Recorder ("CVR") transcript reflects the Captain (flying pilot) stating that he saw the "approach lights," and apparently assumed, incorrectly, that he was in a position to safely land the aircraft. Under Corporate Airlines' policies and procedures, the flying pilot is responsible for flying the aircraft and monitoring the flight instruments, while the non-flying pilot is responsible for looking for visual references for the intended runway.

The Kirksville Airport did not have an Instrument Landing System ("ILS") installed at the time of the accident that would have provided precision approach vertical guidance. Because the Kirksville Airport is surrounded by featureless upsloping terrain, having little surrounding lights and a short narrow runway with medium to high intensity lights, this environment creates a "black hole" approach or illusion, especially at night when IMC conditions exist. The IMC conditions and the black hole illusion contributed to a lack of situational awareness on the part of the flight crew as they were attempting a non-precision approach into Kirksville. Corporate Airlines believes that had an ILS system been installed at the Kirksville Airport, the vertical guidance provided by the system could have helped prevent this accident.

Following the accident, Corporate Airlines, along with its FAA Principal Operations Inspector, reviewed its operations, procedures, and training with regard to non-precision approaches, crew resource management ("CRM"), and controlled flight into terrain ("CFIT"). As a result of the accident and this review, it was determined that no changes were needed to be made as to existing training and operational procedures and policies. Corporate Airlines has re-emphasized its existing stabilized approach criteria, pilot duties, standard call-outs for deviations, and distance versus altitude calculations for non-precision approaches.

In its 9 years of operation, Corporate Airlines has had no other accidents. Additionally, Corporate Airlines has undergone regular and frequent FAA inspections and surveillances as to its operations and training, and there have been no ongoing issues nor major discrepancies found from any inspection or surveillance.

II. FACTUAL INFORMATION AND ANALYSIS

A. CORPORATE AIRLINES OPERATIONS AS PART 121 CARRIER:

Corporate Airlines, now know as RegionsAir, is a privately held Part 121 Operator based in Smyrna, Tennessee that began operations in 1996. At the time of the accident, Corporate Airlines operated 12 Jetstream 3201 aircraft with 65 pilots and 5 dispatchers. Corporate Airlines has an Air Services Agreement with American Airlines to operate as American Connection and under such Agreement, Corporate Airlines maintains operational control of all of its flights under its Part 121 Certificate. Before the accident, Corporate Airlines started the process to change its name because the "Corporate Airlines" name was too similar to other operators and was confusing for customers. In February 2005, Corporate Airlines' operating certificate was changed to RegionsAir, Inc.

In October 2004, Corporate Airlines was providing service to the following cities: St. Louis, Missouri; Cape Girardeau, Missouri; Fort Leonard Wood, Missouri; Marion, Illinois; Kirksville, Missouri; Paducah, Kentucky; Quincy, Illinois; Owensboro, Kentucky; Burlington, Iowa; Evansville, Indiana; Nashville, Tennessee; Jackson, Tennessee; Atlanta, Georgia; and Tri-Cities (Bristol), Tennessee. Three of the airports Corporate Airlines flew into had only non-precision approaches (no ILS), those being Ft. Leonard Wood, Missouri, Kirksville, Missouri and Marion, Illinois.

B. FLIGHT CREW AND EQUIPMENT:

1. FLIGHT CREW:

(a) TRAINING AND QUALIFICATION:

The flight crew was current, properly trained and qualified for the flight.[3] The Captain held the appropriate certificates and ratings for this flight. The Captain was rated in the accident aircraft. The Captain had no previous accidents, incidents or enforcement actions indicated in FAA records. The Captain received initial and recurrent training at Corporate Airlines, and successfully completed all initial and recurrent proficiency checks in compliance with Corporate Airlines' training guidelines and procedures. At the time of the accident, the Captain had 4,234 hours total pilot flying time, 3,277 hours pilot-in-command ("PIC") time, and 2,510 hours of Jetstream 3201 time, of which 719 hours were PIC flying time.

The First Officer held the appropriate certificates and ratings for the flight. The First Officer had no accident, incident or enforcement actions listed in the FAA records. The First Officer had successfully completed Corporate Airlines' initial training and all related evaluations. At the time of the accident, the First Officer had 2,856 hours of total pilot flying time, 2,698 hours of PIC time, and 106 hours of Jetstream 3201 time.

The Captain was hired by Corporate Airlines and completed training on May 3, 2001. He upgraded to Captain on September 17, 2003. The First Officer was hired by Corporate Airlines on August 19, 2004, and was in his second month of flying for Corporate Airlines at the time of the accident.

[3] NTSB Operational Factors Report.

Corporate Airlines considers crew experience in crew pairing assignments, and complies with applicable FAA requirements for crew pairing.[4] The Captain and First Officer of the accident flight were properly paired in accordance with Corporate Airlines' policies and the FARs.

(b) CREW FLIGHT AND DUTY TIME:

The Captain and First Officer were scheduled for a 4-day trip sequence, beginning Sunday, October 17, 2004. The accident occurred on the last flight of the third duty day. On Sunday, October 17, 2004, the flight crew flew 3 flights for a total of 3 hours and 3 minutes of flight time, and had a total of 7 hours and 55 minutes of duty time. Before their departure on Monday, the crew had a 16 hour 8 minute layover in Quincy, Illinois. On Monday, October 18, 2004, the flight crew flew 4 flight segments for a total of 3 hours and 36 minutes of flight time, and were on duty for a total of 6 hours and 21 minutes. The crew had a 9 hour and 5 minute layover in Burlington, Iowa. On Tuesday, October 19, 2004, the day of the accident, the flight crew flew 6 flight segments. When the accident occurred, the crew had been on duty for 14 hours and 31 minutes, with 6 hours and 14 minutes of flight time. The crew's flight and duty time were in compliance with FARs and Corporate Airlines' policies.[5]

Corporate Airlines' policy is that flight crews are not to fly if they feel fatigued. NTSB interviews of Corporate Airlines' pilots found that Corporate Airlines' company culture reinforces the belief that pilots should not fly if they

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[4] Appendix 1: Corporate Airlines' Flight Manual, § 2, Crew Qualification and Responsibilities, p. 10, ¶ 33(A).

[5] 14 CFR § 121.471; Appendix 1: Corporate Airlines' Flight Manual, § 2, Crew Qualification, pp. 10-12.

feel fatigued. There was no company imposed pressure to land or complete the trip if the crew felt fatigued.[6]

(c) **<u>PHYSICAL AND PSYCHOLOGICAL CREW CONDITIONS:</u>**

NTSB factual reports and interviews establish that the Captain was 48 years old, held a first class medical certificate, and exhibited no indications of any pre-existing medical or behavioral conditions that might have adversely affected the Captain's performance during the accident flight. The Captain's fiancé reported that he complained of a headache and stomachache during the trip sequence. However, Corporate Airlines' pilot Eric Stout saw the Captain of the accident flight on the day of the accident in the crew room at about 1030 to 1100, and the Captain seemed alert. The Captain had also spoken by telephone with his brother on the evening of the accident, and the Captain's brother told the NTSB in an interview that the Captain sounded alert and was focused.

Both surviving passengers reported that the Captain came back into the cabin and sat in seat 4B (exit row) while he gave the passengers a thorough safety briefing. According to one accident survivor, "The pilot seemed relaxed and alert," and then the pilot returned to the left cockpit seat.[7]

The First Officer was 29 years old, held a first class medical certificate, and had no known pre-existing medical or behavioral conditions that might have affected his flight performance. Corporate Airlines' pilot Eric Stout saw the First Officer on the ramp in St. Louis at about 1-1/2 to 2 hours prior to the

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[6] NTSB Operational Factors Report, Attachment 1, Interview Summaries of Captain George M. Carmo, First Officer John V. Ward, and IOE Check Airman Eric N. Stout; NTSB Human Performance Report, Attachment 14, Interview Summary of Director of Operations Adam C. Huskins, pp. 41-42.

[7] NTSB Survival Factors Group Factual Report, IV., D., § 3.1, p. 6.

accident. Captain Stout told the NTSB in an interview that the First Officer looked alert and happy, and replied appropriately during the conversation.

2. <u>EQUIPMENT:</u>

At the time of the accident, Corporate Airlines operated twelve Jetstream 3201 aircraft. The accident aircraft held U.S. Registration No. N875JX, and was equipped with a Honeywell Sunstrand Mark VI Ground Proximity Warning System ("GPWS"). At the time of the accident, two of the twelve operating Corporate Airlines' Jetstream aircraft had been modified with Enhanced Ground Proximity Warning Systems ("EGPWS") and Corporate Airlines' fleet of Jetstream aircraft were scheduled for EGPWS installation before the March 29, 2005 FAA compliance deadline as set forth in FAR 121.354.

(a) <u>SYSTEMS GROUP FACTUAL REPORT:</u>

The Systems Report and Addendum indicated no anomalies or system defects in the aircraft's instruments, instrumentation and switches, flight control, electrical, avionics, landing gear, oxygen system and fire protection systems, that would have prevented normal flight operation of the aircraft at the time of the accident. However, the NTSB CVR transcript contains a statement by the Captain (flying pilot) at 1935:22 on the final approach that his "DME went off-line" but that it was back at 1935:30. The Captain's DME was destroyed in the post-crash fire and not tested.

(b) <u>POWERPLANTS GROUP FACTUAL REPORT:</u>

The Powerplant Group Report indicated the engines and propellers did not have any pre-existing defects or anomalies that would have prevented normal flight operation, and that the engine teardowns, along with the damage to the propellers and engines, indicated that engines were developing power at the time of the accident.

(c) **<u>MAINTENANCE OF THE ACCIDENT AIRCRAFT:</u>**

The Aircraft Maintenance Records Factual Report identified no anomaly or maintenance issue that prevented normal flight operations of the aircraft at the time of the accident.

Corporate Airlines performs its own maintenance on company aircraft pursuant to Federal Aviation Regulations ("FARs"). At Corporate Airlines' headquarters in Smyrna, Tennessee, all aircraft checks and scheduled maintenance are accomplished in accordance with the Corporate Airlines' maintenance program and the FARs.

Corporate Airlines, at the time of the accident, had twenty-eight mechanics in Smyrna, Tennessee, with six additional mechanics at line stations. Four of the mechanics working for Corporate Airlines were assigned as inspectors. All but three Corporate Airlines' mechanics possess airframe and powerplant certificates. Corporate Airlines had three specialists with a maintenance repairman certificate.

The accident aircraft had all applicable line, A, B, D and E checks. The C check for the accident aircraft had been extended as permitted by Corporate Airlines' Operating Specifications. There were no Minimum Equipment Lists ("MEL") items open at the time of the accident on the accident aircraft, and all Airworthiness Directives ("ADs") and applicable Service Bulletins ("SBs") had been complied with as of the date of the accident.

Corporate Airlines developed an audit program entitled Continued Analysis and Surveillance System ("CASS") pursuant to 14 CFR Part 121.373. The NTSB Maintenance Records Group found that after an examination of the CASS records, Corporate Airlines' audit program was successful in identifying and resolving maintenance problems. Additionally, the FAA, through its Surveillance and Evaluation Program ("SEP"), monitored Corporate Airlines' operations, which included the maintenance operations. Corporate Airlines worked closely with the FAA to address any recommendations made by the FAA pertaining to the SEP.

C. DISPATCH AND FLIGHT FOLLOWING:

Corporate Airlines' Flight Dispatch Office is responsible for the planning, releasing, and flight following of Corporate Airlines' flights. The dispatcher who was responsible for the dispatch and flight following for Flight 5966 holds a dispatch certificate and a private pilot's certificate, and has taught general aviation, meteorology and dispatch courses at a university.[8] On the day of the accident, the dispatcher reported that she was well rested and that there were no computer or other flight planning system equipment problems. Corporate Airlines uses several different weather sources for the dispatch and support of its flights, which include American Airlines' SABRE System for weather text data, and Meteorologix for the terminal forecast at Kirksville. Corporate Airlines uses a weather and dispatch system which gives it access to radar mosaic and satellite imagery overlaid with aircraft situational display information which allowed the dispatcher to track the aircraft with respect to weather. The dispatcher also has air to ground radio communication capability if the dispatcher needs to contact a flight

[8] NTSB Meteorological Factual Report, § 12.0.2.

enroute with weather updates or to consult with the flight crew regarding the best course of action to take if conditions should change enroute.

The dispatcher prepared a flight plan for Flight 5966 with a cruise altitude of 12,000 feet between St. Louis and Kirksville. The dispatcher also designated two (Quincy and St. Louis) alternate airports. In addition to the forty-five (45) minutes required reserve fuel, the dispatcher added forty-nine (49) minutes of "hold fuel" to the required fuel load as well as fuel to fly to the most distant alternate airport. Approximately one hour and fifteen minutes before Flight 5966's departure from St. Louis, the dispatcher again reviewed all weather for Kirksville and the two alternates and issued the flight release. The dispatcher recalled that the Kirksville weather was reporting actual visibility of 4 miles in mist and a ceiling of 700 feet, and that the terminal forecast remained unchanged for Kirksville with a visibility of 2-4 miles in mist and ceilings of 400-600 feet. The dispatcher also noted that the ceiling and visibility conditions at Kirksville were lower during the day, but had improved as the day elapsed.

The dispatcher described the flight planning and dispatch as normal, that Flight 5966 had an experienced crew, that there were no maintenance issues or any other restrictions with the aircraft, and that the weather was above minimums for the dispatch. The flight proceeded normally and she did not have any communications with the flight crew prior to its departure or while the flight was enroute.

D. APPROACH:

1. KIRKSVILLE REGIONAL AIRPORT

RegionsAir believes several factors regarding the Airport or its environment[9] may have been contributing factors in the cause of the accident.

First, Kirksville was not equipped with an Instrument Landing System ("ILS"); therefore, Corporate Airlines' flight crews were required to fly non-precision approaches under IMC conditions into the non-controlled airport. Had an ILS system been installed, the flight crew would have had precise electronic vertical guidance throughout the approach to Runway 36. The accident flight was operated as federal government subsidized scheduled air service through the Essential Air Service Program. RegionsAir believes that the NTSB should evaluate the added safety benefit of requiring ILS or other suitable precision guidance approaches at all airports in the Essential Air Service Program.

Second, according to the "FAA Report of Aircraft Accident," on the night of the accident and before the accident occurred, there was a pilot report at 1830CDT (2330Z) that the approach lights and Visual Approach Slope Indicator (VASI) lights were not working.[10] The FAA report also reflects that an employee of the Kirksville Regional Airport reported at 1903CDT (0003Z) that the approach lights and VASI lights were "all working correctly." However, in a statement to the NTSB, the same employee reported that "He could not see" the VASI lights.[11] In another statement contained in the Survival Factors Group Report, the same airport employee states that he checked the VASI lights after the accident.[12] The CVR transcript indicates that the Captain called "approach lights in sight" at 1936:43.5, but it is unclear whether

[9] It should also be noted that the Automated Surface Observation System ("ASOS") at the Kirksville Airport had been deactivated and moved earlier in the day, but it was reported as operational prior to the accident.

[10] NTSB ATC Group Factual Report, § 2, p. 5.

[11] NTSB Meteorological Factual Report, § 12.0.1, p. 19.

[12] NTSB Survival Factors Report, § 7.1, p. 15.

either flight crew member observed the VASI lights. RegionsAir believes that the operation of the VASI lights is in question.

Third, in interview statements to the NTSB Operations Group, night approaches to Runway 36 were characterized by Corporate Airlines' pilots as "black hole" approaches under conditions which created an illusion that the aircraft was higher than it actually was relative to ground.[13] Both the Airman Information Manual ("AIM") (Chapter 8-1-5) and Corporate Airlines' Aircraft Manual[14] describe the following illusions:

> (b) **Runway width illusion.** A narrower-than-usual runway can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short. A wider-than-usual runway can have the opposite effect, with the risk of leveling out high and landing hard or overshooting the runway.
>
> (c) **Runway and terrain slopes illusion.** An upsloping runway, upsloping terrain, or both, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach. A downsloping runway, downsloping approach terrain, or both, can have the opposite effect.
>
> (d) **Featureless terrain illusion.** An absence of ground features, as when landing over water, darkened areas, and terrain made featureless by snow, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach.

[13] NTSB Operational Factors Report interviews of Captain George M. Carmo, Check Airman Eric N. Stout, and Captain Chris Hardee.

[14] Appendix 5: Corporate Airlines' Aircraft Manual, Normals Section, p. 41.

The runway width illusion, featureless terrain illusion and terrain upslope illusion, as described in the AIM, are also addressed in Corporate Airlines' Manual (Normals Section, page 41). Additionally, Corporate Airlines' Aircraft Manual describes an additional illusion: "'Visibility': Rain, haze, smoke, dust, glare or darkness may cause a flight crew to believe they are higher than they actually are."

Further, the Corporate Airlines' Aircraft Manual provides guidance for flight crews as follows:

> "These illusions and their effect can be minimized by cross-checking the approach path against barometric or radar altimeter indications (but beware of radar altitude - it may be affected by undulating terrain below), and by maintaining an awareness of the special problems associated with such approaches."

Even with the guidance above, the approach to Runway 36, flown over unlighted and featureless up-sloping terrain, in night instrument meteorological conditions and to a relatively short and narrow runway could still create the illusion that the aircraft was higher than it actually was relative to the ground, and this combination of factors would have given the flight crew the perception they were in a position to make a normal landing.

Further, the aircraft struck a grove of trees that were directly on-line with the Runway 36 approach at a range of 1.2 to 1.4 nautical miles from the Runway 36 threshold. According to a chart prepared as part of the NTSB's Performance Study, the trees appear to extend to 80 feet in height.[15] RegionsAir believes that the effect of the trees on the approach path of Runway 36 is in question.

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[15] NTSB Performance Study, p. 16.

2. CORPORATE AIRLINES' NON-PRECISION APPROACH PROCEDURES

Corporate Airlines' flight crews were trained to utilize the "traditional" or "standard" method of performing non-precision approaches.

Flight crews using the traditional descent method are taught that once the Final Approach Fix (FAF) is passed, the pilot should descend at a stabilized rate that will result in arrival at the MDA prior to reaching the Missed Approach Point ("MAP"). The pilot will then level off at the prescribed MDA until the runway environment is in sight (requirements of FAR 91.175 are met), and a normal descent allowing a safe transition to landing can be made, or the MAP is reached and a missed approach is accomplished. Corporate Airlines' Flight Manual states: "Aircraft are not authorized to descend below the MDA until the runway environment is in sight, and the aircraft is in a position to descend for a normal landing, (TERPS).[16]"

The descent rate used from the FAF to the MDA should not exceed stabilized approach criteria and should be adequate to ensure that there is sufficient time allowed once reaching the MDA to acquire the necessary visual references to perform a safe transition to landing. This transition requires both vertical descent management to achieve the proper descent rate to landing and sufficient time for lateral navigation to achieve the correct runway alignment.

The FAA provides guidance on how to train and then perform the traditional descent method. The FAA Instrument Rating Practical Test Standards states:

> *...determine that the applicant:*
>
> *11.Establishes a rate of descent and track that will ensure arrival at the MDA prior to reaching the MAP ...*
> *13.Maintains the MDA, when reached, within +100 feet, -0 feet to the MAP.* [17]

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[16] NTSB Operational Factors Report, Attachment 7-2.

[17] Appendix 2: FAA Instrument Rating Practical Test Standards.

The FAA Airline Transport Pilot and Type Rating Practical Test Standards also provides for the use of the traditional descent method as follows:

> *Determine that the applicant:*
>
> *10.Establishes a rate of descent that will ensure arrival at the MDA (at, or prior to reaching, the visual descent point (VDP), if published) with the airplane in a position from which a descent from MDA to a landing on the intended runway can be made at a normal rate using normal maneuvering.*
>
> *12.Maintains the MDA, when reached, within -0, +50 feet (-0, +15 meters) to the missed approach point.*[18]

Further FAA guidance is provided in FAA Order 8400.10, the Air Transportation Operations Inspector's Handbook, for use of the traditional descent method. In describing the MDA, Order 8400.10 reinforces the traditional method of performing a non-precision approach by stating:

> *(2) The following is a list of statements which describe what MDA is not:*
> *(a) MDA is not a specified decision point.*
> *(b) MDA is not a point at which a specific action is initiated.*
> *(c) MDA is not a point where the decision process begins.*
> *(d) MDA is not the latest point at which a go-around could or should be made.*
> *(e) MDA is not a point where all aspects of the decision are instantaneously formulated.*[19]

Corporate Airlines' procedures for descent from the MDA based upon appropriate visual cues are consistent with FAR 91.175. Corporate Airlines' Flight Manual identifies permissible visual cues to allow a descent from the MDA as follows:

[18] Appendix 3: FAA – S-8081-5D – Airline Transport Pilot and Aircraft ATP and Type Rating Practical Test Standards.

[19] Appendix 4: FAA Order 8400.10, § 491(A)(1)(c).

(1) The approach light system, however, if the approach light system is visible, descent below 100 feet above the touchdown zone is not permitted unless the red terminating bars or the red side row bars are also visible.

(2) The Visual Approach Slope Indicator (VASI).

(3) The Runway End Identification Lights (REIL).

(4) The threshold, the threshold markings, or the threshold lights.

(5) The runway lights.

(6) The touchdown zone lights.

(7) The touchdown zone, or touchdown zone markings.

(8) The runway or runway markings. [20]

Further, the NTSB Operations Group Report notes the Corporate Airlines' Aircraft Manual provided guidance for approximating a 3° flight path. [21] The Aircraft Manual advises flight crews to approximate a 3° glide path by maintaining 300 feet of altitude for each mile from the runway. This manual also gives examples of how to compute rates of descent and gives predicted rates of descent of between 650 and 800 feet per minute. These procedures allow a flight crew to approximate a 3° glide path for the transition from MDA to a normal landing.

3. VERTICAL NAVIGATION (VNAV) APPROACHES

Vertical Navigation can be provided by some avionics systems installed in aircraft cockpits. The use of this technology can, in some cases, provide vertical guidance for non-precision approaches. This technology provides the ability to perform constant angle/constant rate descent approaches. To the best of RegionsAir's knowledge, few regional operators use this technology for non-precision approach procedures.

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[20] NTSB Operational Factors Report, Attachment 8-3.

[21] NTSB Operational Factors Report, Attachment 5-3.

Corporate Airlines' aircraft are not equipped to perform VNAV approaches and their flight crews are not authorized by the FAA to use the VNAV non-precision approach procedures. Further, Corporate Airlines did not have authorization for the utilization of a constant angle/constant rate of descent non-precision approach procedure utilizing a VNAV DA(H) in lieu of a MDA(H).

The Operational Factors Group Report cites Advisory Circular ("AC") No. 120-71A for the proposition that the constant angle/constant rate procedure could be a "safer" way to perform non-precision approaches.[22] There are several aspects of AC 120-71A that should be noted. To begin with, the Advisory Circular is concerned with standard operating procedures ("SOPs") in general and the examples shown in the Appendices to the Advisory Circular cited in the Operations Factors Report "do not represent a rigid FAA view of best practices."[23] The Advisory Circular also acknowledges that procedures "may vary among fleets or among certificate holders" and that certain procedures "may apply to a certain airplane fleet and may not be adaptable apart from that fleet."[24] Additionally, the "stabilized approach" concept noted in the Advisory Circular is consistent with Corporate Airlines' procedures. To the extent that the Operations Group Report suggests that the Advisory Circular describes how to perform a constant angle/constant rate of descent non-precision approach procedure, it should be noted that the only explanation is a single pictorial and a pilot flying/pilot monitoring list of call-outs. RegionsAir believes that the Advisory Circular does not provide sufficient information or guidance to allow an operator to develop, train, or request approval from the FAA for a constant angle/constant rate of descent non-precision approach procedure.

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[22] Appendix 6: Advisory Circular 120-71A.

[23] Appendix 6: Advisory Circular 120-71A, p. i.

[24] *Id.*

4. LOC/DME RUNWAY 36 APPROACH PROCEDURE (JEPPESEN)

The Jeppesen approach plate used by the flight crew depicted a descent from the FAF and a level-off at MDA consistent with "traditional" or "standard" non-precision approach procedures. The approach plate profile view did not include reference altitudes which would have allowed a flight crew to cross check proper descent rates after the final approach fix. Although the approach plate depicted a "VNAV DA(H)", it also contained the warning that "Only authorized operators may use VNAV DA(H) in lieu of MDA(H)." Corporate Airlines was not authorized by the FAA to use the VNAV decision altitude in lieu of MDA. Further, the profile view for the approach plate did not depict a charted visual descent point ("VDP").

5. FLIGHT CREW PERFORMANCE OF NON-PRECISION APPROACH

The flight crew was familiar with operations into Kirksville and had successfully performed the LOC/DME Runway 36 approach at Kirksville under similar weather conditions on an earlier flight on the day of the accident. On the accident flight, a review and comparison of the accident cockpit voice recorder with the flight data recorder indicates that the flight crew set the proper minimum descent altitude for the approach. Additionally, the CVR indicates that the flight crew monitored the weather information available from Kirksville Automated Surface Observation System ("ASOS"), and the weather at Kirksville remained above the required minimums for landing throughout the descent and approach.

The flight crew configured the aircraft approximately three miles prior to the FAF pursuant to established Corporate Airlines' procedures, maintained a stabilized air speed, and continuously tracked the localizer center line. After the FAF, the flight crew descended at a stabilized rate within Corporate Airlines' Flight Manual Stabilized Approach criteria. Additionally, the First Officer activated the pilot control lighting to high intensity (7 clicks) and confirmed with Corporate Airlines' ground personnel that the runway lights were on.

Two seconds after the First Officer called the correct MDA of "thirteen twenty," the Captain acknowledged that he had ground contact simultaneously with the automatic call-out of "minimums, minimums." The Captain called "approach lights in sight" approximately 1.7 miles from the threshold of Runway 36. The First Officer replied "* in sight" followed immediately by "continue."

Based upon the above, it appears that the Captain had some forward and vertical visibility as the aircraft descended through MDA and was in visual conditions approximately 1.7 miles from the threshold of Runway 36. However, the aircraft was below an optimum glide path for a normal landing and no adjustment was made to the rate of descent even when the runway environment was reported in sight.

E. CORPORATE AIRLINES' PROCEDURES APPLICABLE TO THIS ACCIDENT:

Although Corporate Airlines has an established policy consistent with the FARs and documented in its Flight Manual which prohibited all non-essential conversation below 10,000 MSL, except in cruise flight, the CVR transcript prepared by the NTSB indicates the crew engaged in non-essential conversation below 10,000 feet MSL.

Corporate Airlines has established CRM procedures pertaining to the flying pilot and non-flying pilot as to non-precision approaches. Corporate Airlines' CRM procedures provide that the flying pilot will fly the aircraft and monitor flight instruments until advised that visual contact of the runway environment ("runway in sight") is obtained. The non-flying pilot will monitor the approach, looking for runway visual references, will monitor flight instruments, and will call-out any abnormalities or deviations from stabilized approach criteria. Corporate Airlines' procedures for pilot flying and non-flying pilot duties during instrument approaches are consistent with FAA recommended procedures. The Aircraft Manual's description of non-flying pilot duties emphasizes pilot monitoring duties. A review of the CVR transcript indicates the Captain (flying pilot) called "approach lights in sight" rather than the non-flying pilot.

Corporate Airlines' Aircraft Manual also provides for the non-flying pilot to affirmatively state any deviations from Corporate Airlines' stabilized approach criteria.[25]

F. CORPORATE AIRLINES' TRAINING APPLICABLE TO THIS ACCIDENT:

Corporate Airlines conducts its own training of flight crew members pursuant to its Approved Training Manual, and the FARs, Part 121, Subparts N and O. Corporate Airlines offered five different types of training programs at the time of the accident:

1. **Initial new hire training for second-in-command and pilot-in-command crew members who have no previous crew member experience with Corporate Airlines** – program consists of 40 hours of basic indoctrination, 8 hours of general emergency training, 56 hours of ground training, and 22 hours of flight training.

2. **Initial training for Second-In-Command and Pilot-In-Command crew members previously qualified in a specific duty position for a particular aircraft who are being reassigned to a different duty position on a different aircraft** – training consists of 4 hours of general emergency training, 48 hours of aircraft ground training and 16 hours of flight training.

3. **Upgrade training for flight crew members previously qualified as a Corporate Airlines' Second-In-Command on an aircraft who are being reassigned to serve as Pilot-In-Command on the same aircraft** – 2 hours of general emergency training, 16 hours of aircraft ground training, and 8 hours of flight training.

4. **Recurrent training for training assigned crew members who are qualified by Corporate Airlines and will continue to serve as the same duty position on the same aircraft, but must receive recurrent training or qualification checks in accordance with the FARs** – 2 hours of general emergency training, 20 hours of aircraft ground training, and 4 hours of flight training.

[25] Appendix 5: Corporate Airlines' Aircraft Manual, Normals Section, pp. 41-42, 57.

5. **Re-qualification training for previously qualified crew members who have become disqualified due to non-compliance of required recurrent experience, training or checking requirements within the allowed eligibility period.** This re-qualification training is classed into three different divisions based on the length of time the crew member has been out of qualification. The training consists of up to 4 hours of general emergency training, 24 hours of aircraft ground training, and 16 hours of flight training.

Captains and First Officers undergo recurrent ground training every 12 months. First Officers undergo recurrent flight training every 12 months. Captains undergo a proficiency check or recurrent flight training every 6 months.

The Corporate Airlines' Training Manual and training curriculum and program at the time of the accident were approved by the FAA. Corporate Airlines graded and evaluated its initial, recurrent, upgrade and re-qualification candidates on a true grading system to assess the skills of and proficiency of each candidate. Corporate Airlines used training curriculum and testing to measure a pilot's skills and proficiency to determine whether that pilot met qualifications set forth by Corporate Airlines and the FAA.

Corporate Airlines had an established CRM program that teaches CRM concepts and policies of cockpit responsibility and duties during flight in both its initial and recurrent training. In addition to the Special CRM Curriculum outlined in the Corporate Airlines' Approved Training Manual, Corporate Airlines utilized initial training booklets which included CRM issues, power point presentations, and classroom exercises involving role-playing and testing of communication skills as to CRM issues. Recurrent training also included power point presentations and a take-home booklet and test regarding CRM issues. Corporate Airlines also conducted Controlled Flight Into Terrain ("CFIT") training, including materials from the Flight Safety Foundation Program , the FAA, Jeppesen, and flight crew testing.

Following the accident, the FAA determined that at the time of the accident, there were no underlying systemic problems with Corporate Airlines' operations or pilot training programs. Accordingly, no changes were made to existing training and operational procedures and policies. However, Corporate Airlines has since stressed certain aspects of its training criteria such as the stabilized approach criteria, the flying pilot and non-flying pilot division of duties, the standard call-outs for deviations, and distance versus altitude calculations for non-precision approaches.

The Captain of Flight 5966 received and passed recurrent flight training including CRM and CFIT topics on January 13, 15, 2004; recurrent ground school on July 7-9, 2004, and a proficiency check in the Jetstream 3201 aircraft on July 16, 2004. The First Officer received similar training and passed a proficiency check in the Jetstream 3201 aircraft in August of 2004.

G. FAA AUDITS AND INSPECTIONS:

As part of the FAA's oversight for Corporate Airlines, Corporate Airlines operated under the FAA's Surveillance and Evaluation Program ("SEP"), which provides frequent inspections and audits of Corporate Airlines' facilities and operations. From 2001 until the date of the accident in 2004, the FAA conducted 550 inspections of Corporate Airlines' facilities and operations, of which 445 pertain to Corporate Airlines' operations and 105 pertain to Corporate Airlines' facilities.[26] No major discrepancies were found in any of the SEP inspections of Corporate Airlines. Corporate Airlines addressed any minor discrepancies detected through the SEP inspection process immediately, and there were no outstanding discrepancies at the time of the accident.

[26] NTSB Operational Factors Report, pp. 19-20.

III. FINDINGS & CONCLUSIONS

A. CREW AND EQUIPMENT:

1. The Captain and the First Officer were properly certificated and qualified under federal rules and regulations and company requirements. No evidence indicated any preexisting medical or behavioral conditions that might have adversely affected the flight crew's performance during the accident flight.

2. The accident aircraft was properly certified, equipped, and maintained in accordance with federal regulations and approved company policies and procedures. No evidence indicated engine, system, or structural failures.

3. The accident aircraft was equipped with a Honeywell/Sundstrand Mark VI Ground Proximity Warning System ("GPWS"). At the time of the accident, two of the twelve operating Corporate Airlines aircraft had been modified with Enhanced Ground Proximity Warning Systems ("EGPWS"). The remainder of the Corporate Airlines' fleet was scheduled for the EGPWS installation in compliance with all FAA deadlines.

B. DISPATCH:

1. The aircraft was properly fueled, and passengers and cargo were loaded in accordance with Corporate Airlines' weight and balance requirements and all federal regulations.

2. The accident flight was released in accordance with Corporate Airlines' dispatch procedures, and all federal regulations.

3. The flight crew was provided or obtained sufficient pre-flight, enroute, and arrival weather information to allow them to conduct the flight safely.

4. The Captain and First Officer received the rest time prescribed by federal regulations and company requirements, and their duty time had not exceeded federal regulations or company requirements.

5. The flight crew had adequate and current information concerning the weather at Kirksville as they began their descent to Kirksville.

6. All flight crew communications with Air Traffic Control were routine and the flight crew accomplished all required checklists.

C. APPROACH:

1. The approach to Runway 36 at Kirksville was flown over unlighted and upsloping featureless terrain, in night IMC, to a relatively short, narrow runway, which resulted in "black hole" conditions. These conditions created the illusion that the aircraft was higher than it actually was relative to the ground, and would have given the crew the perception they were in a position to make a normal landing.

2. Approximately 1 hour and 24 minutes before the accident, there was a pilot report that the Kirksville approach lights and Visual Approach Slope Indicator ("VASI") were not working. Although the FAA records indicate a Kirksville Regional Airport employee advised the FAA that the approach lights and VASI were working before the accident, the employee said he could not see the VASI lights, but indicated the approach lights and VASI are all turned on at the same time. Further, the same employee in another interview stated he did not check the VASI lights until after the accident. Therefore, there is uncertainty as to whether the VASI lights were operational at the time of the accident.

3. The Kirksville Airport, an Essential Air Service Community, was not equipped with an ILS at the time of the accident. An ILS system would have provided the crew with an electronic glideslope providing vertical guidance to make the approach into Kirksville. It is RegionsAir's understanding that funding for an ILS at Kirksville has been approved by Congress. Where actions are initiated to install ILSs, whether those actions include funding approval, equipment requisition or facilities analysis and changes, the FAA should expedite the ILS installation process.

4. Corporate Airlines' Flight Manual contains approved procedures for performing non-precision approaches. The Corporate Airlines' non-precision approach procedures are consistent with the "traditional" or "standard" procedures used for years by many operators and provides a safe method for performing non-precision approaches. Such procedures call for the pilot to use a stabilized descent rate of approximately 1,000 feet per minute ("FPM") (not to exceed 1200 FPM) from the final approach fix ("FAF") to the minimum descent altitude ("MDA").

5. The Jetstream Model 3201 aircraft utilized by Corporate Airlines are not designed with equipment necessary to perform a VNAV approach, and Corporate Airlines was not authorized by the FAA to use the VNAV non-precision approach procedure.

6. The Corporate Airlines' Aircraft Manual provides sufficient guidance for approximating a 3° flight path by maintaining 300 feet of altitude for each mile from the runway threshold, and gives target descent rates to approximate that 3° glide path.

7. Corporate Airline's manuals provide FAA approved operational criteria for a stabilized approach.

8. Corporate Airlines' procedures for descent below the MDA, based upon appropriate visual cues, were consistent with all federal regulations.

9. Corporate Airlines' procedures for the flying pilot and non-flying pilot duties during instrument approaches are approved by the FAA.

10. The LOC/DME Runway 36 Jeppesen approach plate used by the accident flight crew depicts a descent from FAF and a level-off at MDA consistent with the "traditional" or "standard" non-precision approach procedure.

11. The Jeppesen approach plate for the LOC/DME Runway 36 profile view did not have reference altitudes which would allow a flight crew to cross check a proper descent rate after the FAF.

12. Corporate Airlines was not authorized to use the "VNAV DA(H) in lieu of MDA(H)" depicted on the Jeppesen approach plate for the LOC/DME Runway 36 at Kirksville.

13. The flight crew was familiar with operations into Kirksville and had successfully performed the LOC/DME Runway 36 approach at Kirksville under day IMC weather conditions on an earlier flight the day of the accident.

14. The flight crew continuously monitored the weather information available from the Kirksville ASOS, and the weather at Kirksville remained well above the required minimums for landing.

15. A review of the CVR and Flight Data Recorder ("FDR") indicates the flight crew set the proper minimum descent altitude in their flight instruments.

16. The flight crew configured the aircraft, stabilized airspeed, and were tracking the localizer center line before reaching the FAF. After passing the FAF, the flight crew established a descent rate within Corporate Airlines' Flight Manual stabilized

approach criteria. The First Officer activated the pilot controlled lighting to high intensity (7 clicks), and contacted Corporate Airlines' ground personnel to confirm that the runway lights were activated.

17. After the First Officer called the correct MDA as "thirteen twenty," the Captain stated that he had ground contact. After the automatic call-out of "minimums, minimums," the Captain called "approach lights in sight" at approximately 1.7 miles from the threshold of Runway 36. The First Officer replied "* in sight" followed immediately by "continue."

18. There is a grove of trees on-line with the approach to Runway 36 at Kirksville, with tree heights measuring up to 80 feet above the ground. RegionsAir is not aware of any evaluations that would discount the likelihood of the trees being a hazard to the approach to landing on Runway 36.

19. The evidence from the accident scene indicates the aircraft's initial impact with the trees occurred about 50 feet above the ground, 1.2 nautical miles south of the Runway 36 threshold.

D. CORPORATE AIRLINES' OPERATIONS AND PROCEDURES:

1. RegionsAir has an established policy, consistent with the federal regulations and documented in its Flight Manual, prohibiting all non-essential conversation below 10,000 feet mean sea level ("MSL"). A review of the CVR transcript prepared by the NTSB indicates the crew engaged in non-essential conversation below 10,000 feet MSL.

2. RegionsAir has an established CRM program, and it teaches CRM concepts and policies of cockpit responsibility and duties during flight in its initial and recurrent training. Corporate Airlines trained its pilots that the flying pilot will fly the

aircraft and monitor the flight instruments, until the non-flying pilot advises that visual contact of the runway environment ("runway in sight") is obtained. The non-flying pilot will monitor the approach, looking for runway visual references, will monitor flight instruments, and will call out any abnormalities or deviations from stabilized approach criteria. A review of the CVR transcript indicates that the Captain (flying pilot) called "approach lights in sight" rather than the non-flying pilot.

E. CORPORATE AIRLINES' TRAINING:

1. At the time of the accident, there were no underlying systemic problems with Corporate Airlines' pilot-training program.

2. Corporate Airlines conducted Controlled Flight Into Terrain ("CFIT") training, including materials from the Flight Safety Foundation Program, the FAA, Jeppesen, and flight crew testing.

3. Corporate Airlines had an established CRM program that teaches CRM concepts and policies of cockpit responsibility and duties during flight.

F. FAA AUDITS AND INSPECTIONS:

1. Corporate Airlines operated under the FAA Surveillance and Evaluation Program ("SEP"), and was inspected under the SEP Program a total of 550 inspections from 2001 until the accident. Of the 550 inspections, 105 pertained to facilities, and 445 pertained to operations. No major discrepancies were found in any of the SEP inspections of Corporate Airlines. Corporate Airlines addressed any minor discrepancies detected through the SEP inspection process immediately, and there were no outstanding discrepancies at the time of the accident.

Respectfully submitted,

[redacted]

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APPENDIX TO CORPORATE AIRLINES' SUBMISSION TO NTSB FACTUAL REPORT

Appendix 1: Corporate Airlines' Flight Manual Excerpts

Appendix 2: FAA Instrument Rating Practical Test Standards

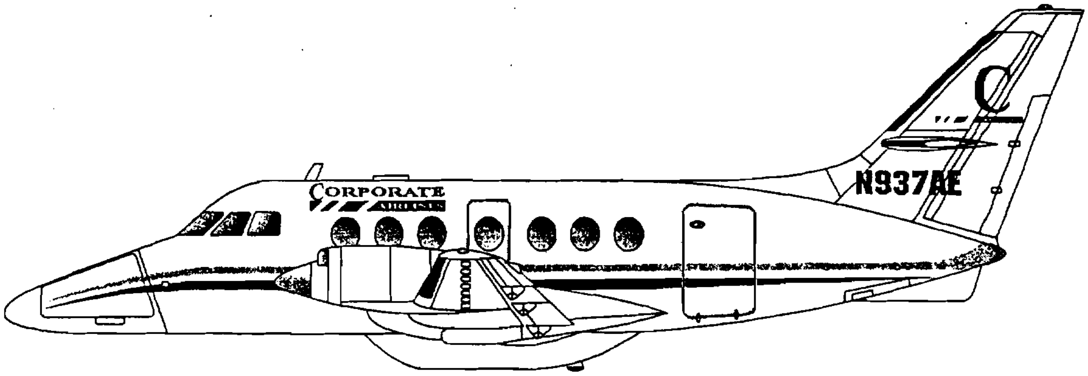
Appendix 3: FAA – S-8081-5D - Airline Transport Pilot and Aircraft Type Rating Practical Test Standards

Appendix 4: FAA Order 8400.10 Excerpts

Appendix 5: Corporate Airlines' Aircraft Manual Excerpts

Appendix 6: Advisory Circular 120-71A

Appendix – 1



CORPORATE AIRLINES

FLIGHT MANUAL (FM)

Printed in U.S.A.

Revision 17
20 SEP 04

Crew Qualification and Responsibilities

crewmembers responsibility to contact the appropriate FSDO prior to expiration of any temporary certificate if the permanent certificate has not yet been received.

31. Crewmember Absence (Return to Service)

A. After a crewmember has been absent due to leave, illness or injury, they must insure that they have made contact with their supervisor concerning that absence.

B. A flight crewmember returning from leave must meet Company's current crewmember standards and qualifications before being permitted to return to line status.

32. Logbooks - General (FAR 61.51)

[*The aeronautical training and experience used to meet the requirements for a certificate or rating, or the recent flight experience requirements must be shown by a reliable record. The logging of other flight time is not required.*]

33. Crew Pairing Requirements (FAR 121.438)

A. Either the PIC or SIC of a revenue flight must have at least 100 hours in revenue service as either PIC or SIC, in aircraft type and seat, except that this restriction can be reduced to 50 hours in seat, if a crewmember is hired with 100 hours recent experience (within one year) in the same type of aircraft.

B. When determining who will be assigned a particular line or seat (PIC, SIC), consolidation of flight experience and "high minimums" pilots will have priority over seniority.

C. Flight crews must have at least 250 hours combined experience in aircraft type for all charter flights.

34. Outside Flying

A. No aircraft, fixed wing or rotor wing, other than those operated by the Company, will be flown by crewmembers for hire or reward.

B. Flight crewmembers may engage in military and personal flying activities, but only to the extent that such flying does not conflict with the crewmembers monthly company flying schedule.

35. Flight Time Limits - Domestic Operations (FAR 121.471)

[*No certificate holder conducting domestic operations may schedule any flight crewmember and no flight crewmember may accept an assignment for flight time in scheduled air transportation or in other commercial flying if that crewmembers total flight time in all commercial flying will exceed:*

A. 1,000 hours in a calendar year as a crewmember.

B. 100 hours in a calendar month.

C. *30 hours in any seven consecutive days.*

D. *Not more than eight hours between required rest periods.*

E. *A flight crewmember shall not be considered to be scheduled for duty in excess of prescribed limitations, if the flights to which he is assigned are scheduled and normally terminate within such limitations, but due to conditions beyond the Company's control, such as adverse weather conditions, are not at the time of departure expected to reach their destination within the scheduled time.*

F. *A flight crewmember must have one of the following rest periods scheduled during the 24 consecutive hours preceding scheduled completion of any flight assignment under FAR 121.*

1) *Nine (9) consecutive hours of rest for less than eight hours of scheduled flight time. The nine hours rest <u>may</u> be reduced to a minimum of eight hours if the crewmember is given at least a 10 hour rest period that begins no later than 24 hours after the beginning of the reduced rest period.*

2) *Ten (10) consecutive hours of rest for more than eight hours but less than nine hours of scheduled flight time. The 10 hour rest may be reduced to a minimum of 8 hours if the crewmember is given at least an 11 hour rest period that begins no later than 24 hours after the beginning of the reduced rest period.*

3) *Eleven (11) consecutive hours of rest for nine or more hours of scheduled flight time. The 11 hours rest may be reduced to a minimum of nine hours it the crew ember is given a 12 hour rest period that begins no later than 24 hours after the beginning of the reduced rest period.*

G. *The crewmember must have the minimum rest required above before being assigned to or performing flight duties.*

H. *Each flight crewmember engaged in scheduled air transportation shall be relieved from all duty with the Company for at least 24 consecutive hours during any seven consecutive days.*

I. *No flight crewmember shall be assigned any duty with the Company during any rest period required by the above.*

J. *Time spent in deadhead transportation to or from duty assignment is not considered a part of a rest period.*]

K. In any conflicting limitations between FAR and between the Company and crewmembers, the most restrictive limitation will apply.

36. Flight Time Limitations Tracking Procedures

A. The following flight crewmember activity is tracked by crew scheduling for domestic flying and is entered into each crewmembers personal history:

A running accumulation of flight time is entered and tracked to assure compliance with FAR 121.471.

B. Sequenced (Scheduled) Operations:

1) As flight operations are conducted, times are entered automatically into the FOS computer system.

2) When crew bids are awarded for a particular month, that information is also entered into FOS. As a crewmember actually flies awarded trips, the flight times are updated in the system.

3) Rest requirements are also examined on an individual trip basis. To assist with regulatory compliance, FOS generates an alert to crew scheduling whenever a potential illegal conflict is identified.

37. Flight Equipment -General

A. Each flight crewmember shall provide themselves with the prescribed flight equipment (see paragraph 40) which will be available at all times during flight. A separate, suitable, preferably black, kit bag of satisfactory appearance will be used to carry the flight equipment. Duffel bags, gym bags, tote bags, shopping bags or any similar type bag is not considered acceptable for flight kit use and must not be used by flight crewmembers.

B. It shall be the captain's responsibility to determine, prior to flight, that each crewmembers' flight equipment meets company requirements.

C. Keep all items of flight equipment in their proper place on the flight deck.

CAUTION

Do not put flashlights, screwdrivers, paper, microphones, etc. where they will interfere with the proper operation of aircraft or engine controls or instruments. Except to mask a light in accordance with MEL instructions, do not obstruct warning, position or indicating lights in any way.

D. At originating stations, immediately prior to boarding and at through stations prior to departure, each crewmember will personally inspect their flight kits and personal luggage for foreign objects if they have been left unattended. Flight kits and personal luggage must not be left unattended in public areas.

E. All flight deck crew kit bags and personal luggage should be locked while on Company premises and unattended.

F. Always have proper identification tags attached.

G. Crewmember baggage - When engaged in regular scheduled or charter flights, crewmembers will restrict their baggage to:

1) Personal effects required, considering the period of time involved and the nature of the flying assignment: and,

2) Authorized required flight equipment.

APPENDIX – 2

FAA-S-8081-4D

U.S. Department
of Transportation
Federal Aviation
Administration

INSTRUMENT RATING
Practical Test Standards

for

AIRPLANE

HELICOPTER

POWERED LIFT

April 2004

FLIGHT STANDARDS SERVICE
Washington, DC 20591

VI. AREA OF OPERATION: INSTRUMENT APPROACH PROCEDURES

NOTE: TASK D, Circling Approach, is applicable only to the airplane category.

NOTE: The requirements for conducting a GPS approach for the purpose of this test are explained on page 8 of the Introduction.

A. TASK: NONPRECISION APPROACH (NPA)

REFERENCES: 14 CFR parts 61, 91; FAA-H-8083-15; IAP; AIM.

NOTE: The applicant must accomplish at least two nonprecision approaches (one of which must include a procedure turn or, in the case of an RNAV approach, a Terminal Arrival Area (TAA) procedure) in simulated or actual weather conditions. At least one nonprecision approach must be flown without the use of autopilot and without the assistance of radar vectors. (The yaw damper and flight director are not considered parts of the autopilot for purpose of this part). The examiner will select nonprecision approaches that are representative of the type that the applicant is likely to use. The choices must utilize two different types of navigational aids. Some examples of navigational aids for the purpose of this part are: NDB, VOR, LOC, LDA, GPS, or RNAV.

Objective. To determine that the applicant:

1. Exhibits adequate knowledge of the elements related to an instrument approach procedure.
2. Selects and complies with the appropriate instrument approach procedure to be performed.
3. Establishes two-way communications with ATC, as appropriate, to the phase of flight or approach segment, and uses proper communication phraseology and technique.
4. Selects, tunes, identifies, and confirms the operational status of navigation equipment to be used for the approach procedure.
5. Complies with all clearances issued by ATC or the examiner.
6. Recognizes if any flight instrumentation is inaccurate or inoperative, and takes appropriate action.
7. Advises ATC or examiner anytime that the aircraft is unable to comply with a clearance.

8. Establishes the appropriate aircraft configuration and airspeed considering turbulence and wind shear, and completes the aircraft checklist items appropriate to the phase of the flight.
9. Maintains, prior to beginning the final approach segment, altitude within +/-100 feet, heading within +/-10° and allows less than ¾ scale deflection of the CDI or within +/-10° in the case of an RMI, and maintains airspeed within +/-10 knots.
10. Applies the necessary adjustments to the published MDA and visibility criteria for the aircraft approach category when required, such as—

    a. NOTAMs.
    b. inoperative aircraft and ground navigation equipment.
    c. inoperative visual aids associated with the landing environment.
    d. NWS reporting factors and criteria.

11. Establishes a rate of descent and track that will ensure arrival at the MDA prior to reaching the MAP with the aircraft continuously in a position from which descent to a landing on the intended runway can be made at a normal rate using normal maneuvers.
12. Allows, while on the final approach segment, no more than a three-quarter-scale deflection of the CDI or within 10° in case of an RMI, and maintains airspeed within +/-10 knots of that desired.
13. Maintains the MDA, when reached, within +100 feet, -0 feet to the MAP.
14. Executes the missed approach procedure when the required visual references for the intended runway are not distinctly visible and identifiable at the MAP.
15. Executes a normal landing from a straight-in or circling approach when instructed by the examiner.

APPENDIX – 3

FAA-S-8081-5D - AIRLINE TRANSPORT PILOT AND AIRCRAFT TYPE RATING
Practical Test Standards for AIRPLANE

February 2001

FLIGHT STANDARDS SERVICE
Washington, DC 20591

Revision History:
Change 1, 2/7/01

NOTE

Examiners may use the practical test standards, dated August 1998, to evaluate airline transport pilot and type rating applicants, until February 1, 2001.

Material in FAA-S-8081-5D will be effective February 1, 2001. All previous editions of the Airline Transport Pilot and Aircraft Type Rating-Airplane Practical Test Standards will be obsolete as of this date.

FOREWORD

The Airline Transport Pilot and Aircraft Type Rating-Airplane Practical Test Standards (PTS) book has been published by the Federal Aviation Administration (FAA) to establish the standards for airline transport pilot and aircraft type rating practical tests for airplanes. FAA inspectors, designated pilot examiners, and check airmen (referred to as examiners throughout the remaining practical test standard) shall conduct practical tests in compliance with these standards. Flight instructors and applicants should find these standards helpful in practical test preparation.

Joseph K. Tintera, Manager
Regulatory Support Division, AFS-600
Flight Standards Service

INTRODUCTION

General Information

D. TASK: NONPRECISION INSTRUMENT APPROACHES

REFERENCES: Part 61; AC 61-27; POH, AFM, AIM; Instrument Approach Procedure Charts.

NOTE: The applicant must accomplish at least two nonprecision approaches (one of which must include a procedure turn) in simulated or actual weather conditions, using two different approach systems. At least one nonprecision approach must be flown manually without receiving radar vectors. The examiner will select nonprecision approaches that are representative of that which the applicant is likely to use. The choices must utilize two different systems; i.e., NDB and one of the following: VOR, LOC, LDA, GPS, or LORAN.

Objective. To determine that the applicant:

1. Exhibits adequate knowledge of nonprecision approach procedures representative of those the applicant is likely to use.
2. Accomplishes the nonprecision instrument approaches selected by the examiner.
3. Establishes two-way communications with ATC as appropriate to the phase of flight or approach segment and uses proper communications phraseology and techniques.
4. Complies with all clearances issued by ATC.
5. Advises ATC or the examiner any time the applicant is unable to comply with a clearance.
6. Establishes the appropriate airplane configuration and airspeed, and completes all applicable checklist items.
7. Maintains, prior to beginning the final approach segment, the desired altitude ±100 feet (30 meters), the desired airspeed ±10 knots, the desired heading ±5°; and accurately tracks radials, courses, and bearings.
8. Selects, tunes, identifies, and monitors the operational status of ground and airplane navigation equipment used for the approach.
9. Applies the necessary adjustments to the published Minimum Descent Altitude (MDA) and visibility criteria for the airplane approach category when required, such as-
    a. Notices to Airmen, including Flight Data Center Procedural NOTAMs.
    b. Inoperative airplane and ground navigation equipment.
    c. Inoperative visual aids associated with the landing environment.
    d. National Weather Service (NWS) reporting factors and criteria.

10. Establishes a rate of descent that will ensure arrival at the MDA (at, or prior to reaching, the visual descent point (VDP), if published) with the airplane in a position from which a descent from MDA to a landing on the intended runway can be made at a normal rate using normal maneuvering.

11. Allows, while on the final approach segment, not more than quarter-scale deflection of the Course Deviation Indicator (CDI) or ±5° in the case of the RMI or bearing pointer, and maintains airspeed within ±5 knots of that desired.

12. Maintains the MDA, when reached, within -0, +50 feet (-0, +15 meters) to the missed approach point.

13. Executes the missed approach if the required visual references for the intended runway are not unmistakably visible and identifiable at the missed approach point.

14. Executes a normal landing from a straight-in or circling approach when instructed by the examiner.

NOTE: If TASK D, Nonprecision Instrument Approaches, the second approach may be waived, if the applicant demonstrates a high degree of proficiency on the first approach and the applicant's training records or instructor certification show that the applicant has satisfactorily completed the nonprecision approach training requirements. The instrument approaches are considered to begin when the airplane is over the initial approach fix for the procedure being used and end when the airplane touches down on the runway or when transition to a missed approach configuration is completed. Instrument conditions need NOT be simulated below the minimum altitude for the approach being accomplished.

E. TASK: CIRCLING APPROACH

REFERENCES: Part 61; AC 61-27; POH, AFM, AIM; Instrument Approach Procedure Charts.

Objective. To determine that the applicant:

1. Exhibits adequate knowledge of circling approach categories, speeds, and procedures to a specified runway.
2. In simulated or actual instrument conditions to MDA, accomplishes the circling approach selected by the examiner.
3. Demonstrates sound judgment and knowledge of the airplane maneuvering capabilities throughout the circling approach.
4. Confirms the direction of traffic and adheres to all restrictions and instructions issued by ATC.
5. Descends at a rate that ensures arrival at the MDA at, or prior to, a point from which

APPENDIX – 4

(1) DH is not a point where a decision or commitment to land is made.

(2) DH is not a point where the decision-making process begins.

(3) DH is not the latest point at which a go-around could or should be made.

(4) DH is not a point where all aspects of the decision are instantaneously formulated.

491. CONCEPT OF MINIMUM DESCENT ALTITUDE AND MISSED APPROACH POINT (MDA/MAP). The MDA/MAP concept is the foundation for safe, CAT I nonprecision approach operations. Electronic glidepath information cannot be provided at certain locations because of obstacle or terrain problems, NAVAID sighting problems, and cost benefit factors. The MDA/MAP concept provides for safe nonprecision approach operations in instrument conditions without electronic glidepath information.

A. Minimum Descent Altitude. An MDA is the lowest permissible height (in a nonprecision approach) at which an aircraft can be controlled by reference only to instrument information. After passing the final approach fix (FAF) a pilot should descend to the MDA as rapidly as practical so that the pilot can acquire sufficient visual references while still in a position to safely complete the approach and landing by visual means. An MDA is established to require that the pilot, before descending below the specified height and before passing the MAP, determine that adequate visual references are available for accomplishing the following actions:

- Verifying that the aircraft is in a position that will permit a safe landing in the TDZ
- Determining that sufficient visual references are available to manually maneuver the aircraft to align it with the runway centerline, touch down within the TDZ, and maintain directional control on the runway
- For helicopter operations, determining that sufficient visual references are available to maneuver the helicopter to align with the landing area; decelerate to air taxi, or hover; and maintain directional control while air taxiing

(1) The following is a list of statements that describe what MDA is:

(a) MDA is the lowest permissible height at which a nonprecision approach can be continued by reference solely to flight instruments.

(b) MDA is the limit to which a pilot can descend before having to decide whether or not to continue the approach by using external visual references.

(c) MDA is the minimum height above the surface to which the aircraft can descend, unless the pilot determines that the aircraft is in a position from which it can be safely maneuvered using normal rates of descent (less than 1,000 fpm) to a touchdown within the TDZ (decelerate to air taxi or hover for helicopters).

(2) The following is a list of statements that describe what MDA is not:

(a) MDA is not a specified decision point.

(b) MDA is not a point at which a specific action is initiated.

(c) MDA is not a point where the decision process begins.

(d) MDA is not the latest point at which a go-around could or should be made.

(e) MDA is not a point where all aspects of the decision are instantaneously formulated.

B. Missed Approach Point. Since an electronic glidepath is not used in a nonprecision approach, it is necessary to define a point on or near the airport where a missed approach must be executed, if adequate external visual references for safely continuing the approach are not available. This point is specified as the MAP. An MAP is a three-dimensional airborne position where the MDA passes over a specified geographic fix (the MAP).

(1) The following is a list of statements that describe what MAP is:

(a) MAP is a specified decision point.

(b) MAP is the last point at which the approach can be continued by reference solely to flight instruments. After the MAP, the approach must be discontinued.

(c) MAP is the last point at which the published missed approach can be safely executed in instrument conditions.

(2) The following is a list of statements that describe what MAP is not:

(a) MAP is not the last point at which a pilot can decide to continue the approach by external visual references. Often, the MAP is located at a point where a pilot cannot safely descend and land if the MDA is maintained until arriving at the MAP (for example,

when the MAP is located over the very high frequency omnidirectional radio range (VOR) on the airport).

(b) MAP is not a point where a decision or commitment to land is made.

(c) MAP is not a point where the decision process is begun.

(d) MAP is not a point where all aspects of the decision are instantaneously formulated.

493. CONCEPT OF CIRCLING MANEUVERS. In many situations, instrument approach design criteria will not permit a "straight-in" approach to the landing runway. In these situations, a circling procedure is necessary to maneuver the aircraft to a landing on the intended runway. Circling maneuvers are usually necessary when there is an obstacle or terrain problem. Circling maneuvers are also required when a NAVAID is located in a position that precludes a straight-in approach to the intended landing runway. U.S. criteria require a circling maneuver if the inbound course is offset more than 30 degrees from the runway centerline. The circling maneuver can be initiated from either a precision or nonprecision instrument approach procedure and must be conducted entirely by external visual references. Electronic course or glidepath guidance cannot be used to perform a circling maneuver. A circling maneuver is not an instrument maneuver. Sufficient visual references for manually maneuvering the aircraft to a landing must be maintained throughout a circling maneuver. The pilot must keep the aircraft's position within the established maneuvering area while performing the circling maneuver. The circling MDA must be maintained until an aircraft (using normal maneuvers) is in a position from which a normal descent (less than 1,000 fpm) can be made to touchdown (decelerate to air taxi or hover for helicopters) within the TDZ. It is critical for pilots to understand that the published missed approach procedure may not provide adequate obstacle clearance, especially during the initial portion of a missed approach executed during a circling maneuver. The published missed approach is designed to provide obstacle clearance only when the missed approach is executed on the published final approach course at or above the MDA, and before passing the MAP. A published missed approach may not guarantee the necessary safety margin when a missed approach is executed past the MAP and/or below the MDA. The aircraft must remain within the established circling maneuvering area until the aircraft is at or above the MDA and established on the missed approach course. The following statements summarize the basic concepts of a circling maneuver:

A. A circling maneuver is a visual maneuver.

B. Sufficient visual references to manually maneuver the aircraft to a landing must be maintained throughout a circling maneuver.

C. The aircraft must be maintained at the MDA until it is at a position from which a safe landing can be made.

D. A missed approach must be executed when external visual references are lost or sufficient visual cues to manually maneuver the aircraft cannot be maintained.

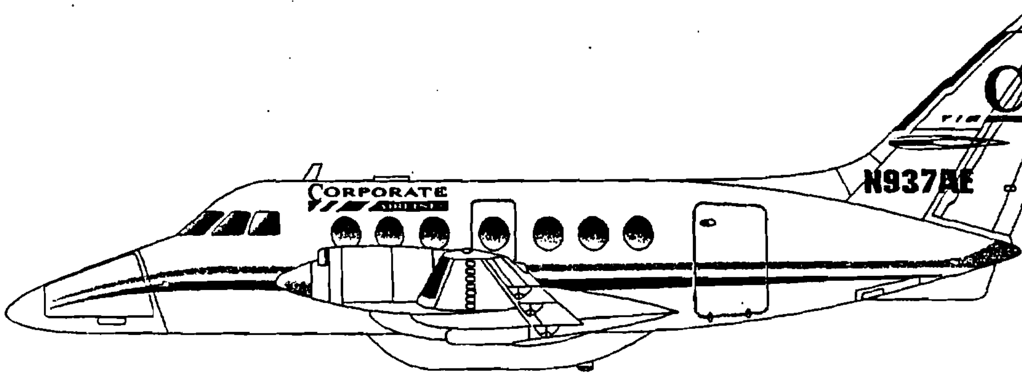
E. The published missed approach procedure does not guarantee obstacle clearance during the initial phases of a missed approach, if initiated during a circling maneuver after descending below MDA or after MAP. Therefore, when a missed approach from a circling maneuver is executed, the direction of the initial turn must always be toward the airport to ensure obstacle clearance and to keep the aircraft within the maneuvering area until it is above MDA and can safely proceed on the missed approach course.

495. CONCEPT OF RUNWAY VISUAL RANGE. Operating minimums are specified in terms of ground visibility, tower visibility, RVV, and RVR. The RVR concept has evolved over a long period, and its use in the U.S. began in 1955. As operating minimums were reduced due to improvements in airborne and ground-based equipment, it became more likely that pilots would not see the full length of the runway upon arrival at the specified decision point. Positions established for taking visibility observations were often several miles from the approach end of many runways. This resulted in reported visibility values that frequently did not represent the seeing-conditions encountered during the final stages of approach and landing. This deficiency was particularly critical when rapidly changing weather conditions within the terminal area occurred. These factors generated a need for systems such as RVR which could rapidly and reliably provide reports of the seeing-conditions that a pilot could expect to encounter in the TDZ and along the runway.

A. RVR measurements are taken by a system of calibrated transmissometers and account for the effects of ambient background light and the runway light intensity. Transmissometer systems are strategically located to provide RVR measurement associated with one or more of the three basic portions of a runway: the TDZ portion, the mid runway (MID) portion, and the rollout (Rollout) portion.

(1) RVR is an instrumentally-derived value that reflects an artificially created seeing-condition on or near the portion of the runway associated with the RVR report. This artificially created seeing-condition

APPENDIX - 5



CORPORATE AIRLINES

AIRCRAFT MANUAL (AM)

Printed in U.S.A.

Revision 15
29 April 2004

Normals

The glide path angle as well as height when crossing the end of the runway directly affect landing distance. For example: crossing the end of the runway at 100' rather than 50' can increase landing distance by about 950' on a 3° glide path. Even crossing the end of the runway at a 50' height, the landing distance is increased as approach path becomes flatter. A glide path angle of 1° can increase landing distance by about 1500' over that required for a 3° path. Best results are obtained at a normal ILS or VASI glide path angle.

Final Approach

A 3° glide path can be closely approximated by maintaining 300' of altitude for each mile from the runway. For example, when crossing a fix five miles from touchdown, the aircraft should be at (or slightly above) 1500' above the runway at that point. Any fix (e.g., DME or established landmark) that is accurately defined can be used in applying this rule.
In addition to the 300-feet per mile rule, ground speed and rate of descent can be used along with visual cues to insure a correct glide path. The rate of descent on a 3° glide path is a function of ground speed and will most often be between 650' and 800' per minute. If the ground speed is known, or can be accurately estimated, the approximate rate of descent on a 3° glide path can be calculated by the following rule of thumb: One-half the ground speed (knots) times ten will give a close approximation of the descent rate (fpm) required to maintain the desired (3°) glide path. For example, ground speed is 140 knots: 140 ÷ 2 x 10 = 700 fpm required to maintain approximate 3° glide path.

Visual Approaches

It is just as important to establish and stabilize the proper glide path angle on visual approach as it is on an ILS approach. The normal glide path angle of 3° is recommended. The following variables affect the ability to accurately judge this angle by visual means alone - when VASI, PAPI, or other visual or electronic approach aids are not available:

- Runway Slope: An up-slope in either the runway or approach zone creates an illusion of being high. A down-slope in the runway or approach zone creates an illusion of being low.
- Visibility: Rain, haze, smoke, dust, glare or darkness may cause a flight crew to believe they are higher than they actually are.
- Lighting: Bright runway lights appear closer, dim runway lights appear farther away – either case can lead to a misjudged approach.
- Runway Dimensions: The width of the runway relative to its length will also affect visual perspective.

These illusions and their effect can be minimized by cross-checking the approach path against barometric or radar altimeter indications (but beware of radar altitude - it may be affected by undulating terrain below), and by maintaining an awareness of the special problems associated with such approaches.

In light of the above, whenever possible, all visual approaches should be made with assistance from VASI, PAPI, or other available visual approach aids, or with an electronic glide slope (ILS) as reference.

Stabilized Approach Criteria

All approaches should be conducted so as to remain within the stabilized approach criteria as outlined in the Flight Manual.

Unstable Approaches

If an approach fails to meet the stabilized approach criteria, the non flying pilot shall state so, and state the criteria not met. For example: "Approach unstable, sink rate twenty-five hundred".

The flying pilot should acknowledge the challenge with "NOTED" or "CORRECTING". If the flying pilot does not respond after two challenges from the non flying pilot they should suspect incapacitation of the flying pilot and assume control of the aircraft.

During IMC conditions if an unstable approach is not corrected promptly a missed approach / balked landing must be executed.

Summary

The use of proper procedures leads to consistently safe and satisfactory approaches and will preclude short landings. All other factors being equal, preference should be given to runways which have either an ILS or VASI system.

If neither an ILS glide slope or a VASI is available, apply the 300 fpm per mile rule, the ground speed method, or any available clues to ensure approach along a 3° glide path angle.

Before Landing Checklist

On all approaches, the flying pilot will call "GEAR DOWN, FLAPS 20°, BEFORE LANDING CHECKLIST". The actions on the checklist will first be completed by "flow" and then confirmed by reading the checklist.

When the flying pilot calls "FLAPS 35°", the non flying pilot will select the flaps to 35°.

After the flying pilot's call for the Before Landing Checklist and upon completion of the flow, the non flying pilot will read aloud the Before Landing Checklist items and appropriate responses. Normally, FLOW selectors are not selected to OFF until prior to touchdown. In such cases, the NFP will state "HOLDING ON FLOWS". Then, prior to touchdown, the NFP will select FLOW selectors to OFF and state, FLOWS OFF, BEFORE LANDING CHECKLIST COMPLETE."

Landing Gear .... DOWN / 3 GREEN .... CR
- Both crewmembers shall confirm that the landing gear is down and locked by observing illumination of the 3 green DOWN indicators, and that the red UNLOCKED lights are out.

Prop Sync .... OFF .. NFP
- Switch selected and checked off.

Speeds .... HIGH .. NFP
- The non flying pilot confirms that the Speed Levers have been advanced full forward to HIGH RPM.

Flaps .... SELECTED / INDICATING ___ .. NFP
- Non flying pilot has checked, confirmed and stated the position of the Flap Handle and Flap Indicator. During ILS approaches, final flap selection is made after calling for the Before Landing Checklist. During all approaches, Before Landing Checklist is called for at flaps 20° (or at GEAR DOWN during a no-flap approach).

Hydraulic and Brake Pressure .... NORMAL .. NFP
- The non flying pilot will confirm that hydraulic indications are normal.

Flows .... OFFNFP
- Before touchdown, the non flying pilot will turn the flows OFF and state "FLOWS OFF".

Normal Non Precision Approach - Profile Notes

When established on a course inbound to the Final Approach Fix (FAF), select flaps 10°and begin slowing to 130 KIAS. Approximately 3 - 4 miles prior to the FAF, at a maximum airspeed of 160 KIAS, the Flying Pilot will call "GEAR DOWN, FLAPS 20°, BEFORE LANDING CHECKLIST". All efforts should be made to stabilize the aircraft in the landing configuration prior to reaching the FAF.

At the FAF, start timing and reduce power to maintain the briefed approach speed and approximately 1,000 fpm rate of descent (as necessary), until reaching MDA. If possible, plan to arrive over the FAF with airspeed stabilized at 130 knots, or the briefed approach speed.

If the missed approach point is reached without establishing visual contact, a missed approach must be initiated.

In the event that visual contact is attained that will allow the descent to continue to 100' above TDZE, (i.e., approach lights in sight), the NFP will call "APPROACH LIGHTS IN SIGHT, CONTINUE". The Non Flying Pilot will then continue to make the appropriate altitude calls.

In the event that visual contact is made with the runway, the Non Flying Pilot will call "RUNWAY IN SIGHT" and will continue to make the appropriate altitude callouts, referenced to Airport Elevation.

Upon hearing the "Runway In Sight" call by the Non Flying Pilot, the Flying Pilot will transition to visual cues outside the cockpit, and upon seeing the runway/airport will state "GOING VISUAL, LEAVING MINIMUMS, FLAPS 35°".

The Non Flying Pilot will continue to monitor the approach and all flight instruments, and will callout any abnormalities.

Upon reaching the Missed Approach Point, if the Non Flying Pilot has not stated "Runway In Sight", or if transition to visual cues is not possible, or if the aircraft is not in position for a normal landing, the Flying Pilot will initiate a missed approach by stating "MISSED APPROACH".

APPENDIX - 6

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: STANDARD OPERATING PROCEDURES FOR FLIGHT DECK CREWMEMBERS

Date: 2/27/03
Initiated By: AFS-210

AC No: 120-71A

1. PURPOSE.

a. General. Standard operating procedures (SOPs) are universally recognized as basic to safe aviation operations. Effective crew coordination and crew performance, two central concepts of crew resource management (CRM), depend upon the crew's having a shared mental model of each task. That mental model, in turn, is founded on SOPs. This advisory circular (AC) presents background, basic concepts, and philosophy in respect to SOPs. It emphasizes that SOPs should be clear, comprehensive, and readily available in the manuals used by flight deck crewmembers.

b. Using this Advisory Circular. This AC is designed to provide advice and recommendations about the development, implementation, and updating of SOPs. Appendix 1, Standard Operating Procedures Template, provides many important topics that should be addressed in SOPs. Stabilized Approach, characterized by a constant-angle, constant-rate of descent ending near the touchdown point where the landing maneuver begins, is among the SOPs specifically identified in this AC and is described in Appendix 2, Stabilized Approach: Concepts and Terms. These and the other appendices represent a baseline and a starting point. Start-up certificate holders and existing certificate holders should refer to the Template in Appendix 1, to Stabilized Approach in Appendix 2, and to the other appendices in developing comprehensive SOPs for use in training programs and in manuals used by their flight deck crewmembers.

c. What's New in this Advisory Circular. AC 120-71A revises and supersedes the earlier version, AC 120-71. Many minor changes have been made to improve clarity, accuracy, completeness, and consistency. Two significant changes are the conversion of the term pilot not flying (PNF) to pilot monitoring (PM) and the addition of a related Appendix addressing "Crew Monitoring and Cross-Checking." It is increasingly acknowledged that it makes better sense to characterize pilots by what they *are* doing rather than by what they are not doing. Hence, pilot flying (PF) remains an appropriate term and is unchanged in this AC. But the term pilot not flying misses the point. Studies of crew performance, accident data, and pilots' own experiences all point to the vital role of the non-flying pilot as a monitor. Hence, the term pilot monitoring (PM) is now widely viewed as a better term to describe that pilot. The term PM is used liberally throughout this AC. In those instances where the older term PNF appears, it should be understood that pilot monitoring (PM) is the preferred meaning.

2. CANCELLATION. This AC cancels AC 120-71, Standard Operating Procedures for Flight Deck Crewmembers, dated August 10, 2000.

3. SCOPE. Appendix 1 consolidates many topics viewed by operators and by the FAA as important to be addressed as SOPs in air carrier training programs and in the manuals used by air carrier flight deck crewmembers. **This AC does not list every important SOP topic or dictate exactly how each topic should be addressed by a certificate holder.** Instead, this AC offers a baseline of topics to be used as a reference. In practice, each certificate holder's manuals and training programs are unique. Each certificate holder could omit certain topics shown in the template when they do not apply, and, on the other hand, could add other topics not shown in the template when they do apply. This AC contains guidance intended for use primarily by Title 14 of the Code of Federal Regulations (14 CFR) part 119 certificate holders authorized to conduct operations under part 121. But operators of aircraft under 14 CFR parts 135, 125, 91, and others should also find this guidance useful.

4. RELATED REGULATIONS. 14 CFR part 121, sections 121.133, 121.141, 121.401; 14 CFR part 125, section 125.287; 14 CFR part 135, section 135.293.

5. RELATED READING MATERIAL.

a. AC 120-51 as amended, Crew Resource Management Training.

b. AC 120-48, Communication and Coordination between Flight Crewmembers and Flight Attendants.

c. AC 120-54, Advanced Qualification Program.

d. AC 121-32, Dispatch Resource Management Training.

NOTE: ACs may be obtained by choosing "Advisory Circulars" at the following FAA public Web site:

http://www.airweb.faa.gov

e. Controlled Flight into Terrain Education and Training Aid (Flight Safety Foundation, ICAO, and Federal Aviation Administration) http://www1.faa.gov/avr/afs/afs200/afs210/index.cfm

f. Flight Safety Digest, Nov. 98 – Feb. 99 (Flight Safety Foundation).

g. Approach-and-landing Risk Awareness Tool, as revised (Flight Safety Foundation) http://www.flightsafety.org/pdf/alar_risk_tool.pdf

h. CFIT Checklist, as revised (Flight Safety Foundation): http://www.flightsafety.org/pdf/cfit_check.pdf

i. Human Performance Considerations in the Use and Design of Aircraft Checklists (FAA). http://www1.faa.gov/avr/afs/afs200/afs210/index.cfm

j. FAA Flight Standardization Board (FSB) Reports. http://www.opspecs.com/AFSData/FSBRs/Final/

6. BACKGROUND.

a. Many aviation safety organizations including the FAA have recently reaffirmed the importance of SOPs.

b. For many years the National Transportation Safety Board (NTSB) has identified deficiencies in standard operating procedures as contributing causal factors in aviation accidents. Among the most commonly cited deficiencies involving flightcrews has been their non-compliance with established procedures; another has been the non-existence of established procedures in some manuals used by flightcrews.

c. The International Civil Aviation Organization (ICAO) has also recognized the importance of SOPs for safe flight operations. Recent amendments to ICAO Annex 6 establish that each member state should require that SOPs for each phase of flight be contained in the operations manual used by pilots.

d. Non-government aviation safety organizations such as Flight Safety Foundation, (Alexandria, VA) have concluded that airlines perform with higher levels of safety when they establish and adhere to adequate SOPs.

e. In 1997 the FAA joined with representatives from the National Aeronautics and Space Administration (NASA) and from a broad cross-section of aviation organizations to form the Commercial Aviation Safety Team (CAST). Chartered by the White House to reduce the commercial aviation accident rate by 80 percent in 10 years, this Team chose controlled flight into terrain (CFIT) as one of the first major aviation hazards to be addressed in meeting this challenge. The Team used a data-driven approach to identify interventions with the highest possible safety leverage, and to develop a comprehensive agenda to implement those interventions.

f. In its study of CFIT accidents, a CAST analysis team including the FAA corroborated the findings of the NTSB, ICAO, and other groups. Almost 50 percent of the 107 CFIT interventions identified by that analysis team related to the flightcrew's failure to adhere to SOPs or the certificate holder's failure to establish adequate SOPs. Subsequent CAST teams confirmed their analysis further.

g. This AC is in large part the final report and end-product of one of the CAST sub-teams, a group comprised of subject matter experts in aviation human factors, in airline operations, and in flightcrew training.

7. THE MISSION OF SOPs. To achieve consistently safe flight operations through adherence to SOPs that are clear, comprehensive, and readily available to flight crewmembers.

8. APPLYING THE SOPs TEMPLATE AND OTHER APPENDICES. Generally, each SOP topic identified in the template (following as Appendix 1) is important; the certificate holder should address them in some manner, if applicable. Stabilized Approach (Appendix 2) is a particularly important SOP. Other important SOPs, such as those associated with special operating authority or with new technology, are not shown in the template, but should be addressed as well, when applicable. Because each certificate holder's operation is unique, the certificate holder should develop the specific manner in which SOPs are addressed. Topics expanded and illustrated in the Appendices are for example only, and represent renditions of SOPs known to be effective. **No requirement is implied or intended to change existing SOPs based solely on these examples.** An SOP topic shown in the Appendices may be addressed in detail, including text and diagrams, or in very simple terms. For example, an SOP may be addressed in a simple statement such as: "ABC Airlines does not conduct Category 3 approaches."

9. KEY FEATURES OF EFFECTIVE SOPs.

a. Many experts agree that implementation of any procedure as an SOP is most effective if:

(1) The procedure is appropriate to the situation.

(2) The procedure is practical to use.

(3) Crewmembers understand the reasons for the procedure.

(4) Pilot Flying (PF), Pilot Not Flying (PNF) / Pilot Monitoring (PM), and Flight Engineer duties are clearly delineated.

(5) Effective training is conducted.

(6) The attitudes shown by instructors, check airmen, and managers all reinforce the need for the procedure.

b. If all elements (above) are not consistently implemented, flightcrews too easily become participants in an undesirable double standard condoned by instructors, check airmen, and managers. Flightcrews may end up doing things one way to satisfy training requirements and checkrides, but doing them another way in "real life" during line operations. When a double standard does appear in this way, it should be considered a red flag that a published SOP may not be practical or effective for some reason. That SOP should be reviewed and perhaps changed.

10. THE IMPORTANCE OF UNDERSTANDING THE REASONS FOR AN SOP.

a. Effective Feedback. When flight crewmembers understand the underlying reasons for an SOP they are better prepared and more eager to offer effective feedback for improvements. The certificate holder, in turn, benefits from more competent feedback in revising existing SOPs and in developing new SOPs. Those benefits include safety, efficiency, and employee morale.

b. Troubleshooting. When flight crewmembers understand the underlying reasons for an SOP, they are generally better prepared to handle a related in-flight problem that may not be explicitly or completely addressed in their operating manuals.

11. COLLABORATING FOR EFFECTIVE SOPs.

a. In general, effective SOPs are the product of healthy collaboration among managers and flight operations people, including flightcrews. A safety culture promoting continuous feedback from flightcrews and others, and continuous revision by the collaborators distinguishes effective SOPs at airlines of all sizes and ages.

b. New operators, operators adding a new aircraft fleet, or operators retiring one aircraft fleet for another must be especially diligent in developing SOPs. Collaborators with applicable experience may be more difficult to bring together in those instances.

c. For a startup certificate holder, this AC and its appendices should be especially valuable tools in developing SOPs. The developers should pay close attention to the approved airplane flight manual (AFM), to AFM revisions and operations bulletins issued by the manufacturer, and to the applicable Flight Standardization Board (FSB) report issued by the FAA. Desirable partners in the collaboration would certainly include representatives of the airplane manufacturer, pilots having previous experience with the airplane or with the kind of operations planned by the operator, and representatives from the FAA, including the principal operations inspector (POI), members of the Certificate Management Team, and members of the Certification, Standardization, and Evaluation Team (CSET). It is especially important for a new operator to maintain a periodic review process that includes line flightcrews. Together, managers and flightcrews are able to review the effectiveness of SOPs and to reach valid conclusions for revisions. The review process will be meaningful and effective when managers promote prompt implementation of revisions to SOPs when necessary.

d. An existing certificate holder introducing a new airplane fleet should also collaborate using the best resources available, including the AFM, operations bulletins, and the FSB report. Experience has shown that representatives of the airplane manufacturer, managers, check airmen, instructors, and line pilots work well together as a team to develop effective SOPs. A trial period might be implemented, followed by feedback and revision, in which SOPs are improved. By being part of an iterative process for changes in SOPs, the end user, the flight crewmember, is generally inclined to accept the validity of changes and to implement them readily.

e. Long-established operators should be careful not to assume too readily that they can operate an airplane recently added to the fleet in the same, standard way as older types or models. Managers, check airmen, and instructors should collaborate using the best resources available, including the AFM, operations bulletins, and the FSB report to ensure that SOPs they develop or adapt for a new airplane are in fact effective for that aircraft, and are not inappropriate carryovers.

12. SUMMARY. Safety in commercial aviation continues to depend on good crew performance. Good crew performance, in turn, is founded on standard operating procedures that are clear, comprehensive, and readily available to the flightcrew. This AC provides an SOPs template and many other useful references in developing SOPs. Development of SOPs is most effective when done by collaboration, using the best resources available including the end-users themselves, the flightcrews. Once developed, effective SOPs should be continually reviewed and renewed.

/s/ Louis C. Cusimano, for
James J. Ballough
Director, Flight Standards Service

NOTES ON APPENDICES

The following appendices contain examples of standard operating procedures (SOPs) that are identical or similar to some SOPs currently in use. Those examples do not represent a rigid FAA view of best practices, which may vary among fleets and among certificate holders, and may change over time.

Some of the examples may be readily adapted to a certificate holder's flightcrew training and operating manuals for various airplane fleets. Others may apply to a certain airplane fleet and may not be adaptable apart from that fleet.

In some cases a term shown in an appendix is a term used by a certificate holder, not the equivalent term used by the FAA. Example: Where the FAA would use the term "height above touchdown," or HAT, the example shows that the certificate holder has used the term "above field elevation," or AFE.

APPENDIX 1

STANDARD OPERATING PROCEDURES TEMPLATE

A manual or section in a manual serving as the flightcrew's guide to standard operating procedures (SOPs) may double as a training guide. The content should be clear and comprehensive, without necessarily being lengthy. No template could include every topic that might apply unless it were constantly revised. Many topics involving special operating authority or new technology are absent from this template, among them ETOPS, PRM, SMGS, RNP, and many others.

The following are nevertheless viewed by industry and FAA alike as examples of topics that constitute a useful template for developing comprehensive, effective SOPs:

- Captain's authority

- Use of automation
  - The operator's automation philosophy
  - Specific guidance in selection of appropriate levels of automation
  - Autopilot/flight director mode control inputs
  - Flight management systems inputs
  - Monitoring of automated systems and Flight Mode Annunciator (FMA)
  - Cross checking of FMS routing with ATC clearance during preflight

- Checklist philosophy
  - Policies and procedures
    - (Who calls for; who reads; who does)
  - Format and terminology
  - Type of checklist
    - Challenge-Do-Verify
    - Do-Verify
  - Walk-arounds

- Checklists
  - Safety check -- power on
  - Originating/receiving
  - Before start
  - After start
  - Before taxi
  - Before take-off
  - After take-off
  - Climb check
  - Cruise check
  - Preliminary landing
  - Landing
  - After landing

Parking and securing
Emergency procedures
Non-normal/abnormal procedures

- Communications
  - Who handles radios
  - Primary language used
    - ATC
    - On the flight deck
  - Keeping both pilots in the loop
  - Company radio procedures
  - Flight deck/cabin signals
  - Cabin/flight deck signals

- Briefings
  - CFIT risk considered (see example, paragraph 4 h in this AC)
  - Special airport qualifications considered
  - Temperature corrections considered
  - Before takeoff
  - Descent/approach/missed approach
  - Approach briefing generally done prior to beginning of descent

- Flight deck access
  - On ground/in flight
  - Jumpseat
  - Access signals, keys

- Flight deck discipline
  - PF/PM duties and responsibilities
  - Sterile cockpit
  - Maintaining outside vigilance
  - Monitoring/cross-checking

- Transfer of control
  - Additional duties
  - Flight kits
  - Headsets/speakers
  - Boom mikes/handsets
  - Maps/approach charts
  - Meals

- Altitude awareness
  - Altimeter settings
  - Transition level
  - Callouts (verification of)
  - Minimum safe altitudes (MSA)

Temperature corrections
Monitoring during last 1000 feet of altitude change

- Report times
    - Check in/show up
    - On flight deck
    - Checklist accomplishment

- Maintenance procedures
    - Logbooks/previous write-ups
    - Open write-ups
    - Notification to maintenance of write-ups
    - Minimum equipment list (MEL)
        - Where it is accessible
    - Configuration Deviation List (CDL)
    - Crew coordination in ground de-icing

- Flight plans/dispatch procedures/takeoff and landing calculations
    - VFR/IFR
    - Icing considerations
    - Fuel loads
    - Weather package
    - Where weather package is available
    - Departure procedure climb gradient analysis

- Boarding passengers/cargo
    - Carry-on baggage
    - Exit row seating
    - Hazardous materials
    - Prisoners/escorted persons
    - Guns onboard
    - Count/load

- Pushback/powerback

- Taxiing
    - All engines running
    - Less than all engines running
    - On ice or snow
    - Prevention of runway incursion

- Crew resource management (CRM)
    - Crew briefings
        - Flight attendants
        - Flightcrew

- Weight & balance/cargo loading
    - Who is responsible for loading cargo, and securing cargo
    - Who prepares the weight & balance data form; who checks it
        - Copy to crew

- Flight deck/cabin crew interchange
    - Boarding
    - Ready to taxi
    - Cabin emergency
    - Prior to take-off/landing

- Take-off
    - PF/PM duties and responsibilities
    - Who conducts it
    - Briefing, IFR/VFR
    - Reduced power procedures
    - Tailwind, runway clutter
    - Intersections/land and hold short procedures (LAHSO)
    - Noise abatement procedures
    - Special departure procedures
    - Flight directors
        - Use of: Yes/No
    - Callouts
    - Clean up
    - Loss of engine
        - Transfer of control, if appropriate
        - Rejected takeoff
        - After V1
            - Actions/callouts
    - Flap settings
        - Normal
        - Nonstandard and reason for
        - Crosswind
    - Close-in turns

- Climb
    - Speeds
    - Configuration
    - Confirm compliance with climb gradient required in departure procedure
    - Confirm appropriate cold temperature corrections made

- Cruise altitude selection
    - Speeds/weights

- Position reports/pilot weather reports (PIREPs)
  - ATC – including PIREPs of hazards such as icing, thunderstorms, and turbulence
  - Company

- Emergency descents

- Holding procedures
  - Procedures for diversion to alternate

- Normal descents
  - Planning and verbalizing beginning of descent point
  - Risk assessment and briefing (see example, paragraph 4.g in this AC)
  - Speedbrakes: Yes/No
  - Flaps/gear use
  - Icing considerations
  - Convective activity

- Ground proximity warning system (GPWS or TAWs)
  - Escape maneuver

- TCAS

- Windshear
  - Avoidance of likely encounters
  - Recognition
  - Recovery / escape maneuver

- Approach philosophy
  - Monitoring during approach
  - Precision approaches preferred
  - Coordinate with ATC and plan ahead to avoid rushed approaches
  - Stabilized approaches standard
  - Use of navigation aids
  - Flight management system (FMS)/autopilot
    - Use, and when to discontinue use
  - Approach gates
    - Limits for stabilized approaches
  - Use of radio altimeter
  - Go-arounds: Plan to go around on every approach; change plan to land when visual, or when conditions permit in low-visibility operations – only if stabilized

- Individual approach type
  - All types, including engine-out

- For each type of approach
    - Profile
    - Airplane configuration for conditions
        - Visual approach
        - Low visibility
        - Contaminated runway
    - Flap/gear extension
    - Auto spoiler and auto brake systems armed and confirmed armed by both pilots, in accordance with manufacturer's recommended procedures (or equivalent approved company procedures)
    - Actions and callouts

- Go-around / missed approach
    - When stabilized approach gates are missed
    - Actions and callouts (see example, Appendix 4)
    - Clean-up profile

- Landing
    - Actions and callouts during landing
    - Close-in turns
    - Crosswind
    - Rejected
    - Actions and callouts during rollout (see example, Appendix 18)
        - "No Spoilers" callout
        - Reverse thrust "Overboost" callout
    - Transfer of control after first officer landing

APPENDIX 2

STABILIZED APPROACH: CONCEPTS AND TERMS

A **stabilized approach** is one of the key features of safe approaches and landings in air carrier operations, especially those involving transport category airplanes.

A stabilized approach is characterized by a **constant-angle, constant-rate of descent** approach profile ending near the touchdown point, where the landing maneuver begins. A stabilized approach is the safest profile in all but special cases, in which another profile may be required by unusual conditions.

All appropriate **briefings and checklists** should be accomplished before 1000' height above touchdown (HAT) in instrument meteorological conditions (IMC), and before 500' HAT in visual meteorological conditions (VMC)

Flight should be **stabilized by 1000'** HAT in IMC, and by 500' HAT in VMC.

An approach is stabilized when all of the following **criteria** are maintained from 1000 HAT (or 500 HAT in VMC) to landing in the touchdown zone:

The airplane is on the correct[1] track.

The airplane is in the proper landing configuration.

After glide path intercept, or after the final approach fix (FAF), or after the derived fly-off point (per Jeppesen) the pilot flying requires no more than normal bracketing corrections[2] to maintain the correct track and desired profile (3° descent angle, nominal) to landing within the touchdown zone. Level-off below 1000' HAT is not recommended.

The airplane speed is within the acceptable range specified in the approved operating manual used by the pilot.

The rate of descent is no greater than 1000 feet per minute (fpm).

- If an expected rate of descent greater than 1000 fpm is planned, a special approach briefing should be performed.
- If an unexpected, sustained rate of descent greater than 1000 fpm is encountered during the approach, a missed approach should be performed. A second approach may be attempted after a special approach briefing, if conditions permit.

Power setting is appropriate for the landing configuration selected, and is within the permissible power range for approach specified in the approved operating manual used by the pilot.

APPENDIX 2 (continued)

When no vertical guidance is provided: Vertical guidance may be provided to the pilot by way of an electronic glideslope, a computed descent path displayed on the pilot's navigation display, or other electronic means. On approaches for which no vertical guidance is provided, the flightcrew should plan, execute, and monitor the approach with special care, taking into account traffic and wind conditions. To assure vertical clearance and situation awareness, the pilot not flying should announce crossing altitudes as published fixes and other points selected by the flightcrew are passed. The pilot flying should promptly adjust descent angle as appropriate. A constant-angle, constant-rate descent profile ending at the touchdown point is the safest profile in all but special cases.

Visual contact. Upon establishing visual contact with the runway or appropriate runway lights or markings, the pilot should be able to continue to a safe landing using normal bracketing corrections, or, if unable, should perform a missed approach.

No visual contact. The operator may develop procedures involving an approved, standard MDA buffer altitude or other approved procedures to assure that descent below MDA does not occur during the missed approach. If no visual contact is established approaching MDA or an approved MDA buffer altitude, or if the missed approach point is reached, the pilot should perform the published missed approach procedure. (OpSpec paragraph C073 provides for special authorization under certain conditions to go below the MDA while executing a missed approach.) Below 1000' HAT, leveling off at MDA (or at some height above MDA) is not recommended, and a missed approach should be performed.

Note [1]: **A correct track** is one in which the correct localizer, radial, or other track guidance has been set, tuned, and identified, and is being followed by the pilot. Criteria for following the correct track are discussed in FAA Advisory Circulars relating to Category II and Category III approaches. Criteria for following track in operations apart for Category II and Category III are under development.

Note [2]: **Normal bracketing corrections** relate to bank angle, rate of descent, and power management. Recommended ranges are as follows (operating limitations in the approved airplane flight manual must be observed, and may be more restrictive):

Bank angle	Maximum bank angle permissible during approach is specified in the approved operating manual used by the pilot, and is generally not more than 30°; the maximum bank angle permissible during landing may be considerably less than 30°, as specified in that manual.
Rate of descent	± 300 fpm deviation from target
Power management	Permissible power range is specified in the approved operating manual used by the pilot
Overshoots	Normal bracketing corrections occasionally involve momentary overshoots made necessary by atmospheric conditions. Such overshoots are acceptable. Frequent or sustained overshoots caused by poor pilot technique are not normal bracketing corrections.

APPENDIX 3

(examples)

ATC COMMUNICATIONS and ALTITUDE AWARENESS

ATC Communications: SOPs should state who (PF, PM, FE/SO) handles the radios for each phase of flight, as follows:

PF makes input to aircraft/autopilot and/or verbally states clearances while PM confirms input is what he/she read back to ATC.

Any confusion in the flight deck is immediately cleared up by requesting ATC confirmation.

If any crewmember is off the flight deck, all ATC instructions are briefed upon his/her return. Or if any crewmember is off the flight deck all ATC instructions are written down until his/her return and then passed to that crewmember upon return. Similarly, if a crewmember is off ATC frequency (e.g., when making a PA announcement or when talking on company frequency), all ATC instructions are briefed upon his/her return.

Company policy should address use of speakers, headsets, boom mike and/or hand-held mikes.

Altitude Awareness: SOPs should state the company policy on confirming assigned altitude.

Example: The PM acknowledges ATC altitude clearance.
If the aircraft is on the autopilot then the PF makes input into the autopilot/altitude alerter. PF points to the input while stating the assigned altitude as he/she understands it. The PM then points to the input stating aloud what he/she understands the ATC clearance to be confirming that the input and clearance match.

If the aircraft is being hand-flown then the PM makes the input into the Altitude Alerter/autopilot, then points to the input and states clearance. PF then points to the alterter stating aloud what he/she understands the ATC clearance to be confirming that the alerter and clearance match.

Example: If there is no altitude alerter in the aircraft then both pilots write down the clearance, confirm that they have the same altitude, and then cross off the previously assigned altitude.

APPENDIX 4

(example)

NORMAL GO-AROUND – ACTIONS and CALLOUTS

Callouts: shown in **"BOLD TEXT"** – **Actions:** shown with bullets (•) in plain text		
Go-around	**PF**	**PM**
	"GO AROUND" • Press either GA switch **"GO-AROUND POWER"** • Verify thrust levers move to GA power • Rotate towards 15° pitch attitude, then follow flight director commands **"FLAPS 20"**	• Verify GA annunciates • Select flaps 20 • Verify thrust levers move to maintain 2,000 FPM climb rate **"POWER SET"**
Positive Rate of Climb	• Verify positive rate of climb **"GEAR UP"** • Execute published missed approach or proceed as instructed by ATC	**"POSITIVE RATE"** • Position gear lever UP • Advise ATC • Monitor missed approach procedures
At or above 400' AFE	**"LNAV" or "HEADING SELECT"**	• Select LNAV or HDG SEL • Verify LNAV or HDG SEL annunciates
Climbing through 1,000' AFE	**"REF 80"** **"FLAPS_____"** (Retract flaps on flap retraction speed schedule)	• Set command airspeed cursor to V_{REF} 30 + 80 • Select proper flap setting, when requesting
At flap retraction speed	**"FLAPS UP, AFTER TAKEOFF CHECKLIST"**	• Retract flaps • Accomplish checklist

APPENDIX 5

(example)

SINGLE ENGINE GO-AROUND -- ACTIONS and CALLOUTS

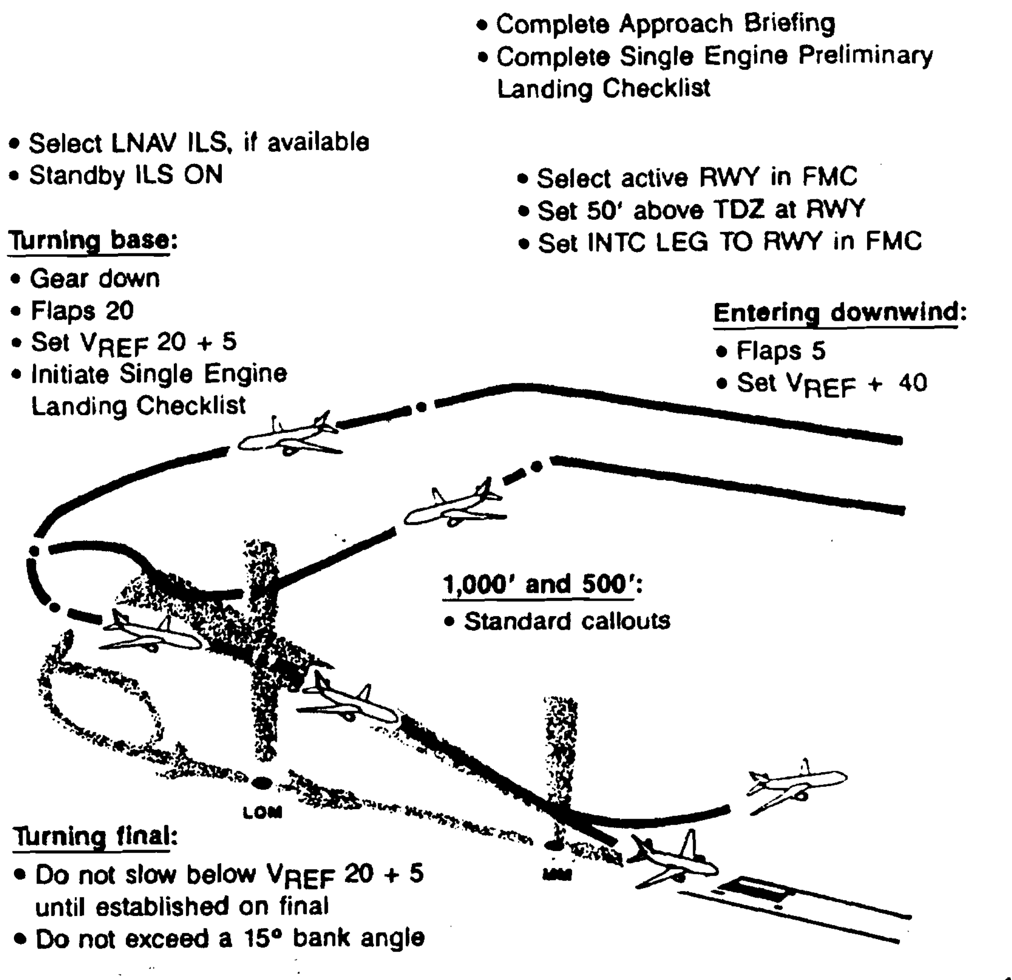
Callouts: shown in "BOLD TEXT" -- Actions: shown with bullets (•) in plain text		
	PF	**PM**
Go-around	**"GO AROUND"** • Press either GA switch **"GO-AROUND POWER"** • Advance thrust lever to GA power • Rotate towards 10° pitch attitude, then follow flight director commands **"FLAPS 5"**	• Verify GA annuciates • Verify GA power set • Select flaps 5 **"POWER SET"**
Positive Rate of Climb	• Verify positive rate of climb **"GEAR UP"** •• Execute airport specific "Engine Failure Missed Approach," published missed approach, or proceed as instructed by ATC, as appropriate	• Position gear lever UP • Advise ATC
At or above 400' AFE, or lower if Engine Failure procedure specifies a turn prior to 400' AFE	**"LNAV" or "HEADING SELECT"**	• Select LNAV or HDG SEL • Verify LNAV or HDG SEL annunciates • Monitor missed approach procedure
Climbing through 1,000' AFE or obstruction clearance altitude (OCA), whichever is higher	**"REF 80"** **"FLAPS____"** (Retract flaps on flap retraction speed schedule)	• Set command airspeed cursor to VREF 30 + 80 • Select proper flap setting, when requested
At flap retraction speed	**"FLAPS UP"**	• Retract flaps
At V_{REF} 30 + 80	**"MAXIMUM CONTINUOUS THRUST AFTER TAKEOFF CHECKLIST"**	• Press CON on TMSP • Set MCT **"POWER SET"** • Accomplish After Takeoff Checklist

APPENDIX 6

(example)

SINGLE ENGINE VISUAL LANDING – PROFILE

SINGLE ENGINE VISUAL LANDING PROFILE



APPENDIX 7

(example)

SINGLE ENGINE ILS APPROACH – ACTIONS and CALLOUTS

Callouts: shown in "BOLD TEXT" – **Actions:** shown with bullets (•) in plain text		
	PF	**PM**
Initial Approach	**"FLAPS 1, REF 60"** **"FLAPS 5, REF 40"**	• Select flaps 1 • Set command airspeed cursor to V_{REF} 30 + 60 • Select flaps 5 • Set command airspeed cursor to V_{REF} 30 + 40
When Cleared for the Approach	•• Verify Nav radio tuned to appropriate ILS frequency • Select APP mode	• Verify LOC and G/S annunciates white (armed) on ADI
LOC Alive	• Verify localizer indication	**"LOCALIZER ALIVE"**
LOC Capture	•• Verify LOC annunciates green (captured) on ADI	
GS Alive	• Verify G/S indication **"GEAR DOWN, FLAPS 20, V_{REF} 20 + 5, SINGLE ENGINE LANDING CHECKLIST"**	**"GLIDESLOPE ALIVE"** • Position gear lever DOWN • Select flaps 20 • Set command airspeed cursor to VREF 20 + 5 • Complete Single Engine Landing Checklist
GS Capture		**"GLIDESLOPE CAPTURE"**

APPENDIX 8

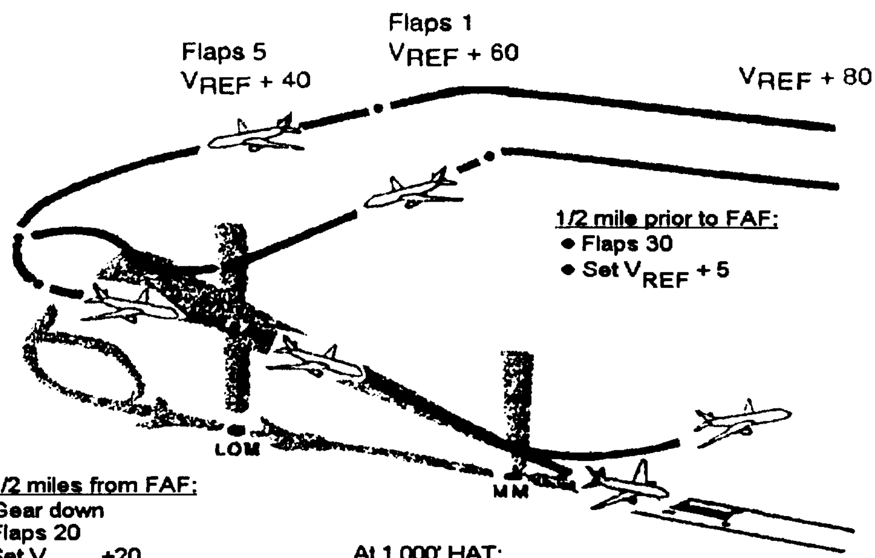
(example)

APPROACH PROFILE: LNAV, LOC, or LOC B/CRS

- Complete Approach Briefing
- Complete Preliminary Landing Checklist

When cleared for the approach:

- Select LNAV, LOC, or LOC B/CRS*, as appropriate
- Verify armed
- Set raw data backup, as required



2-1/2 miles from FAF:

- Gear down
- Flaps 20
- Set V_{REF} +20
- Initiate Landing Checklist

At 1,000' HAT:

- Stabilized Approach

At MDA or MDA Buffer Altitude:

- Set missed approach altitude
- If runway environment is in sight and the aircraft is in a position from which a normal approach to the intended runway can be made, land the aircraft.

- or -

- If runway environment is not in sight, perform a missed approach procedure.

* Aircraft not equipped with B/CRS feature, use LNAV

APPENDIX 9

(example)

LNAV, LOC, or LOC B/CRS APPROACH – ACTIONS and CALLOUTS

Callouts: in "BOLD TEXT" – Actions: with bullets (•) in plain text		
	PF	PM
Initial Approach	**"FLAPS 1 REF 60"** **"FLAPS 5, REF 40"**	• Select flaps 1 • Set command airspeed cursor to V_{REF} 30 + 60, if requested • Select flaps 5 • Set command airspeed cursor to V_{REF} 30 + 40, if requested
2-1/2 miles from FAF	**"GEAR DOWN, FLAPS 20, REF 20, LANDING CHECKLIST"**	• Position gear lever DOWN • Select flaps 20 • Set command airspeed cursor to VREF 30 + 20, if requested • Initiate Landing Checklist
½ mile prior to FAF	**"FLAPS 30, REF 5"** • Set/Request MDA or MDA Buffer Altitude	• Select flaps 30 • Set command airspeed cursor to VREF 30 + 5, if requested • Set altitude, if requested

APPENDIX 9 (continued)

At FAF	•• Start timing, if appropriate Select/Request V/S	• Set V/S, if requested • Monitor descent
At 1,000' AFE	• Verify altitude • Stabilized approach	**"1,000 ft."**
	PF	PM
At 100' above MDA (or MDA buffer altitude)	• Verify altitude	**"100 ABOVE"** • Divide time between monitoring instruments and scanning outside for runway environment
AT MDA (or MDA buffer)	**"SET MISSED APPROACH ALTITUDE"** • Execute missed approach	**"MINIMUMS"** • Set missed approach altitude
(Runway environment IS in sight)	•• Call out appropriate visual cues **"LANDING"** •• See landing procedure	**"RUNWAY IN SIGHT"** • Monitor speed and sink rate
—or— *(Runway environment NOT in sight or a safe landing is NOT possible)*	**"GO-AROUND"** •• See go-around procedure	**"MISSED APPROACH POINT, NO CONTACT"**

APPENDIX 10

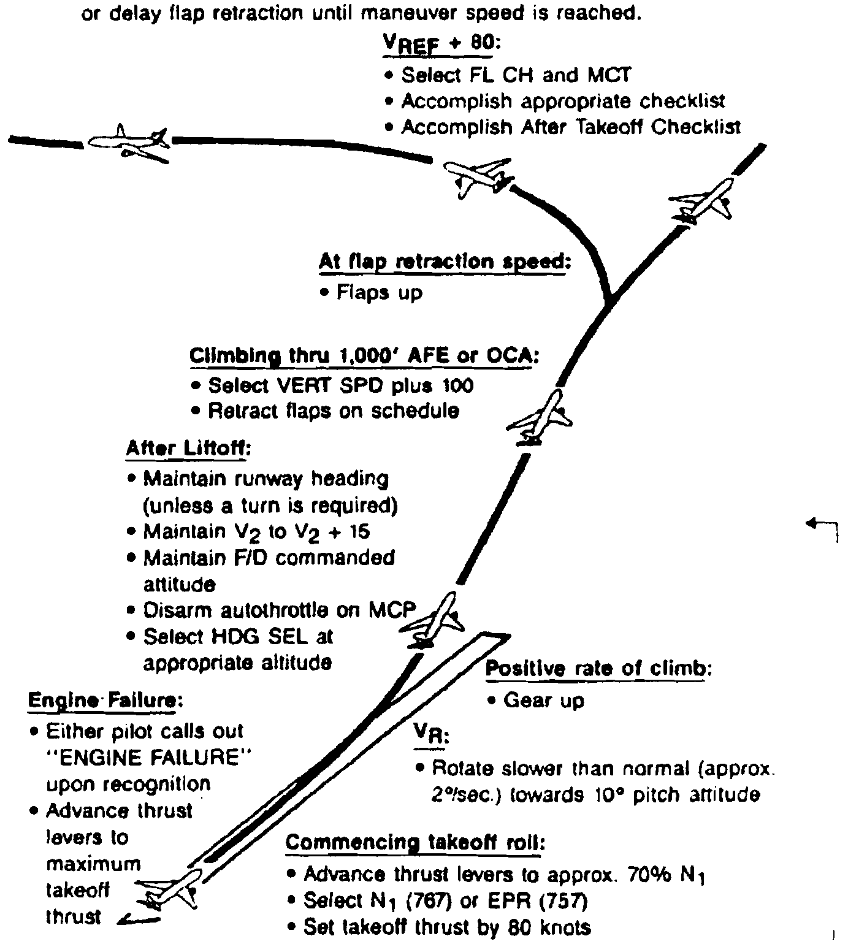
(example)

ENGINE FAILURE AT or ABOVE V1 – PROFILE

ENGINE FAILURE AT OR ABOVE V_1 PROFILE

FLAP/SPEED SCHEDULE				
	Flap Setting for Takeoff			
	20	15	5	1
Select flaps 5 at	V_{REF} + 20	V_{REF} + 20		
Select flaps 1 at	V_{REF} + 40	V_{REF} + 40	V_{REF} + 40	
Select flaps 0 at	V_{REF} + 60	V_{REF} + 60	V_{REF} + 60	V_{REF} + 60
Final Segment Climb	V_{REF} + 80			

NOTE: After takeoff (and accelerating), the next lower flap setting may be made 20 knots prior to the maneuver speed for the flap settings as shown in the table above. In the event of a turn during flap retraction, limit bank angle to 15° or delay flap retraction until maneuver speed is reached.



APPENDIX 11

(example)

ENGINE FAILURE AT or ABOVE V_1 – ACTIONS and CALLOUTS

Callouts: in "**BOLD TEXT**" – **Actions:** with bullets (•) in plain text		
	PF	PM
Engine Failure	•• Pilot first noting Engine Failure **"ENGINE FAILURE"**	
	"SET MAX POWER"	• Advance thrust levers to maximum takeoff thrust **"POWER SET"**
V_R	• Rotate towards 10° pitch attitude	**"ROTATE"**
Positive rate of climb	• Verify positive rate of climb **"GEAR UP"**	**"POSITIVE RATE"** • Position gear lever UP
After lift-off	• Maintain F/D commanded attitude **"ADVISE ATC,"** when appropriate	• Monitor speed and attitude • Advise ATC
	•• Comply with airport specific "Engine Failure After Takeoff" procedure (if published); otherwise, fly runway heading	
	"HEADING SELECT"	• Select HDG SEL • Verify HDG SEL annunciates • Position A/T arm switch OFF

APPENDIX 11 (continued)

ENGINE FAILURE AT or ABOVE V_1 – ACTIONS and CALLOUTS

Callouts: in "**BOLD TEXT**" – **Actions:** with bullets (•) in plain text		
Climbing through 1,000' AFE or obstruction clearance altitude (OCA), whichever is higher	**PF** **"VERTICAL SPEED PLUS 100"** • Reduce pitch and accelerate **"FLAPS_____"** (Retract flaps on flap retraction speed schedule)	**PM** • Select VERT SPD to +100 FPM • Select proper flap setting, when requested
At flap retraction speed	**"FLAPS UP"**	• Retract flaps
At V_{REF} 30 + 80	**"FLIGHT LEVEL CHANGE, MAXIMUM CONTINUOUS THRUST, ENGINE _______ CHECKLIST, AFTER TAKEOFF CHECKLIST"**	• Select FL CH • Press CON on TMSP • Set MCT **"POWER SET"** • Accomplish appropriate checklist **"ENGINE ________ CHECKLIST COMPLETE"** • Accomplish After Takeoff Checklist

APPENDIX 12

(example)

WINDSHEAR – TAKEOFF WHILE on the RUNWAY – RECOVERY TECHNIQUE

Takeoff While on The Runway
Recovery Technique

- THRUST
- Apply thrust aggressively (Firewall Power)
- PITCH
- Push go-around switch
- Rotate toward 15° no later than 2,000 ft. remaining
- Increase beyond 15° if required to lift off
- Follow flight director commands

Note: After lift-off, follow After Lift-off Recovery Technique

After Lift-off/On Approach Windshear
Recovery Technique

- THRUST
- Apply thrust aggressively (Firewall Power)
- PITCH
- Push either go-around switch
- Adjust toward 15°
- Follow flight director commands
- Increase beyond 15° if required to ensure
acceptable flight path
- Always respect stickshaker
- CONFIGURATION
- Maintain existing configuration

Note: With a WINDSHEAR warning, if normal commands do not result in a substantial rate of climb, the AFDS smoothly transitions to a 15° pitch attitude or slightly below the pitch limit indicator, whichever is less.

APPENDIX 13

(example)

GROUND PROXIMITY WARNINGS

Refer to the FOM for Ground Proximity Warning System general procedures. See Chapter 13 (in this handbook) for the system description.

BELOW GLIDESLOPE ALERT
If a GLIDESLOPE alert is activated between the altitudes of 1,000' and 150' AGL, application of power sufficient to bring the airplane back up toward the glideslope beam center will cancel the alert when it is less than 1.3 dots below the glideslope. The allowable deviation increases to 2.7 dots at 50' AGL. This deviation causes an offscale deflection on the glideslope deviation scale.

GPWS WARNING ESCAPE MANEUVER

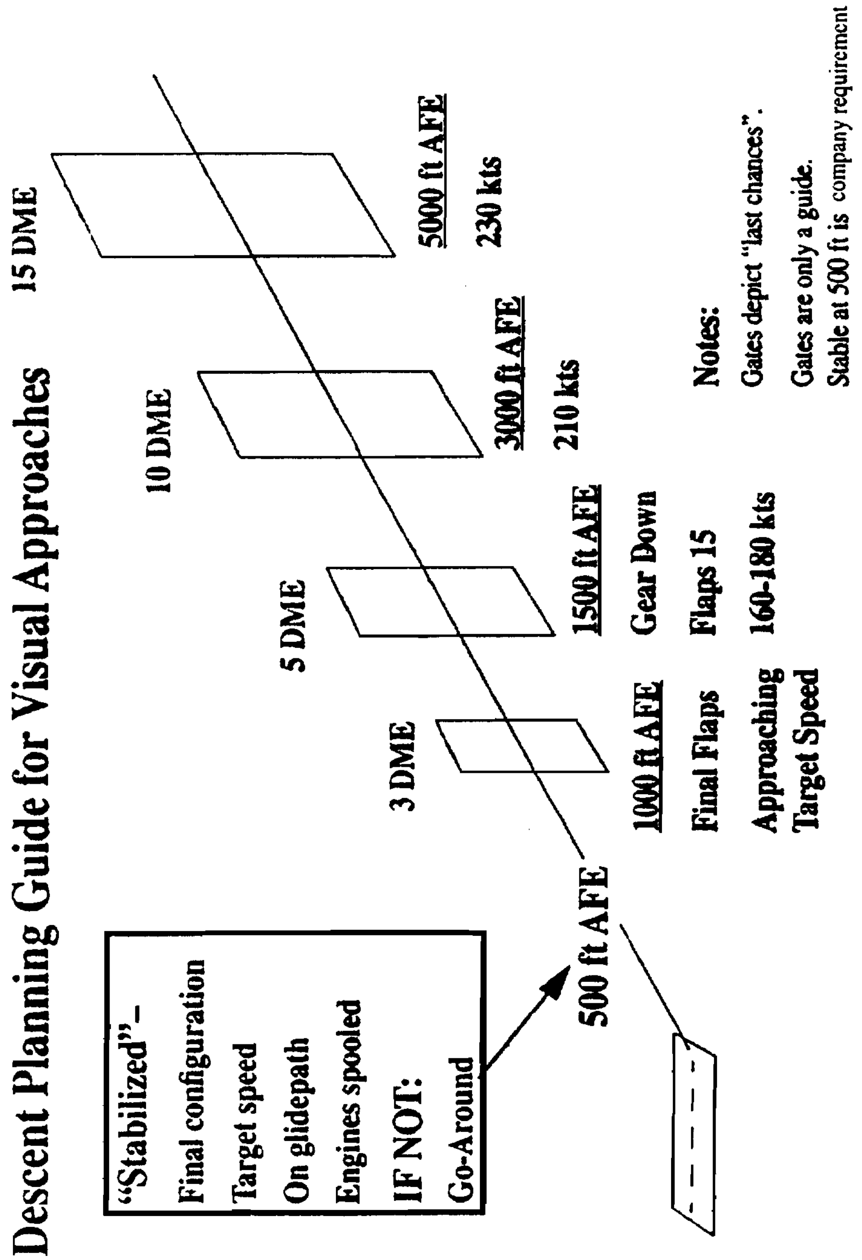
If a GPWS "PULL UP" warning or "TERRAIN" alert occurs at night or in IMC, perform the following maneuver entirely from memory:

Callouts: in **"BOLD TEXT"** -- **Actions:** with bullets (•) in plain text		
Step	PF	PM
1	**Thrust** • Auto throttles – disconnect • **"FIREWALL POWER,"** set firewall thrust **Pitch** • Autopilot – disconnect • Roll wings level • Rotate (3°/sec) to 20° pitch attitude. If GPWS warning continues – increase pitch (respect stickshaker/buffet)	• Verify all actions have been completed and call out any omissions • Monitor radio altimeter, and call out information on flight path (e.g., **"300 FEET DESCENDING; 400 FEET CLIMBING,"** etc.)
2	**Configuration** • Speedbrakes – retract • Do not alter gear/flap configuration	• Call out safe altitude (e.g., **"MSA IS 3,400 FEET"**) • Advise ATC
3	• Climb to safe altitude	
4	• Resume normal flight. Retract flaps on flap retraction speed schedule.	

APPENDIX 14

(example)

DESCENT PLANNING GUIDE for VISUAL APPROACHES



APPENDIX 15

(example)

DESCENT PLANNING for VISUAL APPROACHES

DESCENT PLANNING for VISUAL APPROACHES

At each airport, ATC has established descent profiles to vector aircraft to intercept an instrument approach. However, pilots are cleared for visual approaches with the descent profile at the discretion of the pilot. If the pilot's descent profile does not result in a stabilized visual approach by 500' AFE, then a missed approach must be executed (FOM page 5-37).

Visual approaches can be difficult. The wide range of variables, such as position and altitude when cleared for the approach, the lack of glideslope information, and establishing separation from a variety of visual traffic all contribute to the complexity. The secret to flying a good visual approach is accurate descent planning. This requires analysis at sequential points during the descent/approach, and making corrections to altitude and airspeed.

The Descent Planning Guide provides suggested reference points or "gates" to assist in analyzing the descent to arrive at 500' AFE in a stabilized condition. As you progress through these "gates," it is important that any deviations be corrected immediately to arrive at the next "gate" within the parameters. The longer the delay in making a correction, the greater the chance of arriving at 500' AFE in an unstabilized condition.

During the early stages of the descent, corrections to altitude and/or airspeed can usually be done using speedbrakes. If in the latter stages of the descent/approach, or if speedbrakes are not effective in correcting to the desired airspeed/altitude, consider extending the landing gear to assist in increasing rate of descent and/or deceleration. Extending flaps and slats to increase deceleration or descent rate is not as effective as the use of speedbrakes and gear extension.

Utilizing the FMC to reference the landing runway is an excellent technique for a visual approach. This will easily establish a DME reference to the landing runway for the targeted "gates." The key to a successful visual approach is to plan and make corrections early.

APPENDIX 16

(example)

PRELIGHT

Preflight
Preflight (Page 1 of 2)

CAPTAIN	FIRST OFFICER
The first pilot on the flight deck will determine the aircraft maintenance status prior to actuating switches and controls.	
Brief the lead flight attendant (see FOM, chapter 9). Accomplish the captain's preflight. After fueling is complete, verify that the fuel load on board meets the requirements of the dispatch release and is adequate for the route of flight.	Accomplish the exterior preflight. Accomplish the first officer's preflight. Record the current ATIS information. **Note:** The captain may accomplish this step if it will expedite the departure process. When the fuel slip becomes available, review it for any discrepancies, and perform the reasonableness check (see FOM, chapter 5). Verify that the fuel on board meets the requirements of the dispatch release and the flight plan. Check the ECAM FUEL page to verify the total fuel load and the proper distribution.
Obtain and print the ATC clearance using ACARS Predeparture Clearance (PDC) procedures. If ACARS PDC is not available, obtain the ATC clearance using voice procedures at a time convenient to both crewmembers. The captain may ask the first officer to call for the clearance or the first officer may initiate the call after ensuring the captain is prepared to listen as the clearance is received. The captain will monitor the clearance as it is copied by the first officer.	
Verify that the proper clearance altitude and transponder code are set. Ensure that the cleared route is the active FMGC route, or modify as required.	Set the clearance altitude in the FCU ALT window. Set the transponder code. Verify that the cleared route is the active FMGC route.

APPENDIX 16 (continued)

(example)

PREFLIGHT

Preflight (Page 2 of 2)

CAPTAIN	FIRST OFFICER
Set the required navigation frequencies and courses for the departure. If required, use the RAD NAV page to modify the frequencies and courses. Caution: Frequencies and courses set by the pilot must be cleared when no longer required. Review the preliminary MGL (see FOM, chapter 8). This will enable the crew to plan the anticipated runway, flap setting, and FLEX capability.	
At a convenient time prior to engine start, give a pilot briefing to ensure an understanding by both pilots as to the conduct of the flight (see FOM, chapter 9).	
♦ Call for the PREFLIGHT CHECK. Verify, as appropriate, and respond to the PREFLIGHT CHECK.	
	Read, verify as appropriate, and respond to the PREFLIGHT CHECK. Announce "PREFLIGHT CHECK COMPLETE." If the takeoff weight data becomes available prior to engine start, complete the initialization on INIT page B. Insert ZFW and BLOCK FUEL.

APPENDIX 17

(example)

CREW BRIEFINGS

Pilot Briefing

The purpose of the pilot briefing is to enhance communications on the flight deck and to promote effective teamwork. Each crewmember is expected to perform as an integral part of the team. The briefing should establish a mutual understanding of the specific factors appropriate for the flight.

A pilot briefing will be given prior to starting engines for the first flight of the day (subsequent flight, if applicable). The captain determines the length and detail of the briefing. Factors to consider include:

- Experience level of the pilots
- Special MEL procedures as a result of inoperative components
- Altimeter setting units
- Use of delayed engine start and/or engine out taxi procedures
- Presence of armed passengers, when applicable

When personnel occupy the extra crew seat(s), ensure they understand the use of oxygen/interphone operations and emergency exits, and sterile flight deck procedures.

Takeoff Briefing

A Takeoff Briefing will be given prior to takeoff. Factors to consider include:

- Takeoff weather conditions
- Runway surface conditions
- NOTAMS
- Departure review
- Obstructions and high terrain
- Closeout weight and balance message/takeoff numbers
- Critical conditions affecting the GO/NO GO decision (e.g., gross weight limited takeoff, wet or slippery runway, crosswind, aircraft malfunctions)
- Birdstrike potential, if applicable

APPENDIX 17 (continued)

(example)

CREW BRIEFINGS

Flight Attendant Briefing

The purpose of the flight attendant briefing is to develop a team concept between the flight deck and cabin crew. An ideal developed team must share knowledge relating to flight operations, review individual responsibilities, share personal concerns, and have a clear understanding of expectations.

Upon flight origination or whenever a crew change occurs, the captain will conduct a verbal briefing, preferably with all the flight attendants. However, preflight duties, passenger boarding, rescheduling, etc. may make it impractical to brief the entire flight attendant complement. Regardless of time constraints, company policy is that the captain must brief the lead flight attendant. The briefing will be supplemented with a completed Flight Attendant Briefing Form.

The briefing should cover the following items:

- Logbook discrepancies that may affect flight attendant responsibilities or passenger comfort (e.g., coffee maker inop, broken seat backs, manual pressurization, etc.)
- Weather affecting the flight (e.g., turbulence – including appropriate code levels, thunderstorms, weather near minimums, etc.). Provide the time when the weather may be encountered rather than a distance or location (e.g., "Code 4 Turbulence can be expected approximately one hour after takeoff.")
- Delays, unusual operations, non-routine operations (e.g., maintenance delays, ATC delays, re-routes, etc.)
- Shorter than normal taxi time or flight time which may affect preflight announcements or cabin service.
- Any other items that may affect the flight operation or in-flight service such as catering, fuel stops, armed guards, etc.
- A review of the sterile flight deck policy, responsibility for PA announcements when the Fasten Seat Belt sign is turned on during cruise, emergency evacuation commands, or any other items appropriate to the flight.
- During the briefing, the captain should solicit feedback for operational concerns (e.g., does each person understand the operation of the emergency exits and equipment). The captain should also solicit feedback for information which may affect expected team roles. Empower each crewmember to take a leadership role in ensuring all crewmembers are made aware of any potential item that might affect the flight operation.
- The lead flight attendant will inform the captain of any inoperative equipment and the number of flight attendants on board.
- The captain will inform the lead flight attendant when there are significant changes to the operation of the flight after the briefing has been conducted.

Appendix 18

(MD-80 example)

Landing Rollout – Actions and Callouts

Callouts: shown in "BOLD TEXT" – Actions: shown with bullets	
PF	**PM**
• Moves throttles to Idle	• Observes Spoiler Lever moves aft to EXT position. • If spoiler lever does not move aft to EXT position, PM calls, "**NO SPOILERS**" and moves lever to full extend position and up to latched position.
• Deploys Thrust Reversers • Maintains directional control and initiates braking as required	• Monitors Thrust Reverser Deployment • Advises PF of thrust reverser status • Advises PF if 1.6 EPR is exceeded on dry runway or 1.3 EPR is exceeded on a wet or contaminated runway. (Suggested EPR limits may be exceeded in the event of an emergency)
	• Monitors airspeed and announces, "**80 KNOTS**"
• Reduces reverse thrust to achieve idle reverse thrust by 60 knots.	
If First Officer is PF, a positive transfer of controls shall occur during landing roll-out in accordance with company procedures	
• Clearing runway, retracts spoilers and announces, "**FLAPS UP, AFTER LANDING CHECKLIST**"	• Confirms retraction of ground spoilers and selects flaps to 0/RET position.

Appendix 19

(examples)

Crew Monitoring And Cross-Checking

Background

Several studies of crew performance, incidents and accidents have identified inadequate flight crew monitoring and cross-checking as a problem for aviation safety. Therefore, to ensure the highest levels of safety each flight crewmember must carefully monitor the aircraft's flight path and systems and actively cross-check the actions of other crew members. Effective monitoring and cross-checking can be the last barrier or line of defense against accidents because detecting an error or unsafe situation may break the chain of events leading to an accident. Conversely, when this layer of defense is absent, errors and unsafe situations may go undetected, leading to adverse safety consequences. It is difficult for humans to monitor for errors on a continuous basis when these errors rarely occur. Monitoring during high workload periods is important since these periods present situations in rapid flux and because high workload increases vulnerability to error. However, studies show that poor monitoring performance can be present during low workload periods, as well. Lapses in monitoring performance during lower workload periods is often associated with boredom and/or complacency.

Crew monitoring performance can be significantly improved by developing and implementing effective SOPs to support monitoring and cross-checking functions, by training crews on monitoring strategies, and by pilots following those SOPs and strategies. This Appendix focuses on the first of these components, developing and implementing SOPs to improve monitoring.

A fundamental concept of improving monitoring is realizing that many crew errors occur when one or more pilots are off-frequency or doing heads-down work, such as programming a Flight Management System (FMS). The example SOPs below are designed to optimize monitoring by ensuring that both pilots are "in the loop" and attentive during those flight phases where weaknesses in monitoring can have significant safety implications.

Review and modification of existing SOPs

Some SOPs may actually detract from healthy monitoring. Operators should review existing SOPs and modify those that can detract from monitoring. For example, one air carrier required a PA announcement when climbing and descending through 10,000 feet. This requirement had the unintended effect of "splitting the cockpit" at a time when frequency changes and new altitude clearances were likely. When the air carrier reviewed its procedures it realized that this procedure detracted from having both pilots "in the loop" at a critical point and consequently decided to eliminate it.

Another carrier required a company radio call to operations once the aircraft had landed. A critical review of procedures showed that this requirement, although sometimes necessary, had resulted in runway incursions because the first officer was concentrating on making this radio call and not fully monitoring the captain's taxi progress. The procedure was modified so that crews make this call only when necessary and then only once all active runways are crossed, unless unusual circumstances warrant otherwise (such as extensive holding on the ground.)

In addition to modifying existing SOPs, operators may consider adding sections to the SOP manual to ensure that monitoring is emphasized, such as:

- **High-level SOPs that send an over-arching message that monitoring is a very important part of cockpit duties.**

  Examples:

  A. Change title of "Pilot Not Flying" (PNF) to "Pilot Monitoring" (PM).
  B. The SOP document could explicitly state that monitoring is a primary responsibility of each crewmember.

     Example:

     Monitoring Responsibility

     - The PF will monitor/control the aircraft, regardless of the level of automation employed.
     - The PM will monitor the aircraft and actions of the PF.

  Rational:

  A. Several air carriers have made this change because they feel it is better to describe what that pilot should be doing (monitoring) rather than what he/she is not doing (not flying).
  B. Although some SOP documents do define monitoring responsibilities for the PF, this role is often not explicitly defined for the PNF (PM). In many cases non-monitoring duties, such as company-required paperwork, PA announcements, operating gear and flaps, are clearly spelled-out, but seldom are monitoring duties explicitly defined for each pilot.

- **SOPs to support monitoring during airport surface operations**
  (also refer to AC 120-74)

  Examples:

  A. Both pilots will have taxi charts available. A flight crewmember—other than the pilot taxiing the aircraft—should follow the aircraft's progress on the airport diagram to ensure that the pilot taxiing the aircraft is following the instructions received from ATC.
  B. Both pilots will monitor taxi clearance. Captain will verbalize to FO any hold short instructions. FO will request confirmation from Captain if not received.
  C. When approaching an entrance to an active runway, both pilots will ensure compliance with hold short or crossing clearance before continuing with non-monitoring tasks (e.g.,

FMS programming, Airborne Communications Addressing and Reporting System (ACARS), company radio calls, etc.).

Rational: Pilot-caused runway incursions often involve misunderstanding, not hearing a clearance or spatial disorientation. These SOPs are designed to do several things.

A. The requirement for both pilots to have taxi charts out ensures that the pilot who is not actively taxiing the aircraft can truly back-up the pilot who is taxiing.
B. Requesting that both pilots monitor the taxi clearance and having the captain verbalize any hold short instructions is a method to ensure that all pilots have the same understanding of the intended taxi plan.
C. The requirement to suspend non-monitoring tasks as the aircraft approaches an active runway allows both pilots to monitor and verify that the aircraft stops short of the specified holding point.

- **SOPs to support improved monitoring during vertical segments of flight** (also refer to Appendix 3 of this document, "ATC Communications and Altitude Awareness")

Examples:

A. PF should brief PM when or where delayed climb/descent will begin.
B. Perform non-essential duties/activities during lowest workload periods such as cruise altitude or level flight.
C. When able, brief the anticipated approach prior to top-of-descent.
D. During the last 1,000 feet of altitude change both pilots should focus on the relevant flight instruments to ensure that the aircraft levels at the proper altitude. (When VMC one pilot should include scanning outside for traffic; however, at least one pilot should focus on ensuring that the aircraft levels at the proper altitude.)

Rational: A study on crew monitoring conducted by NASA Aviation Safety Reporting System (ASRS) revealed that three-quarters of the monitoring errors in that study occurred while the aircraft was in a vertical phase of flight, i.e., climbing, descending or approach. These SOP statements ensure that proper attention can be devoted to monitoring during vertical phases of flight.

A. The ASRS monitoring study highlighted that a number of altitude deviations occurred when crews were given an altitude crossing restriction, but then failed to begin the descent in a timely manner. Briefing the anticipated top-of-descent point not only promotes healthy CRM, but also allows the other pilot to "back up" the planned descent point and ensure the descent begins at the proper point. Example: "We'll begin our descent at 80 DME."
B. Studies likewise show that in order to minimize the chance of a monitoring error, crews should schedule performance of non-essential duties/activities during the lowest workload periods, such as cruise altitude or level flight.
C. Briefing the anticipated instrument approach prior to descent from cruise altitude allows greater attention to be devoted to properly monitoring the descent because the crew is

not having to divide attention between reviewing the approach and monitoring the descent. It also allows greater attention to be devoted to the contents of the approach briefing, which can increase situation awareness and understanding of the intended plan for approach and landing.

D. Many altitude deviations occur because pilots are not properly monitoring the level off. This SOP statement is to ensure that pilots concentrate on ensuring the aircraft levels at the proper altitude, instead of being distracted by or performing non-monitoring tasks.

- **SOPs to support improved monitoring of automation**

Examples:

A. Before flight, the routing listed on the flight release must be cross-checked against the ATC clearance and the FMS routing.

B. When making autoflight systems inputs, comply with the following items in the acronym CAMI:
C onfirm FMS inputs with the other pilot when airborne
A ctivate the input
M onitor mode annunciations to ensure the autoflight system performs as desired
I ntervene if necessary.

C. During high workload periods FMS inputs will be made by the PM, upon the request of PF. Examples of high workload include when flying below 10,000 feet and when within 1000 feet of level off or Transition Altitude.

D. Pilots should include scanning of the Flight Mode Annunciator as part of their normal instrument scan, especially when automation changes occur (e.g., course changes, altitude level off, etc.).

Rational:

A. It is not unusual for the routing that is loaded in the FMS to be different from the routing assigned by ATC, especially in those cases where the flight plan is uplinked directly into the FMS, or when an FMS stored company route is used. Various studies have demonstrated that FMS programming errors made during preflight are not likely to be caught by flightcrews during flight. Therefore it is critical that these items be cross-checked before takeoff.

B. The above-mentioned ASRS monitoring study found that 30 percent of the monitoring errors in that study's dataset occurred when a crewmember was programming a Flight Management System (FMS). Another NASA-funded study showed that even experienced pilots of highly automated aircraft sometime fail to adequately check the Flight Mode Annunciator to verify automation mode status. The acronym "CAMI" can be used to help emphasize cross-checking of automation inputs, monitoring and mode awareness.

C. The statement concerning FMS inputs during high workload allows the PF to concentrate on flying and monitoring by simply commanding FMS inputs during highly vulnerable times. Several ASRS reports indicate problems with failure to level-off and failure to reset altimeters to proper settings. Therefore, the definition of "high workload" should include those vulnerable phases.

D. Automated flight guidance systems can have mode reversions and can sometimes command actions that are not anticipated by pilots. Therefore, pilots should include the Flight Mode Annunciator into their normal instrument scan. Special attention should be given to periods of course changes, altitude level off, etc.)