U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Standard Operating Procedures and Pilot Monitoring Duties for Flight Deck Crewmembers

Date: 1/10/17
Initiated by: AFS-200

AC No: 120-71B
Change:

This advisory circular (AC) provides guidance for the design, development, implementation, evaluation, and updating of standard operating procedures (SOP), and for pilot monitoring (PM) duties. SOPs are universally recognized as fundamental to safe aviation operations. Their importance cannot be overstated, especially in light of the advent of PM standards with respect to the use of increasingly modernized automated systems. This AC provides a process for developing procedures that meet clear and specific requirements. Safe operations are founded on comprehensive SOPs made readily available within the manuals used by flight deck crewmembers. This AC also provides guidance on the definition and the training of PM duties and their integration into SOPs. Although this AC is directed towards Title 14 of the Code of Federal Regulations (14 CFR) part 121 and part 135 air carriers, the Federal Aviation Administration (FAA) encourages all air carriers, aircraft operators, pilot schools, and training centers to utilize this guidance.

John Barbagallo
Deputy Director, Flight Standards Service

CHAPTER 5. DEVELOPING CHECKLISTS

5.1 General. Checklists are a special type of procedure. They are often the form into which extended procedures are distilled, and often the most common and most frequent form through which people interact with formal procedures. On the flight deck, checklists are an important tool in making sure that operational tasks are performed in a standardized fashion.

Checklists are of no value if the flightcrew is not committed to their use. Without discipline and dedication to using the checklist at the appropriate times, errors will inevitably occur.

Although it may be published in a manual, a checklist is designed for independent use so that the user will seldom need to reference that manual, especially after having been previously trained on the content therein. Checklists are used to ensure that a particular series of specified actions are accomplished in the correct sequence and to verify that the correct aircraft configuration has been established in specified phases of flight.

Checklists have been a significant part of the foundation of pilot standardization and flight deck safety for years. Such procedures, when applied in a disciplined and standardized fashion, are intended to support human performance regardless of circumstance. The checklist is an aid to the memory and helps to ensure that critical items necessary for the safe operation of aircraft are not overlooked or forgotten.

Checklists must be easy to access, easy to read, and easy to use. Checklists should provide enough information to enable the flightcrew to verify it is the correct checklist before they begin using it. Instructions should be concise, but sufficient information must be provided so that actions are performed correctly and essential issues are considered. The checklist must accommodate the demands of high-workload phases of flight and the performance limitations experienced by humans when under stress. It should respond to the specifics of the situation but also assist crews in their management of the overall task.

5.1.1 Consistency. Operators should standardize checklist items and the sequence of those items to the maximum extent practicable, given possible make, model, and series (M/M/S) and variant differences across the fleet.

5.1.2 Type of List and Manner of Execution. For most normal procedures on the flight deck, a "flow" is conducted as a sequence of actions done from memory to configure the aircraft and its systems. The flow is followed by a checklist containing a subset of items from the flow that may be the most critical items within that flow and items that confirm the flow was done correctly.

5.1.3 Timing. Given the criticality of the checklist procedure, the crew's ability to pay full attention to its execution is crucial. The timing of the checklist must be such that it would minimize the distractions and concurrent tasks. Timing of checklists should be designed not to interfere with other tasks and be resistant to interruption. For example, a "Taxi Checklist" that is to be accomplished during taxi might appear as an efficient use of crew

time, but it creates a high-risk situation because the crew cannot pay full attention to both the taxi and the checklist.

5.1.4 Roles. The role of providing the right cue at the right time for initiating the checklist is always assigned to one of the two pilots; usually, the pilot in command (PIC) on the ground and the PF in the air. Typically, the cue comes in the form of a verbal call (e.g., "before start checklist"), and serves to prompt the other pilot to retrieve the checklist. Assuming a checklist for normal operation involves both crewmembers in a challenge-response method, both pilots would then be expected to direct their attention to the checklist task. The pilot responsible for leading the checklist begins by calling out (or "challenging") the first item on the list. The other pilot verifies that the item has been done correctly and provides the relevant response. There are several variations on the theme of the challenge-response method: Following the response of the responding pilot, the challenging pilot may go on to challenge the next item, may also verify the state of the item, and may or may not provide a verbal response. The verification may or may not involve specific gestures such as pointing to the relevant switch, lever, or indication.

5.1.5 Initiation Anchor. The initiation of a checklist is best anchored in a clear cue that cannot be easily removed, obstructed, or forgotten, such as the occurrence of a particular event (e.g., arrival at a point 2,000 feet prior to the hold-short line cues the initiation of the Before Takeoff checklist). Often, initiation of a checklist is left open, only constrained by a time window (e.g., Taxi checklist to be completed anytime during taxi) and acceptable circumstances (e.g., when both pilots are free of other duties). Cues for initiating checklists in these situations are often more of a personal technique among pilots, who use internal as well as external flight deck cues to aid them in remembering to initiate the checklist at the correct time. However, such "floating" checklist initiations create a high risk of failing to initiate the checklist on time and thus having to rush through it, or failing to initiate the checklist altogether. The importance of having clear and reliable external cues to trigger the initiation of the checklist procedure at the right pause point cannot be overemphasized.

5.1.6 Completion Signal. The checklist completion signal indicates that the checklist has indeed been performed in its entirety and leads into the next segment of activities. The most common completion cue is a verbal annunciation such as the "Before Taxi checklist complete" by the pilot who has been responsible for leading the respective checklist. The completion call should be written out as the last line item, or centered under each checklist. When the completion call is not explicitly listed on the checklist, a layer of redundancy is removed and the risk of omissions increases.

5.1.7 Checklist Verification. During the design of the checklist it is important to keep in mind that all checklist designs are subject to human error. Crewmembers may omit and skip checklist items or erroneously respond to a checklist at times believing that an item or a task was accomplished when it was not. At other times, crewmembers may see what they expect to see rather than what is actually accomplished or indicated.

One strategy that helps to overcome human error is to develop policies for using checklists which require stringent cross-checking and verification and reinforce those

policies through crew training programs. The procedures intended for checklist use should be clearly written in the operator's operating manual and must be compatible with the operator's CRM philosophy.

The policy should include, but not be limited to, the following items:

1. Flightcrew responsibilities for maintaining aircraft control, analyzing situations, and requesting the appropriate checklist in normal, abnormal, non-normal, and emergency situations.
2. The specified crewmember responsible for initiating each checklist.
3. The specified time when each checklist is to be initiated.
4. The specified crewmember responsible for accomplishing each item on the checklist.
5. The specified crewmember responsible for ensuring that each checklist is completed and reporting that completion to the crew.
6. Crewmember responsibilities for bringing to the attention of the PIC and the rest of the crew any observed deviation from prescribed procedures.

5.2 Methods for Managing Checklist Accomplishment.

5.2.1 Single-Pilot Aircraft. For single-pilot aircraft, operators should mount the Before-Takeoff and the Before-Landing checklists on the instrument panel. When aircraft characteristics allow, the operator should develop touch-verification procedures which include a requirement that the pilot touch each control to verify it is in the correct position.

5.2.2 Multi-Pilot Aircraft.

5.2.2.1 Flight-Related Checklists. Flight-related checklists should be accomplished by one crewmember reading the checklist and the second crewmember confirming and responding to each item, as appropriate. Exceptions to this may be the After-Takeoff and After-Landing checklists. While airborne the PF should not be distracted from controlling the aircraft flightpath to perform a checklist item that another crewmember can accomplish. Only one pilot should be in a head-down posture at any time the aircraft is in motion.

5.2.2.2 Verification. Crewmembers should be directed that when they observe that another crewmember is not taking or has not taken a required action, they are required to inform the crewmember.

5.2.2.3 Checklist Completion Tracking. The crewmember responsible for initiating the checklist should be responsible for ensuring that the checklist is completed systematically and expeditiously. This crewmember should be responsible for managing interruptions, cross-checking controls and indicators to ensure that the required actions have been accomplished, and reporting that the checklist has been completed.

5.2.2.4 Callouts. A callout should be made by the pilot if he or she is accomplishing a task that requires him or her to be "heads down." This helps ensure the other pilot is not heads down at the same time.

5.2.2.5 Critical Items. Critical items should be verified by both the PF and PM.

1. In the before-start phase, flight guidance and navigation items are considered critical items. Concurrence should be required from both pilots when the same setting is required for more than one device (such as computers, flight instruments, and altimeters). Inertial platform alignment and computer programming should be accomplished by one crewmember and independently confirmed by another. As many of these checklist items as possible should be accomplished and verified before the aircraft is moved.
2. In the taxi and pre-takeoff phases, aircraft configuration (such as flaps, trim, and speed brakes) and flight guidance items (such as heading, flight-director, altitude select panel settings, and airspeed cues) are also critical items. Consideration must be given to non-standard operations such as deicing which may result in configuration changes from what was previously set.
3. On approach, flight guidance checklist items are critical. The PF and PM should be required to confirm and respond to these items when incorporated in a checklist. Concurrence should be required when the same setting is required on two separate devices (such as computers, flight instruments, or altimeters).
4. Checklist items that are critical in the before-landing phase vary with the type aircraft involved. The landing gear and flaps are critical items and should require a confirmation and response by both pilots when incorporated in a checklist.
5. A checklist should not be depended upon to initiate a change in aircraft configuration. Operators should key aircraft configuration changes to specific operational events (e.g., direct the landing gear to be extended at glide slope intercept). For any change in configuration, a command from the PF and an acknowledgment from the crewmember taking the action should be required.

5.2.3 Interruptions. Crewmembers frequently cannot complete a checklist because of interruption or an item on the checklist has not yet been accomplished. Operating procedures must be established to ensure that the correct checklist sequence is completed after an interruption. If the sequence cannot be re-established or the crew is unclear on where to resume the checklist, the appropriate section of the checklist should be reaccomplished from the beginning.

5.2.4 Representative Items. Representative items are selected items that represent a whole subset of flow actions such that if the selected item was performed, the whole subset must have also been performed. For instance, if all engine indications are in the green, the whole engine start sequence must have been done correctly; therefore, checking the engine indications can serve as a representative item for the engine start sequence.

5.3 Item Order. The order of the items on the checklist can mirror the sequence of the flow or of the operation if the flow preceding the checklist is carefully designed to:

- Take advantage of the physical layout and location of switches, displays, and indicators in the flight deck (e.g., going from left to right, or from top to bottom);
- Account for the inherent dependencies between the systems involved;
- Support human memory; and
- Be short.

Such order aids in learning and increases ease of use. Another possible ordering consideration is item priority. The probability of interruptions and distractions increases with checklist length and the time it takes to execute it. Thus, even though checklists mainly contain critical items, these could be prioritized, and those with higher importance could be placed first on the checklist.

5.4 Phraseology. The challenge portion of a checklist item is best phrased to mirror the label used in the flight deck for the corresponding switch, lever, indicator, or system. The response portion is best phrased in terms of the actual system status, switch or lever position, or the specific parameter value. For example, the autobrake system may be set to RTO, OFF, ARM, DISARM, 1, 2, 3, etc. The challenge for this system may be "Autobrake," and the response may be "RTO". The PF and PM should only use the phrases listed in the SOP or checklist to help reduce any ambiguity or confusion.

The generic responses of "set" or "checked" may not be very informative and does not provide as good of an opportunity to confirm correct action as the actual indication.

5.5 Common Errors That Occur When Using Checklists. Checklist errors can occur in the following areas:

- Crew overlooked item(s) on the checklist.
- Crew failed to verify settings visually.
- Operator or aircraft manufacturer checklist contained error(s) or was incomplete.
- Failing to complete a step after an interruption.
- Failing to complete a checklist.
- Completing the wrong checklist
- Difficulty in finding a checklist.
- Becoming disoriented within the checklist.
- Difficulty in confirming that the checklist action was carried out correctly.
- Problems in understanding and interpreting the checklist.
- Difficulty in determining who should be carrying out the checklist actions (PF vs. PM).

5.6 Preventing Checklist Errors. All checklists are subject to interruption at any point in the flight by ATC or for other operational reasons. However, operational data indicates that flightcrews are most susceptible to interruption and distraction during the ground phases before flight (i.e., "BEFORE START," "PUSHBACK," "START," "TAXI," and "BEFORE TAKEOFF") due to time pressure and interruptions from support personnel (e.g., ramp crew, deice crew).

5.6.1 Training Support Personnel. Many of the distractions or interruptions occurring on the ramp area can be reduced to a minimum by the aircraft operators through training of support personnel. Operators should ensure that ground support personnel who communicate directly with flightcrews are familiar with the procedures used on the flight deck and the need to avoid interrupting the crew during a checklist flow. Persons entering the flight deck to talk to the crew, or contacting the crew via interphone, should make their presence known and unless an emergency exists, refrain from interrupting any flight deck activity or talking to the crew until the crew indicates that they have completed their task and acknowledges their presence.

5.6.2 Restarting From the Beginning. It is recommended that anytime the crew is not clear as to their progress through the checklist the PIC should, without hesitation, direct that the appropriate section of the checklist be reaccomplished from the beginning.

5.6.3 Cognitive Limitations. Cognitive limitations experienced by humans when dealing with stress, concurrent task demands, and time pressure underlie many of the errors made by crews when responding to emergencies. Including more information in checklists can reduce memory load and other cognitive demands. However, the more information included in a checklist, the longer it becomes and the more time needed to complete it. Checklist designers should include items within checklists that remind crews of information they may not easily recall and other cues they should attend to as they respond to a particular situation.

5.6.4 Checklist Error Prevention Tips.

1. Remember to use the checklist.
2. Check every item, every time.
3. Slow down and confirm significant items.
4. Deliberately read the checklist.
5. If interrupted, restart from the beginning.