EAC No. 00_12

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Standard Operating Procedures For Flight Deck Crewmembers

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 their flight deck crewmembers.
   (c) The term pilot not flying(PNF) 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. SCOPE. Appendix 1 consolidates many topics viewed by operators and by the ECAA 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 certificate holders authorized to conduct operations under part 121.

3. RELATED REGULATIONS.   Part 121, sections 121.133, 121.141, 121.401; and EAC0011

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

5. 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."

6. 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, flight crews too easily become participants in an undesirable double standard condoned by instructors, check airmen, and managers. Flight crews may end up doing things one way to satisfy training requirements and check rides, 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.

7. 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.

8. COLLABORATING FOR EFFECTIVE SOPs.

(a) In general, effective SOPs are the product of healthy collaboration among managers and flight operations people, including flight crews. A safety culture promoting continuous feedback from flight crews 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 ECAA. It is especially important for a new operator to maintain a periodic review process that includes line flight crews. Together, managers and flight crews 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, . 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, to ensure that SOPs they develop or adapt for a new airplane are in fact effective for that aircraft, and are not inappropriate carryovers.

9. 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 flight crew. 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 flight crews. Once developed, effective SOPs should be continually reviewed and renewed.

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 ECAA 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 flight crew 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 ECAA Example: Where the ECAA 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 flight crew'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, 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-a rounds
• 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
    Jump seat

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/power back
• 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
    Flight crew
• 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)
  - Speed brakes: Yes/No
  - Flaps/gear use
  - Icing considerations
  - Convective activity
- Ground proximity warning system (GPWS or TAWs)
  - Escape maneuver
- TCAS
- Winds hear
  - 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-a rounds: 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 "Over boost" 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 correct1 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 corrections2 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.

When no vertical guidance is provided: Vertical guidance may be provided to the pilot by way of an electronic glide slope, 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 flight crew 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 flight crew 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 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.

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 alerter 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 VREF 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

Go-around   PF   PM
"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"

• Position gear lever UP
• Advise ATC
        •• Execute airport specific "Engine Failure Missed Approach," published missed approach, or proceed as instructed by ATC, as appropriate
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 VREF 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

APPENDIX 7
(Example)
SINGLE ENGINE ILS APPROACH -- ACTIONS and CALLOUTS

Callouts: shown in "BOLD TEXT" -- Actions: shown with bullets (•) in plain text

Initial Approach   PF   PM
"FLAPS 1, REF 60"

"FLAPS 5, REF 40"
• Select flaps 1
• Set command airspeed cursor to VREF 30 + 60

• Select flaps 5
• Set command airspeed cursor to VREF 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, VREF 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

APPENDIX 9
(Example)
LNAV, LOC, or LOC B/CRS APPROACH -- ACTIONS and CALLOUTS

Callouts: in "BOLD TEXT" -- Actions: with bullets (•) in plain text

Initial Approach   PF   PM
"FLAPS 1 REF 60"

"FLAPS 5, REF 40"
• Select flaps 1
• Set command airspeed cursor to VREF 30 + 60, if requested

• Select flaps 5
• Set command airspeed cursor to VREF 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
1/2 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
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."

At 100' above MDA (or MDA buffer altitude)   PF   PM

• 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" "RUNWAY IN SIGHT"

• Monitor speed and sink rate
•• See landing procedure
-or-
(Runway environment NOT in sight or a safe landing is NOT possible)

"GO-AROUND"   "MISSED APPROACH POINT, NO CONTACT"
•• See go-around procedure

<h3 style="text-align:center">APPENDIX 10
(Example)
ENGINE FAILURE AT or ABOVE V1 -- PROFILE</h3>

<h3 style="text-align:center">APPENDIX 11
(Example)
ENGINE FAILURE AT or ABOVE V1 -- ACTIONS and CALLOUTS</h3>

Callouts: in "BOLD TEXT" -- Actions: with bullets (•) in plain text

Engine Failure PF   PM
•• Pilot first noting Engine Failure
"ENGINE FAILURE"
"SET MAX POWER"
• Advance thrust levers to maximum takeoff thrust
"POWER SET"
VR
• 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
Climbing through 1,000' AFE or obstruction clearance altitude (OCA), whichever is higher
        "VERTICAL SPEED PLUS 100"

• Reduce pitch and accelerate
"FLAPS_____"
(Retract flaps on flap retraction speed schedule)
• Select VERT SPD to +100 FPM

• Select proper flap setting, when requested
At flap retraction speed   "FLAPS UP"
• Retract flaps
At VREF 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 Winds hear 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 stick shaker
• 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 glide slope beam center will cancel the alert when it is less than 1.3 dots below the glide slope. The allowable deviation increases to 2.7 dots at 50' AGL. This deviation causes an off scale deflection on the glide slope 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 stick shaker/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
• Speed brakes - 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

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.

Visual approaches can be difficult. The wide range of variables, such as position and altitude when cleared for the approach, the lack of glide slope 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 speed brakes. If in the latter stages of the descent/approach, or if speed brakes 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 speed brakes 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

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 cabin crew.
Accomplish the captain's preflight.

After fueling is complete, verify that the fuel load on board meets the requirements of the dispatch release and are 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. 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 the ATC clearance 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.
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. 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.
• 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)
• Bird strike potential, if applicable
Cabin crew Briefing

The purpose of the Cabin crew 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 cabin crew. However, preflight duties, passenger boarding, rescheduling, etc. may make it impractical to brief the entire cabin crew complement. Regardless of time constraints, company policy is that the captain must brief the lead cabin crew. The briefing will be supplemented with a completed cabin crew Briefing Form.

The briefing should cover the following items:
• Logbook discrepancies that may affect cabin crew 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 cabin crew will inform the captain of any inoperative equipment and the number of cabin crew on board.
• The captain will inform the lead cabin crew 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 are 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.

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 verbalizes 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 does not have 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 auto flight systems inputs, comply with the following items in the acronym CAMI:

Confirm FMS inputs with the other pilot when airborne

Activate the input

Monitor mode annunciations to ensure the auto flight system performs as desired

Intervene 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 flight crews 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.)