NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

June 12, 2020

Attachment 8 – United Airlines Flight Operations Manual

[Excerpt]

OPERATIONAL FACTORS

DCA20CA058

non-compliant flight crews are far more likely to commit errors. LOSA refers to errors caused by INC as “intentional non-compliance errors.”

When INC becomes habitual in the absence of consequences, Normalization of Deviation is established as an alternative to compliance. This creates opportunity for exponential errors, and a growing systemic threat to safe operations. The best defense against intentional non-compliance is holding one’s self and each other accountable to the established standard operating policies and procedures.

ERROR MANAGEMENT

Effective error management mitigates the negative consequences of human errors. The first step in error management is to ***identify errors***. The earlier an error is identified, the more quickly it can be repaired, thus returning the flight to a safe operation. The strategies for error management are the implementation of applicable CRM/TEM skills. These may include:

- ***Monitor/Cross-Check*** by maintaining awareness of the aircraft status and the crewmember actions
- ***Workload management*** by ensuring tasks are properly prioritized and managed
- ***Automation management*** by ensuring proper automation levels are selected

Stated simply: ***Identify And Repair***.

An Undesired Aircraft State (UAS) may occur if an error is not identified, or not properly repaired.

UNDESIRED AIRCRAFT STATE

Undesired Aircraft State (UAS) is a position, attitude, condition, or configuration of an aircraft that reduces safety margins. It is a safety-compromising state that results from ineffective error management. Identifying an UAS is the first step to returning the flight to safe operations. The earlier an UAS is identified the earlier recovery can occur. Pilots must take immediate action that may include a combination of CRM/TEM and technical skills. These may include:

- ***Monitor/Cross-check*** to actively verify aircraft position and configuration
- ***Automation management*** to ensure proper automation levels are selected
- ***Technical skills*** (stick and rudder) to fly the aircraft

Stated simply: ***Identify And Recover***.

An aircraft operating in an undesired state and not promptly recovered may lead to an incident or accident.

CRM/TEM SKILLS

A safe operation is maintained by combining technical skills with managing threats and errors through the effective implementation of CRM and TEM skills. These observable and assessable human behaviors include both CRM and TEM skills that when combined enhance flight safety by giving crewmembers tools to manage operational threats and human errors. The CRM/TEM skills are:

Situational Awareness Correctly assess the current and anticipated environment; identify and anticipate threats and errors.

Leadership Effectiveness Exercise responsibilities in a manner that promotes teamwork, professionalism, and mentoring.

Planning and Decision Making Incorporate relevant information, develop operational strategies, and choose the best course of action consistent with safe, reliable, and efficient operations.

Communication Exchange information, ideas, and/or instructions in a timely manner.

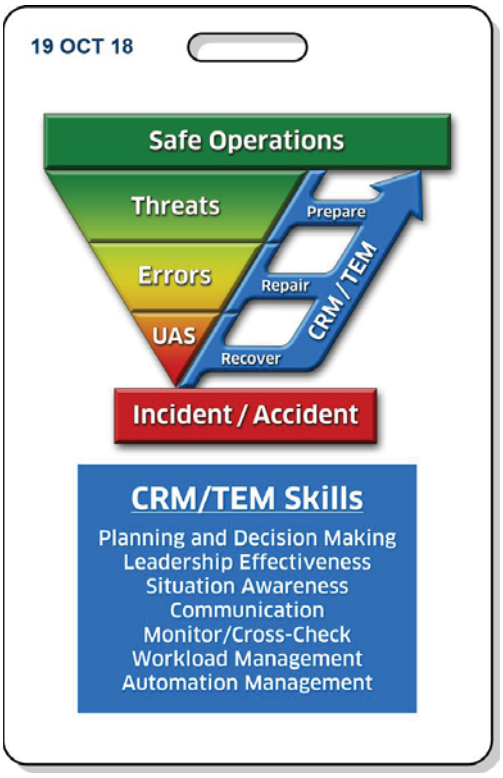
Monitor/Cross-check Actively verify aircraft systems, aircraft position/configuration, and crewmember actions; resolve inconsistency and uncertainty.

Workload Management Effectively manage tasks to optimize overall performance.

Automation Management Select appropriate level of automation for the situation and verify automation status.

CRM/TEM MODEL

CRM/TEM may be visualized using the CRM/TEM model below. Safe operations are depicted at the top of the model and represents the desired operating environment. As a crew encounters operational threats or human error, there is a potential to move away from the safe operations area. If the trend continues, the result may be an incident or accident. Effective application of CRM/TEM skills creates a path away from an incident/accident and will turn a divergent trend back toward safe operations.



PASSENGER SEAT BELTS PROCEDURES

The seat belt signs will be turned ON before pushback, after the passengers have boarded, as a signal that aircraft movement is imminent; and will be ON for taxi, takeoff, landing, and whenever turbulence is encountered or expected.

See the PA Announcements section in this chapter for required announcements regarding the seat belt sign.

STARTING ENGINES

Either verbal clearance over the flight interphone or hand signals (if the flight interphone is inoperative) are required for engine start.

PUSHBACK PROCEDURES

Note: *ATIS pushback procedures supersede airport information page (10-7) pushback procedures.*

DELAYS TO PUSHBACK

If pushback is significantly delayed, notify the CSR and/or Station Operations of the situation and expected duration of the delay.

RELEASING PARKING BRAKE

The parking brake must not be released until the Before Push Checklist is complete, the Ground crew is ready for pushback, and push clearance has been received (if required).

COMMUNICATIONS COORDINATION

Ground personnel have the primary responsibility for detecting and advising of hazards during pushback. The Captain has the primary responsibility for monitoring and responding promptly to instructions from the marshaller. The First Officer has the primary responsibility for monitoring Ramp Control and relaying any instructions to the Captain. The Captain monitors and communicates only on the flight interphone. The First Officer monitors and communicates with ATC and Ramp. It is acceptable for the First Officer to monitor the flight interphone.

Wireless Ground Crew Headsets

The wireless headset pushback system provides communication between the tug operator, wing walkers, and pilots via the flight interphone system. The tug operator can hear and speak to the pilots and both wing walkers. The pilots can hear and speak to the tug operator, but cannot hear any conversations between the wing walkers and the tug operator. All parties can hear the pilots when they talk on the flight interphone. The system is paired to prevent cross talk interference from other operations.

Pilot Alert System If the tug operator loses connection, goes out of range (1,600 feet), or turns off their headset during a push back, a two-step alternating alert tone will be heard by the pilots, tug driver, and wing walkers. If this occurs, carefully monitor the situation, watch for hand signals, and only use the brakes when directed to, or if a breakaway is evident. If the alert tone occurs after the tug driver has been cleared to disconnect the headset, the indication is that the intercom module is still connected to the aircraft; it must be removed prior to flight.

Coordination Prior to Pushback

Using the flight interphone or hand signal communications, the Ground crew will confirm with the Captain that the parking brake is set and the chocks have been

- **ACARS 2.0:** Use the departure delay code page to enter the 2-letter delay code that applies and free text to provide further detail on the situation.

Example:

DEPARTURE DELAY UA1758 SNA IAH THIS FLIGHT WAS ASSIGNED A FLIGHT OPERATIONS CODE OF **FN-COCKPIT CHECKS**. DEPENDING ON FLEET EQUIPAGE PLEASE USE THE MISC REPORT PAGE OR THE DELAY CODE PAGE TO ENTER ONE OF THE 2-LETTER DELAY CODES SHOWN BELOW AND FREE TEXT TO PROVIDE FURTHER DETAIL ON THE SITUATION.

STYLE OF FLYING

No pilot may operate an aircraft in a careless or reckless manner so as to endanger life or property (FARs 91.13, 121.535).

Spectacular or stunt flying in United equipment is strictly prohibited. All maneuvers not necessary to the safe and orderly progress of the flight are to be avoided. Normal scheduled flying should not require bank angles greater than 30° nor airspeeds higher than the normal limit speed (see FM). United explicitly prohibits the inflight simulation of aircraft emergencies on any flight. Flight Test exceptions with no revenue passengers and/or cargo on board are covered in the Flight Test Operations Manual (e.g., engine shut down and restart testing).

ABSENCE FROM THE FLIGHT DECK/SEAT POSITION

Whenever the Captain or First Officer leaves the flight deck or their seat position in flight, that pilot must, upon return, be briefed by the remaining pilot on any matters relating to operation of the flight such as changes to route, heading, altitude, or aircraft status. If there is no change, it should be so stated.

ABSENCE FROM THE ATC FREQUENCY

If one of the two required pilots is off the ATC frequency at the time ATC assigns a different altitude, heading, speed, etc., the remaining pilot is not expected to wait for concurrence from the other pilot before accomplishing the new clearance. Upon returning to the frequency, the returning pilot must be briefed on all changes.

CHECKLIST INITIATION

Required checklists should be initiated by the FM-prescribed pilot at the appropriate time. If it becomes apparent a checklist is becoming overdue, the other pilot should provide a prompt that a required checklist is required. Checklists must be read; do not rely on memory.

FLIGHT WATCH (FAR 121.601)

The Dispatcher shall provide the Captain with all available information that may affect the safety of the flight. This information includes meteorological conditions (including adverse weather phenomena, such as clear air turbulence, thunderstorms, and low

altitude windshear), irregularities of facilities and navigation aids, and airport condition updates.

SIGNIFICANT WEATHER CHANGES

The Dispatcher must advise the Captain, before departure, of any significant change to the information in the weather briefing. The guidance below provides examples of when dispatch may advise the pilots of changing conditions.

Subject	Action
Alternate Weather	Advise of any change likely to cause the pilot to reconsider alternate selection.
Anticipated Non-normal Operations	Advise of any changes that affect the validity of the operating plan or that are likely to cause the pilot to reconsider agreement to the operating plan.
ATC Delay	Advise of any delay if not previously advised to expect delay. Advise of any increase in delay greater than 15 minutes.
Field Conditions	Changes in runway availability and obstructions or hazards in any operating area must be relayed to the pilot in a timely fashion. During winter storm conditions when snow, ice, or slush accumulations are constantly changing, frequent updates to the pilot are important.
NOTAMs	Advise of any change to flight-planned facilities.
Terminal Weather	Advise of change in descent or approach conditions, particularly if weather conditions are deteriorating. VFR to (or from) IFR. CAT I to (or from) CAT II. Above minimums to (or from) below minimums.
Thunderstorms, Turbulence, Shear, Icing, Freezing Precipitation	These are dynamic conditions and require frequent updating of information to keep the pilot adequately advised of any changes affecting enroute and terminal operations. Normally, reports indicating development from anticipated light intensity to moderate or severe intensity is relayed.

DIVERSION TO AN ALTERNATE

If diverting to an alternate, the weather conditions need only be at or above the published approach and landing minimums, and no additional alternate (alternate for the alternate) is required.

DESTINATION OR ALTERNATE CHANGE (FAR 121.631[f])

No person may change an original destination or alternate airport that is specified in the original Dispatch or Flight Release to another airport while the aircraft is enroute unless the other airport is authorized for that type of aircraft and the appropriate requirements are met at the time of redispatch or amendment of the Flight Release (FARs 121.593 through 121.597 and 121.173).

CHANGE IN DESTINATION

A flight may not continue toward any airport to which it has been dispatched if the Captain or Dispatcher believes that the flight cannot be completed safely, unless, in the judgment of the Captain, there is no safer alternative. Preferred actions include proceeding to a designated alternate, or amending the release and proceeding to another destination. See the Diversion Planning and Recovery Guides in the FOM QRG.

Chapter 3 OPERATING INFORMATION

Section 90 CREW INFORMATION

CREW BRIEFINGS

The Captain is responsible for ensuring that flight planning and predeparture briefings create a clear plan of action in a working-together environment. Using the verbiage "standard operating procedure "or "SOP" is appropriate for those routine items that do not require further amplification. To enhance safety, pilots should brief with meaning and visualization, asking questions for clarity and understanding when needed.

FLIGHT ATTENDANT BRIEFING

The Captain is required to conduct a predeparture briefing with only the Purser. However, if time allows, the Captain may brief the entire crew.

The Captain should strive to conduct the briefing as early as possible to minimize disruption to other predeparture duties of the pilots and flight attendants, and minimize potential delays to our passengers. Items to be briefed include, but are not limited to the following:

- Introductions
- FAM/FFDO/LEO/Jumpseat
- Relief Pilot Items
- Flight Time/Short Taxi
- Wx/Turbulence
- Cabin Mx Items
- Channel 9 (if installed)
- Security or Unusual Circumstances
- Greater than 50 NM Offshore
- FA Coordination (T.E.S.T.)

- **Introductions** Allow for an introduction of each crewmember present at the briefing. Provide the names of any pilots not present and known jumpseaters.
- **FAM/FFDO/LEO/Jumpseat** Notify the flight attendants of all known security resources to include FAMs, FFDOs, armed LEOs, jumpseaters etc. If FAMs are present and desire to brief the crew, have them do so.
- **Relief Pilot Items** If passenger seats are to be used for the relief pilots, confirm the location. Discuss any other particulars, such as estimates of when the pilot breaks will occur, etc.
- **Flight Time/Short Taxi** Review the planned flight time, any anticipated ground/flight delays, and any possibility of a short taxi time, as it may relate to timing of the passenger safety briefing.
- **Wx/Turbulence** Review the destination weather and any pertinent turbulence issues for the flight, to include approximately when the turbulence may be expected (if known). If the weather will require the flight attendants to remain seated after takeoff, provide an estimate of the duration.
- **Cabin Mx Items** Review any inoperative equipment that might impact the flight attendants or passengers. If the Cabin App is unavailable, provide a reminder that notification of cabin discrepancies is preferred prior to the start of the descent phase.
- **Channel 9 (if installed)** Advise if Channel 9 (ATC audio) will not be made available to the passengers.
- **Security or Unusual Circumstances** Review any known security information and any unique security measures for the flight. Discuss any unusual circumstances that may affect the flight attendants. Address any questions or open issues and ask if the flight attendants have any additional information for the pilots.

Chapter 3 OPERATING INFORMATION

Section 100 PA ANNOUNCEMENTS

GENERAL GUIDANCE

Proper use of the PA system creates a professional image. Coordination of announcements should be made so as to cause the least disruption to the passengers/crew, while being relevant, informative, and engaging.

The following general rules should be followed when using the PA system:

- Think before you speak.
- Tell the truth.
- Do not make promises you cannot keep.
- Avoid technical terms and aviation jargon (e.g., IFR, ATC, altimeter setting).
- Do not make any statement or comment that is religious in nature.
- Do not express personal opinions or political views.
- Speak in a clear tone and at a calm pace.
- Be cautious with humor.
- Consider limiting non-safety related PA announcements during sleeping hours.
- Emphasize safety.

WELCOME ANNOUNCEMENT

Time permitting, a welcome announcement should be made prior to pushback. The Captain and First Officer should be introduced by last name and the Purser by first name. This communication sets appropriate customer expectations and can reduce anxiety. Suggested information to include: any anticipated pushback or taxi delays, planned flight time, expected flight conditions, unusual circumstances, and expected arrival weather and time. If aircraft door is closed and pushback does not occur by 5 minutes after departure, time permitting, make an announcement with reason for delay and updated pushback time if available.

PRIOR TO TAKEOFF

“Flight attendants, please be seated for departure.” This must be a standalone announcement, given approximately 2 minutes prior to taking the runway and not combined with any other PA announcement. Flight attendants are trained to listen for precisely these words.

Flight attendants must notify the flight deck if they are unable to comply. If the flight attendants cannot complete their preparations in the time remaining, the Purser notifies the flight deck and the Captain delays the takeoff until assured that all is in readiness for takeoff.

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“Flight attendants, please be seated for departure.” This must be a standalone announcement, given approximately 2 minutes prior to taking the runway and not combined with any other PA announcement. Flight attendants are trained to listen for precisely these words.

Flight attendants must notify the flight deck if they are unable to comply. If the flight attendants cannot complete their preparations in the time remaining, the Purser notifies the flight deck and the Captain delays the takeoff until assured that all is in readiness for takeoff.

Chapter 4 DISPATCH

Section 10 FLIGHT PLANNING POLICY

DISPATCH COORDINATION

On international flights, Captains are required to contact Dispatch for a briefing if the flight is 6 hours or longer, unless determined by the Captain that overriding operational considerations exist preventing the briefing. Briefings may be conducted by any available means of communication.

If the flight is under 6 hours, Captains are not required but still encouraged to contact Dispatch. If prior to any flight the Dispatcher determines there are significant operational concerns, a “Contact Dispatch” comment will be included in the Release COMMENTS section and contact with the Dispatcher is required (FAR 121.601 & 121.603).

OPERATING PRIORITY AND EFFICIENCY

OPERATING PRIORITIES

Make operating plans and route selections in accordance with United’s operating priorities. Planning or conducting the flight for scenic or other interests not pertinent to best operating procedures is not authorized.

ROUTE AND ALTITUDE SELECTION

All flights will be dispatched and operated along the least-cost routing, with consideration to ATC constraints and hazardous weather. The least-cost route and altitude profile provides the lowest total sum of fuel, time, delay, and over-flight costs, while maximizing payload. If the route and/or altitude planned are not along the least-cost routing, the Dispatcher must state the reason for the alternative altitude or route selection in the REMARKS section of the Release.

Dispatch may add EXTRA fuel for altitude/lateral deviations, or adjust the planned altitude/routing to ***avoid and/or mitigate hazardous weather threats***. Hazardous weather is defined as follows:

- Area of known/forecast continuous moderate or severe turbulence intensity as indicated by WSI SIGMET or Flight Plan Guidance (FPG).
- Area of broken convection (BKN) or greater coverage (SOLID) as indicated by WSI SIGMET or FPG.
- Elevated ozone concentrations (non-filtered aircraft only) as defined by WSI products or FPG .
- Areas of volcanic ash as defined by WSI SIGMET or FPG.

WSI is the FAA-approved controlling weather provider. A combination of WSI SIGMETs, Flight Plan Guidance and PIREPs (considering aircraft type, time, location and altitude) must be considered in verifying areas of continuous moderate or greater turbulence.

IRREGULAR OPS DIVERSION AND RECOVERY PLAN (SCATTER PLAN)

The scatter plan is designed to improve handling of diversion aircraft by strategically/tactically scattering flights to prevent overloading of diversion airports or not having the logistical support in place (e.g., ground service equipment, fueling,

REQUIRED DISPATCH REPORTS

For all flights the following events must be reported to Dispatch (ACARS or radio) as soon as practical (OpSpecs B043, B044, B343, and Exemption 8653):

- If actual ETA will exceed planned by more than ***15 minutes***, or there is an accumulated deviation of plus or minus ***5 minutes*** from a previously reported estimate
- If cruise altitude varies by ***4000 feet*** or more from the flight plan.
- If a lateral deviation from the planned route exceeds ***100 miles***.
- Any enroute failure of a flight deck ***fuel quantity indicator***
- If it becomes apparent that all contingency fuel will be burned (i.e., ACF, EXTRA, and HOLD) and therefore ***part of the reserve fuel will be burned***, coordinate a plan of action with Dispatch and provide the details of what occurred (e.g., holding at destination).
- A flight encounters ***weather significantly different*** than forecast, or any time moderate or greater turbulence is encountered.
- The flight is assigned enroute or arrival holding.
- Unplanned or sustained use of deicing or anti-icing systems.
- Assigned a CDR. See Operating Information chapter>Flight Planning>Coded Departure Route.
- When an ATC-initiated callsign change occurs.

RECORDING AMENDMENTS

FAR 121.631 requires the Dispatcher and Captain to record any changes to release information (required by FAR 121.687) on their copies of the Release, or in the case of electronic documents, on a piece of paper that is retained until the conclusion of the flight. Therefore, any amendments to the following items must be recorded:

- Aircraft nose number
- Flight number
- Departure airport, intermediate stops, destination airport, and any required alternates to include takeoff, Method II driftdown, ETOPS, and destination
- Minimum fuel supply

COMPUTER OUTAGE/VERBAL RELEASE

CAPTAIN'S RESPONSIBILITIES

If a computer outage occurs where Dispatch cannot operate normally to process flight plans and offer the information expected by pilots, all dispatch procedures should still be followed as closely as possible. However, the following considerations are available and can be used as necessary to help mitigate the situation.

Release Procedures

Contact Dispatch via phone or any available means to receive weather, NOTAMS, field conditions, and any other adverse weather phenomena (FAR121.601). Copy Release information along with the Dispatcher's name (FAR 121.663) received over the phone from the Dispatcher. (The phone is the primary communications tool.)

Flight Plan Considerations

- Fuel should be planned conservatively to account for possible delays.

Chapter 7 ADVERSE WEATHER

Section 10 ADVERSE WEATHER

GENERAL

FARs dictate that a flight may not continue toward the destination if the Captain or the Dispatcher does not believe that the flight can be completed safely. The only exception is when the Captain believes there is no safer course of action than to continue toward the destination by exercising Captain's emergency authority.

TURBULENCE DEFINITIONS

Light Turbulence Slight bumpiness and/or momentary erratic changes in altitude/attitude:

- Drinks occasionally splash out of cup.
- Little or no difficulty in walking.
- Occupants may feel slight strain against seat belts.

Light Chop Slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude.

Moderate Turbulence A harsher ride than light turbulence with changes in altitude and/or attitude, but the aircraft remains in positive control; typically causes variations in indicated airspeed:

- Drinks splash out of cup with consistency.
- Standing or walking is sometimes difficult or impossible without holding on to a part of the aircraft.
- Occupants feel definite strain against seat belts.

Moderate Chop Rapid bumps or jolts without appreciable changes in aircraft altitude and attitude.

Severe Turbulence Large, abrupt changes in altitude and/or attitude and the aircraft may be momentarily out of control; typically causes large variations in indicated airspeed:

- Unsecured items are tipped over or tossed about.
- Standing or walking is impossible without holding on to part of the aircraft.
- Occupants are forced violently against seat belts.

Extreme Turbulence Aircraft is violently tossed about and is practically impossible to control; it may cause structural damage.

MODERATE OR GREATER TURBULENCE ENCOUNTERS

Note: *Turbulence of moderate or greater intensity must be reported to Dispatch as soon as possible.*

TURBULENCE PA COMMANDS

FORECASTED/IMPENDING TURBULENCE OF MODERATE OR GREATER INTENSITY		
Note: *An interphone briefing may still be accomplished, but when the flight attendants are to be seated, the command **must** be given over the PA. This allows all flight attendants to hear the PA command and informs the passengers that the flight attendants **must** be seated in their jumpseats and not completing service items.*		
Condition	**Pilot Actions**	**Flight Attendant Response**
Forecasted/Impending Turbulence Turbulence of moderate or greater is forecasted or impending.	Make PA: **"Flight attendants, take your jumpseats."**	Flight attendants will discontinue service and move the carts to a safe location outside of the aisle. Flight attendants will move to their jumpseats and fasten seatbelts/shoulder harnesses.
Turbulence Improves/Subsides Captain determines it is safe for flight attendants to resume their duties.	Make PA: **"Flight attendants, check in."**	Flight attendants are free to resume duties. After all the flight attendants have checked in with the Purser, a call from the Purser to the flight deck will be made to report cabin status. The Captain may inform Purser of any subsequent turbulence or crew actions.

UNEXPECTED TURBULENCE OF MODERATE OR GREATER INTENSITY		
Note: *Anytime the Captain seats the flight attendants for turbulence, the command **must** be given over the PA. This allows all flight attendants to hear the PA command and informs the passengers that the flight attendants **must** be seated in their jumpseats and not completing service items.*		
Condition	**Pilot Actions**	**Flight Attendant Response**
Unexpected Turbulence of Moderate or Greater Sudden onset turbulence of moderate or greater intensity.	Make PA: **"Flight attendants, be seated immediately, be seated immediately."**	Flight attendants will stop the service and leave carts with brakes set. Flight attendants will either take their jumpseats, occupy the nearest available passenger seat or drop to the floor of the aircraft, whichever is closer.
Unexpected Turbulence of Moderate or Greater Improves Captain determines that flight attendants are safe to return to their jumpseats, but not safe to resume duties.	Make PA: **"Flight attendants, take your jumpseats."**	Flight attendants will discontinue service and move the carts to a safe location outside of the aisle. Flight attendants will move to their jumpseats and fasten seatbelts/shoulder harnesses.
Unexpected Turbulence of Moderate or Greater Ceases Captain determines it is safe for flight attendants to resume their duties.	Make PA: **"Flight attendants, check in."**	Flight attendants are free to resume duties. After the flight attendants have checked in with the Purser, a call from the Purser to the flight deck will be made to report cabin status. Captain may inform the Purser of any subsequent turbulence or crew actions.

TURBULENCE ONSET TYPES

Note: *The ride experience on the flight deck may be considerably different from the ride being experienced in the cabin. Historically, the cruise and descent phases of flight are high risk for flight attendant injuries. Proper planning and coordination can significantly reduce the potential for injury.*

Unexpected

Moderate or greater turbulence is encountered, and there is not enough time for flight attendants to safely move to their jumpseats. The pilots should ensure the seatbelt sign is on and make a PA announcement stating, "Flight attendants, be seated ***immediately***, be seated ***immediately***." This prompts the flight attendants to "stop, drop, and hold on" at their current locations. If necessary, make a PA announcement to inform the passengers to also be seated immediately. After making the "Flight attendants, be seated ***immediately***, be seated ***immediately***" PA, if the Captain does not feel that it is safe for the flight attendants to resume their duties, but safe enough to move to their jumpseats, then the Captain may make the, "Flight attendants, take your jumpseats" PA.

When the Captain feels it is safe for the flight attendants to resume their duties, the "Flight attendants, check in" PA is made. This will allow the flight attendants to leave their jumpseats and return to normal duties expeditiously and simultaneously.

The Purser will assess conditions and report the status of the cabin, F/A crew, and passengers to the pilots.

Impending

There is sufficient time for the flight attendants to move to their jumpseats, but not enough time to clean up and secure their work areas. This may include reported turbulence from other aircraft, WSI forecasts, TAPS reports or possible turbulence while deviating for weather. Ensure the seatbelt sign is on and make a PA announcement stating, "Flight attendants, take your jumpseats." This triggers the flight attendants to stop service, move carts to a safe location out of the aisle, and return to their jumpseats and fasten seatbelts and shoulder harnesses. If necessary, also make a PA announcement to inform the passengers to return to their seats. An interphone briefing may still be accomplished (e.g., "There is turbulence forecasted ahead, so I'll be sitting you down in 10 minutes."), but when the flight attendants are to be seated, make the announcement over the PA.

When the Captain feels it is safe for the flight attendants to resume their duties, then the "Flight attendants, check in" PA is made. This will allow the flight attendants to leave their jumpseats and return to normal duties expeditiously and simultaneously. The Purser or designee will assess conditions and report the status of the cabin, F/A crew, and passengers to the pilots.

Forecasted/Expected

There is sufficient time for the crew coordination steps below. Allow sufficient time, depending on the size of the aircraft, for flight attendants to adjust their cabin service and secure their equipment. This also allows ample time for passengers to return to their seats.

Crew Coordination The Captain, or designee, is responsible to inform the Purser of the following:

- How much time is available before the turbulence is expected.
- The anticipated intensity and duration of turbulence.
- Any special instructions (e.g., modifying or curtailing cabin service, securing galley carts).
- If flight attendants are to be seated in their jumpseats.

SEVERE TURBULENCE

Do not intentionally conduct flight through areas of known severe turbulence. If a chance of severe turbulence is forecasted for the route, be alert for PIREPs and other indications of actual severity of turbulence present. If informed of the presence of severe turbulence, consider the following action:

- In the vicinity of the departure airport, seek departure routing that avoids the turbulent area, if possible, or delay departure until conditions improve.
- Enroute, change altitude and/or route in order to avoid the reported area.
- In the vicinity of the destination airport, seek a descent and approach path to avoid the reported turbulence area. If avoidance is doubtful, consider holding until the situation improves (PIREPs, LLWAS, TDWR, etc.) or consider diversion.
- Contact Dispatch for help in obtaining current weather and PIREPs.

TURBULENCE PIREPS

Turbulence of moderate or greater intensity must be reported to ATC and Dispatch as soon as possible. The preferred method of sending the Turbulence PIREP to Dispatch is to use the SUBMIT PIREP prompt in ACARS, if available. To help the situational awareness of other aircraft on frequency and to minimize follow-up questions, provide a full PIREP to ATC that includes the aircraft location, turbulence intensity and duration, whether in or near clouds, altitude, and aircraft type.

Example: "Chicago Center United 960 with a turbulence PIREP"
When Center answers:
"United 960 is 100 miles south west of ORD experiencing moderate in cloud turbulence at FL 370, Boeing 757"

Note: *A defect report to Maintenance is required anytime severe or extreme turbulence is encountered.*

AUTOMATIC TURBULENCE ADVISORIES

Aircraft receive auto generated turbulence advisories via ACARS, which are simultaneously sent to the flight deck and dispatch. This process automates the delivery of PIREPs, WSI Turbulence SIGMETs, WSI Convective SIGMETs, and WSI Turbulence Advisory Areas. Dispatchers are still responsible for ensuring flights are informed of all potentially hazardous turbulence information. Dispatchers will ensure the automated system is working, and that pilots are made aware of other possible turbulence hazards that don't meet the thresholds of the automated system. Messages from the automated system include the time and location of where the flight path comes closest to the reported PIREP location or the time the flight path intersects the SIGMET or Turbulence Advisory Area.

TURBULENCE AUTO PIREP SYSTEM (TAPS)

TAPS is a component of the turbulence reporting program and uses aircraft accelerometers to automatically report aircraft ride quality. When an aircraft reports turbulence using the TAPS system, a Turbulence Advisory message is automatically generated by WSI for nearby aircraft and requires no pilot input. A Turbulence Advisory includes:

- Time, location, and altitude of the reporting aircraft
- Time and location of where the flight path is closest to the TAPS report
- Turbulence Level code:
  - 0.1 to <0.2 = Light
  - 0.2 to <0.3 = Moderate
  - >=0.3 = Severe

Automated Turbulence Advisories

Automatic turbulence reporting messages are to increase situational awareness, and are not a substitute for vigilance. Consider turning on the seat belt sign, curtailing cabin service, and having the flight attendants seated when approaching an area that generated an automated uplink. Reference the Turbulence Action Guide in the FOM QRG to determine the appropriate response to an automated turbulence advisory.

TAPS and PIREPS Parameters

TAPS and PIREPs advisories are sent automatically via ACARS if the route of flight is within 30 minutes of entering the affected area, which is defined as 75 miles and 2000' of a:

- TAPS report with a Turbulence Level of 0.15 or greater
- Turbulence PIREP of moderate or greater

SkyPath

The SkyPath EFB application displays real-time turbulence. When the EFB is docked and calibrated, the app uses the accelerometers in the iPad to measure turbulence and converts the movements to color-coded tiles representing different turbulence severities. An algorithm filters out any movement of the EFB not associated with turbulence. See the Pilot EFB>Content App>07-iPad/EFB Help Guides>iLOG>Chapter 10.

SkyPath should be used as an additional approved turbulence data source, in conjunction with other approved sources (e.g., WSI, TAPS, PIREPS) for route, speed, and altitude selection. Though SkyPath data is seen by the Dispatcher, it is not a substitution for PIREP submissions.

SIGMETs

WSI Turbulence SIGMET and WSI Convective SIGMET messages are sent when the aircraft is within 30 minutes of entering the affected area. When flights are closer than 30 minutes to the reported location or area when it is generated, an advisory is sent immediately. The message will state the time the aircraft will enter the SIGMET or Turbulence Advisory Area. If the aircraft is already in the area when the SIGMET is created, the message will state “Your aircraft is within a. . . (i.e., Turb SIGMET area).”

It is important to note that automated advisories are not issued for government-issued SIGMETs. WSI SIGMETS should be comprehensive for determining threats; however, there will be differences between the government SIGMETs announced by ATC and WSI SIGMETs.

Own Ship TAPS Reporting

When aircraft are equipped with the TAPS reporting algorithms, an ACARS message will report own ship turbulence TAPS reports for two turbulence specific metrics; Turbulence Level and Eddy Dissipation Rate (EDR). Turbulence Level is a measure of how much the aircraft is “shaking,” while EDR is the “sea state” of the atmosphere. ACARS advisories are based on reported Turbulence Levels and reported with a turbulence level code.

CUMULUS CLOUDS

Seemingly small cumulus clouds can have a significant, sudden onset of turbulence. One of the most difficult threats to detect is rapidly growing cumulus clouds developing beneath the flight path. These cumulus clouds have the highest potential for generating moderate or severe turbulence, usually with little warning. Use the airborne weather radar to scan for any precipitation displayed below the flight path prior to descent.

THUNDERSTORMS

WARNING: Do not attempt to penetrate a thunderstorm.

The onboard radar is the primary means of circumnavigating convective weather. WSI, in conjunction with Dispatch and ATC, may be helpful for long range routing decisions and turbulence avoidance. However, the receipt of WSI weather information may be delayed up to 15 minutes and should not be used for convective weather avoidance that is within weather radar detection range. Wi-Fi connectivity may

be deferred per the MEL. The turbulence associated with thunderstorms can be minimized by adhering to the following guidance:

- **Circumnavigating Storms** Avoid the downwind (anvil) side of the storm by at least 1 mile for every knot of wind at that flight level.
- **Flight Above a Thunderstorm** Should be avoided, however, if this is not practical, attempt to vertically clear the cell by at least 5000 feet. The vertically propagating convective waves associated with both building and dissipating storms present a hazard that requires careful consideration and action.
- **Flight Beneath a Thunderstorm** Should not be attempted for storms of moderate or severe intensity.

The seatbelt sign ***should be on*** and the flight attendants ***should be seated*** when operating:

- Within 20 miles of strong radar echoes (sharply defined edges and/or contour indications of heavy precipitation).
- Within 10 miles of moderate radar echoes (less sharply defined, but still indicative of moderate thunderstorm activity).
- In airspace above thunderstorms.

DOPPLER RETURN TURBULENCE

If a Doppler return showing turbulence is associated with moderate or severe thunderstorm returns, avoid the area using the thunderstorm avoidance criteria. If a Doppler return showing turbulence is present in light precipitation, or no precipitation, avoid the area by 5 NM, if possible.

MULTISCAN WEATHER RADAR (IF EQUIPPED)

Multiscan Weather Radar (see FM) uses sophisticated algorithms to automatically scan the atmosphere for convective hazards.

ENROUTE STORM AREA AVOIDANCE

Early detours of storms, considering distance and storm position, are good operating procedure. Plan an avoidance path as soon as possible for all weather echoes which appear beyond 100 miles. While ATC may be able to provide some assistance, controllers can only advise of precipitation areas and cannot ensure clearance from severe weather.

When serious thunderstorm conditions exist in terminal areas, prompt rerouting clearance from ATC may not be attainable. If in a terminal area and unable to obtain a clearance to deviate around a thunderstorm which in the Captain's judgment threatens the safety of the flight, declare an emergency and advise ATC of the heading to clear the storm. The possibility of less than adequate separation from other aircraft exists and mandates early planning and immediate communication of the deviation decision to ATC.

FLIGHT THROUGH WIDESPREAD STRATUS

Caution should be used when flying through extended areas of moderate rain (yellow echoes not associated with the gradients of a cell), due to attenuation which may prevent identification of embedded cells.

TERMINAL AREA STORM AVOIDANCE

If storm activity in the terminal area is such that recommended cell clearance cannot be maintained, the Captain must consider the following:

- Circumnavigating around the area or landing at an alternate airport.
- Holding at the gate, or delaying takeoff until the Captain determines that a safe departure can be conducted.
- Takeoffs, approaches, and landings should not be attempted when thunderstorms are near the airport, unless the runway and flight path, ***including any Engine Failure Procedures***, are clear of the thunderstorm effects and its associated gust front.

HAIL

Hail is more clearly identified with intensity of echoes than turbulence is, and the greater the cell height, the greater probability of hail. Due to the strength of updrafts, hail can be carried to great heights, and can fall some distance from the storm core, particularly beneath the anvil of a large cumulonimbus cloud. Protrusions, fingers, hooks, or a wavy scalloped edge on the echo suggest the presence of extreme hail and severe turbulence. However, hail is not limited to these echo shapes. Although hail shafts present a high reflectivity return, it is generally not possible to distinguish from a rain shaft. The presence of rain at the surface does not mean the absence of hail aloft. In tropical and subtropical regions, hail seldom reaches the ground, and these storms contain less hail aloft than do comparable mid-latitude storms.

Note: *Any hail strike or suspected hail strike must be reported to Maintenance.*

WINDSHEAR/MICROBURSTS

POLICY

- Avoid areas of known severe windshear.
- When the words “microburst,” “microburst alert,” or “shears of 30 knots” or greater are being broadcast by a controller, takeoff initiation and descents below 1000’ AGL for the affected runway are ***prohibited***.
- If windshear is encountered, initiate windshear escape maneuver.

PROBABILITY ASSESSMENT

The following are indications that windshear is possible during convective weather conditions:

- ATC issued advisories, windshear or microburst alerts
- A temperature/dew point spread greater than 15° C
- Visual cues of the following close to the runway:
  - Rain showers (observed or radar indications of contour, red or attenuation shadow)
  - Lightning
  - Virga
  - Blowing dust or dust devils

Use these cues along with current PIREPs to help develop a prudent plan of action, which may include taking FM prescribed windshear precautions or making a decision to avoid (e.g., delay, hold or divert).