Federal Aviation Administration

55054003 EN ROUTE RADAR ASSOCIATE CONTROLLER TRAINING PART C: ADVANCED CONCEPTS

Lesson 5: Introduction to Controller Pilot Data Link Communications (CPDLC)

Version: 1.0 2022.08

INSTRUCTOR LESSON PLAN

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LESSON PLAN DATA SHEET

Course Name	En Route Radar Associate Controller Training Part C: Advanced Concepts
Course Number	55054003
Lesson Title	Introduction to Controller Pilot Data Link Communications (CPDLC)
Duration	2 hours, 30 minutes (includes lesson, part-task exercise, and ELT)
Version	1.0 2022.08
Reference(s)	JO 7110.65, Air Traffic Control; JO 7110.125, Controller Pilot Data Link Communications (CPDLC) in the ERAM Environment; TI 6110.100, En Route Automation Modernization R-Position User Manual; TI 6110.101, En Route Automation Modernization RA-Position User Manual; TI 6110.108, En Route Automation Modernization Quick Reference Controller Card
Prerequisites	NONE
Handout(s)	⊙ Part-Task Exercise *HO01_05 (Print prior to class)* ⊙ TI 6110.108, ERAM Quick Reference Controller Card
Exercise / Activity	Refer to handout for: ⊙ Part-Task Exercise: Introduction to CPDLC
Scenario	⊙ Run scenario 55054003_L05_S## in TTL
Assessments	⊙ YES - Written *(Refer to ELT01_L05, print prior to class)*
Materials and Equipment	⊙ Pencil and/or pen
Other Pertinent Information	⊙ **Ensure lesson materials are downloaded to the classroom computer** ⊙ This lesson is based on ERAM EAE410 ⊙ The lesson has been reviewed and reflects current orders and manuals as of April 2022

 *As you prep for this lesson, recall and be prepared to talk about examples and personal experiences that illustrate or explain the teaching points in the lesson.*

LESSON ICON LEGEND

	Description
	The Activity icon indicates an exercise, lab, or hands-on activity.
	The Discussion Question icon signals a discussion question to be asked to the students.
	The Handout icon indicates a handout is to be distributed to the students.
	The Instructor Note icon is in hidden text and indicates text that is for the instructor only.
	The Multimedia icon indicates a video or audio clip is in the presentation.
	The Phraseology icon indicates that phraseology is in the content.
	The WBT icon indicates a component of web-based training.
	The Click icon indicates a PPT slide with click-based functionality to present additional information.
	The Definition icon indicates a published definition.

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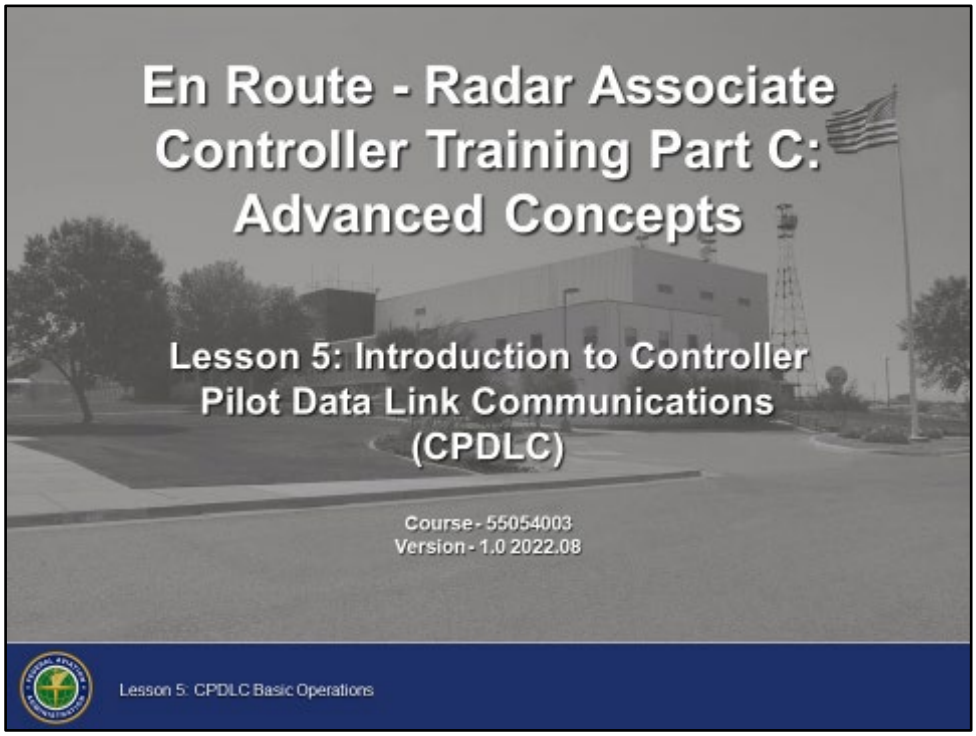
LESSON INTRODUCTION

Overview



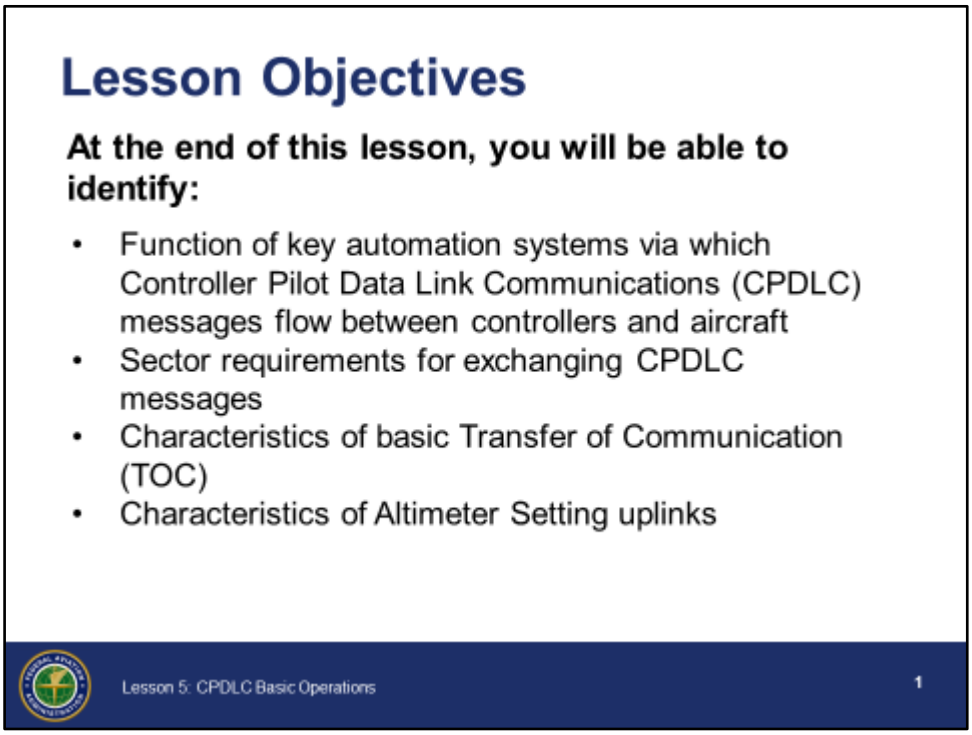
This lesson introduces the basic operation of Controller Pilot Data Link Communications (CPDLC) Transfer of Communications (TOCs), and Altimeter Setting uplinks.

Based upon local facility procedures, the Radar Associate may be responsible for assisting with CPDLC operations.

NOTE: CPDLC was formerly known as Data Comm.

LESSON INTRODUCTION *(CONT'D)*

Lesson Objectives



Review the lesson objectives.

⊙ At the end of this lesson, you will be able to identify:

- Function of key automation systems via which Controller Pilot Data Link Communications (CPDLC) messages flow between controllers and aircraft
- Sector requirements for exchanging CPDLC Messages
- Characteristics of basic Transfer of Communication (TOC)
- Characteristics of Altimeter Setting uplinks

NOTE: There will be a graded end-of-lesson test upon completion of the lesson. The passing score is 70%. If you do not achieve a score of 70%, you will be provided study time and one retake of an alternate end-of-lesson test.

CPDLC KEY AUTOMATION SYSTEMS

Controller Pilot Data Link Communica-tions (CPDLC)

JO 7110.65, PCG

CONTROLLER PILOT DATA LINK COMMUNICATIONS (CPDLC) - A two-way digital communications system that conveys textual air traffic control messages between controllers and pilots using ground or satellite-based radio relay stations.

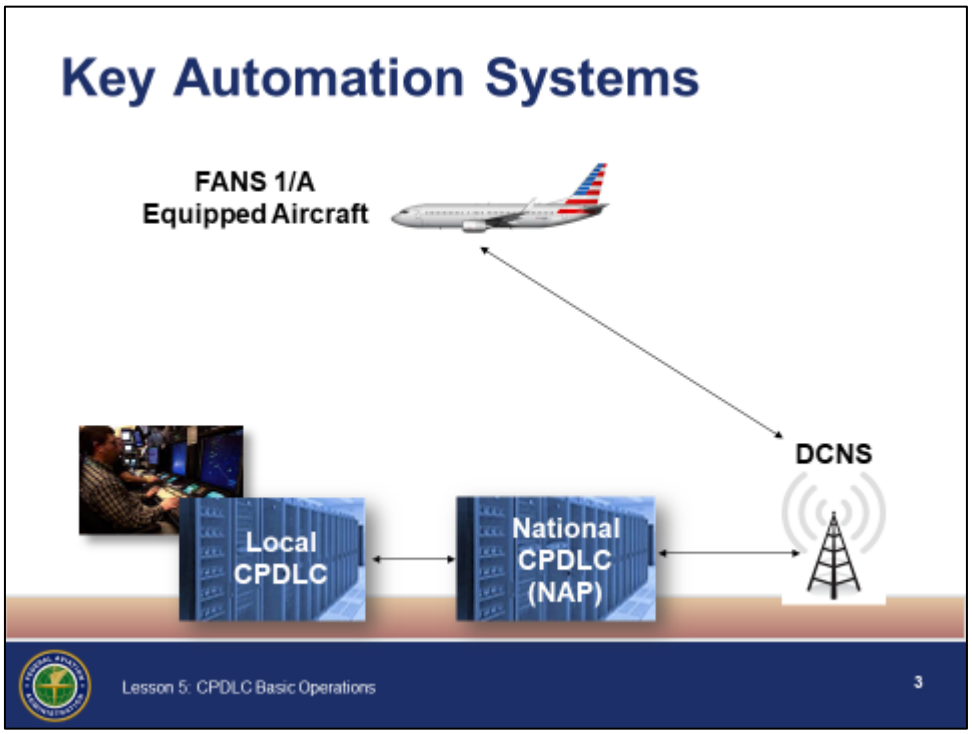
NOTE: Voice communication should be used when delay is not operationally acceptable.

CPDLC KEY AUTOMATION SYSTEMS *(CONT'D)*

Key Automation Systems

TI 6110.101, secs. 6.2.1, 11

TI 6110.108, secs. CPDLC Message Composition, CPDLC Symbology



UPLINK - A text message sent from the ground system to the aircraft.

DOWNLINK - A text message sent from the aircraft to the ground system.

⊙ CPDLC symbols are contained in the Full Data Block (FDB), Aircraft List (ACL), and various menus and views

- Keyboard command options are available to uplink messages
- Local CPDLC software will send messages to the active National CPDLC site for transmission to the aircraft

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CPDLC KEY AUTOMATION SYSTEMS *(CONT'D)*

Key Automation Systems (Cont'd)

TI 6110.101, sec. 6 and Glossary

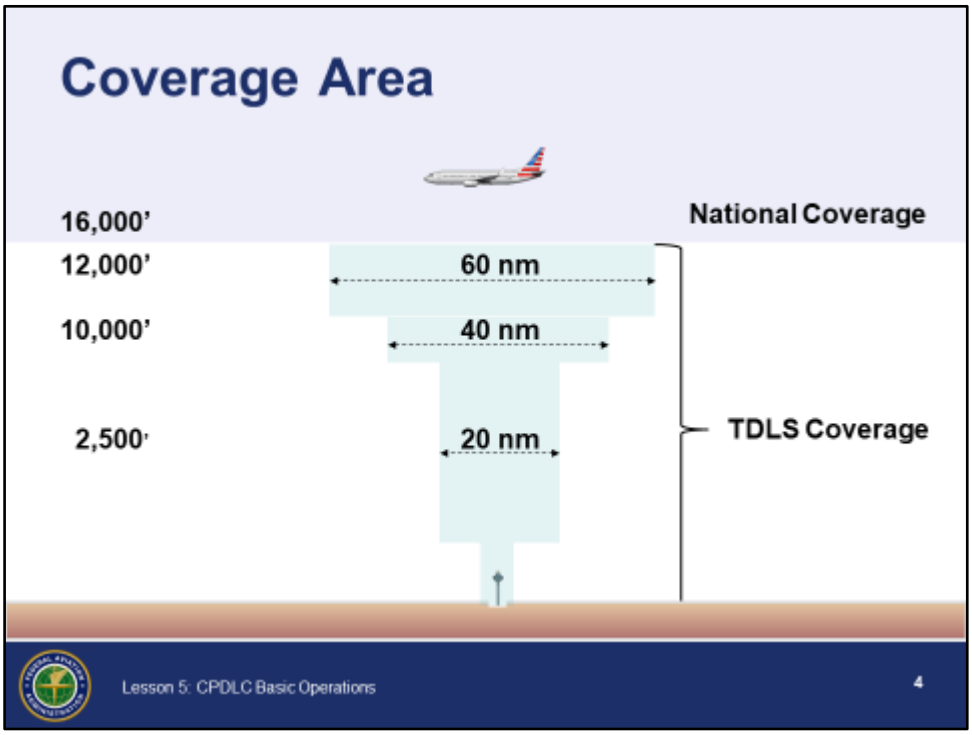
- There are two National CPDLC sites, which are responsible for all National Application Processing (NAP):
  - Salt Lake ARTCC
  - Atlanta ARTCC
- The NAP handles three functions:
  - Manage all message transmission functions such as security and message traffic flow
  - Manage the aircraft logon process
  - Determine which facility can exchange messages with an aircraft at any given time
    - Only one facility at a time can exchange messages
- One NAP is always active for the entire system, while the other is in backup mode
- From the NAP, messages are routed to the Data Comm Network Service (DCNS), for transmission to the aircraft
- DCNS provides a network of transceivers that serve as the digital link to the aircraft
- To be CPDLC capable, an aircraft must be equipped with a Flight Management System (FMS) that complies with the Future Air Navigation System (FANS) 1/A specifications
- To be considered CDPLC eligible:
  - An aircraft's flight plan must include the correct code in the ICAO Field 18 DAT/ text string (either FANSE, FANSER, or FANSPE)
  - For en route operations, the flight plan must include a J4 CPDLC equipment code
    - In addition to J4, the aircraft must also contain an equipment code of J5 or J7 to be eligible for CPDLC messages to be communicated via satellite communications
- To modify either the ICAO Field 18 DAT/ text string or the CPDLC equipment code, use the COMM tab in the Equipment Template

CPDLC KEY AUTOMATION SYSTEMS *(CONT'D)*

Coverage Area

JO 7110.65, PCG

Data Comm Program Office



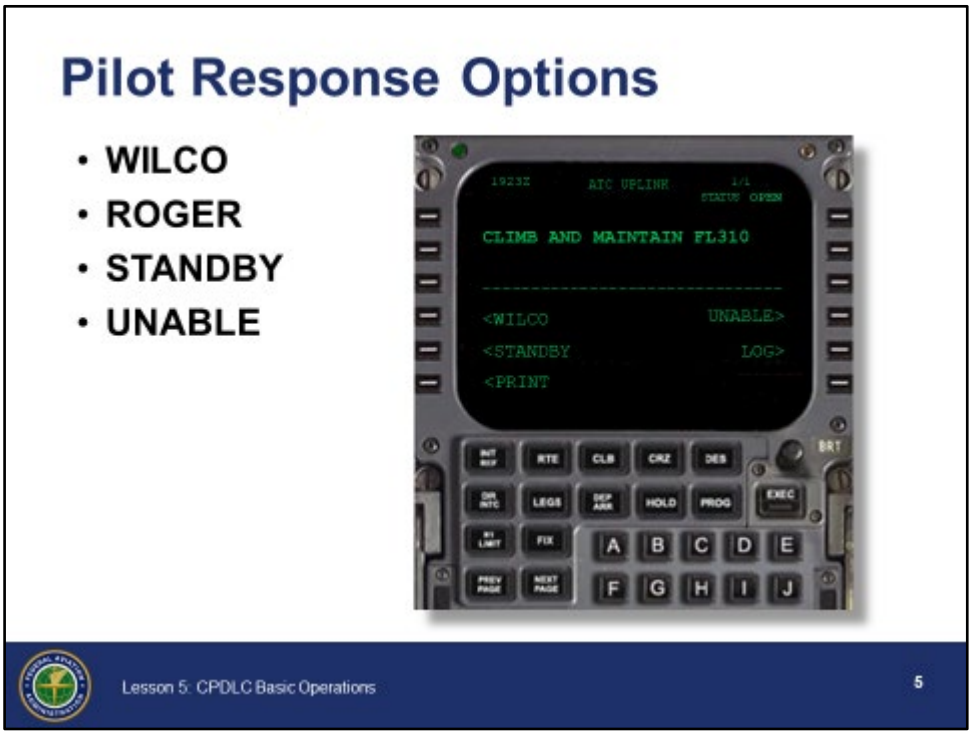
- The DCNS provides, at a minimum, the following coverage:
  - National coverage 16,000' and above
  - Around Terminal Data Link System (TDLS) airports within:
    - 60 nm radius - 12,000' and above
    - 40 nm radius - 10,000' and above
    - 20 nm radius - 2,500' and above
    - 5 nm radius - surface and above

TERMINAL DATA LINK SYSTEM (TDLS) - A system that provides Digital Automatic Terminal Information Service (D-ATIS) both on a specified radio frequency and also, for subscribers, in a text message via data link to the flight deck or to a gate printer. TDLS also provides Pre-departure Clearances (PDC), at selected airports, to subscribers, through a service provider.

CPDLC KEY AUTOMATION SYSTEMS *(CONT'D)*

Pilot Response Options

TI 6110.101, sec. 6



⊙ On the flight deck, the uplink message is displayed on a Control Display Unit (CDU)

- The flight crew manages all FMS inputs using buttons and keys on the CDU
- When a CPDLC message is received, an audio tone will alert the pilot
  - The pilot can then display the uplink message
- To respond to the message the pilot presses one of the multi-function buttons on the side of the CDU
  - The basic response options available are:
    - WILCO (available for clearance or instruction messages)
    - ROGER (available for informational messages)
    - STANDBY
    - UNABLE

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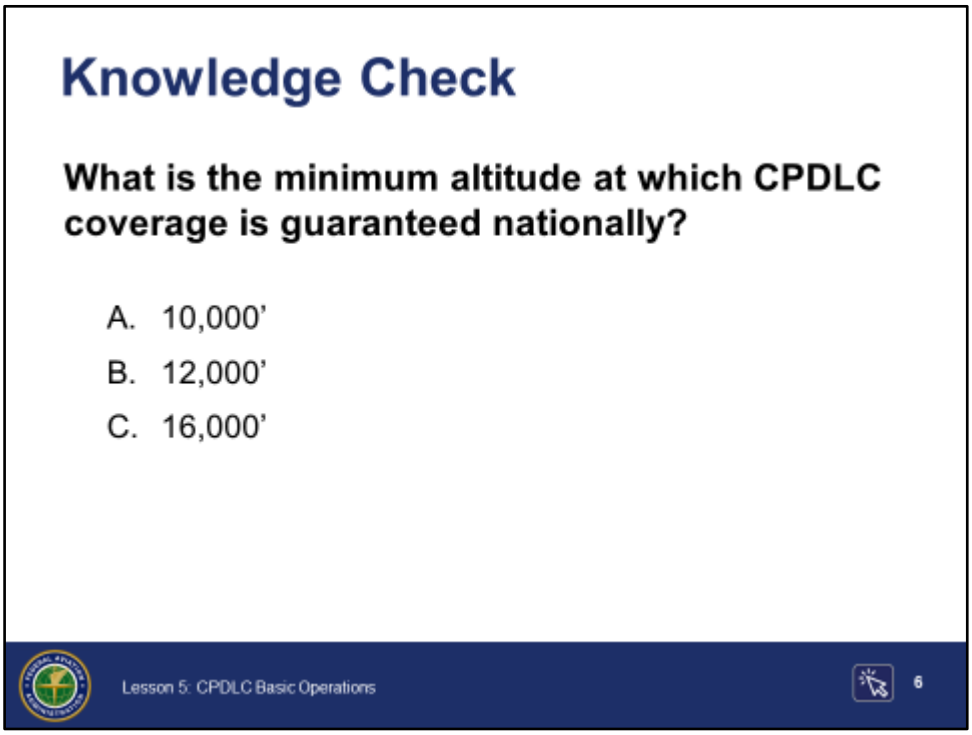
CPDLC KEY AUTOMATION SYSTEMS *(CONT'D)*

Pilot Response Options (Cont'd)

TI 6110.101, sec. 6

- While the system is waiting for a pilot response, the status of the message is considered to be open
- When a WILCO, ROGER, or UNABLE response is received, the system will set the message status to closed
- Appropriate ACL and FDB changes are based on the pilot response
  - If a pilot responds with STANDBY the message is still considered to be open

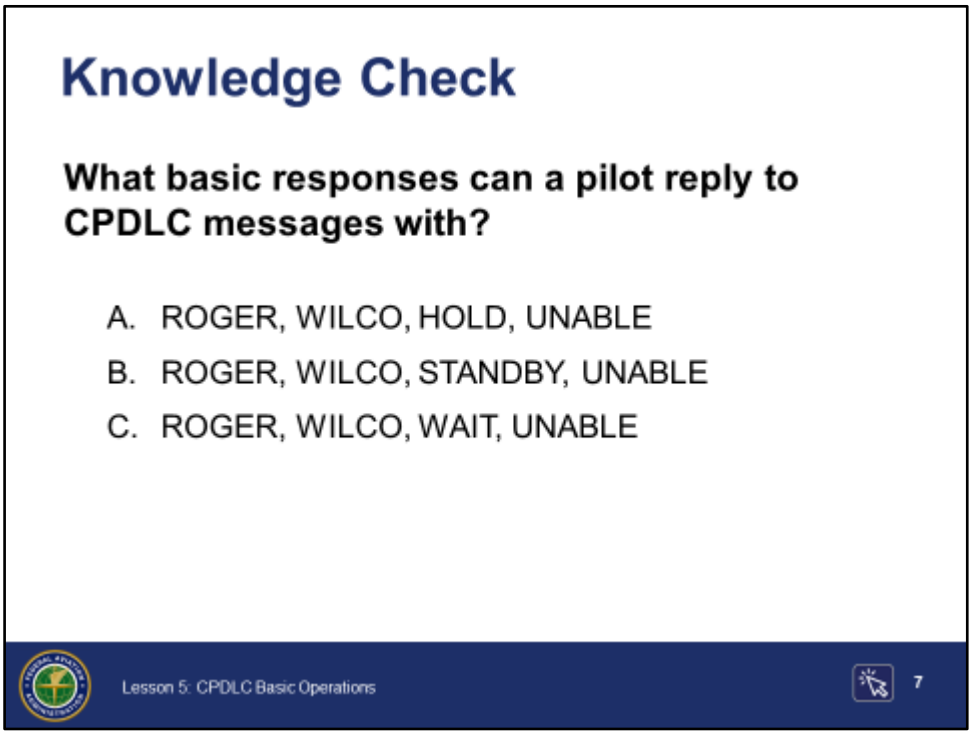
Knowledge Check



Question: What is the minimum altitude at which CPDLC coverage is guaranteed nationally?

Answer: *C. 16,000'*

Knowledge Check



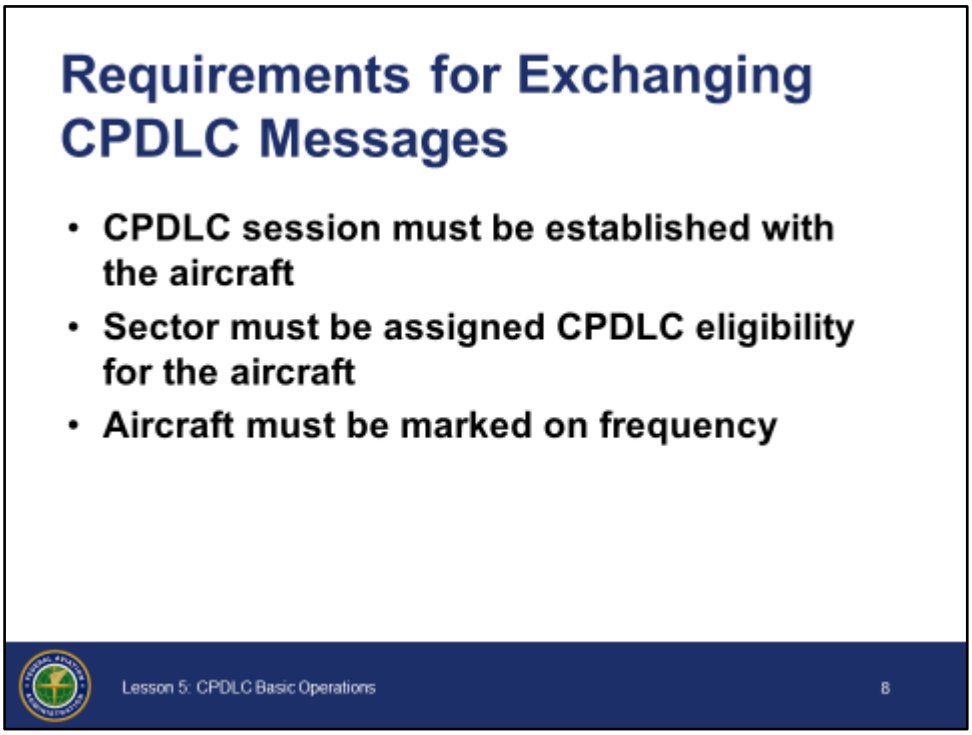
Question: What basic responses can a pilot reply to CPDLC messages with?

Answer: *B. ROGER, WILCO, STANDBY, UNABLE*

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES

Requirements for Exchanging CPDLC Messages

TI 6110.101, sec. 6

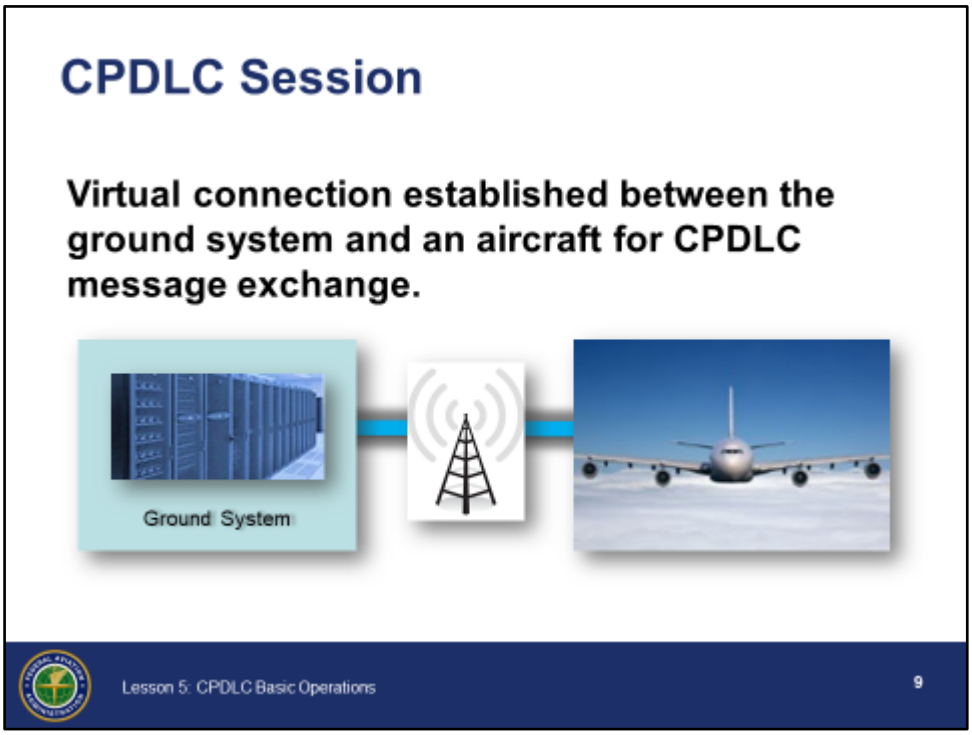


- Three requirements must be satisfied for a sector to be able to exchange CPDLC messages with an aircraft
  - CPDLC session must be established with the aircraft
  - Sector must be assigned CPDLC eligibility for the aircraft
  - Aircraft must be marked on frequency

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

CPDLC Session

TI 6110.101, sec. 6



CPDLC SESSION - The virtual connection that must be established between a properly equipped aircraft and the CPDLC ground system in order to exchange CPDLC messages.

- It is impossible to communicate with an aircraft using CPDLC if a CPDLC session has not been established
- To the pilot, the United States CPDLC ground system is considered a single entity and referred to as KUSA
  - A pilot must log on to KUSA before the session can get established
  - There are two ground systems adjacent to the United States, the Canadian system and the Advanced Technologies and Oceanic Procedures (ATOP) system
- Sessions are typically started automatically after a pilot logs on to the system
  - For proposed departures from TDLS equipped airports the sessions are started at the airport, which allows the aircraft to receive a pre-departure clearance

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REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

CPDLC Session (Cont'd)

TI 6110.101, sec. 6

- For active flights, CPDLC starts the sessions based on a number of triggering events

  Examples:

  - Flights inbound from Canada and ATOP
  - Departures from non-TDLS airports

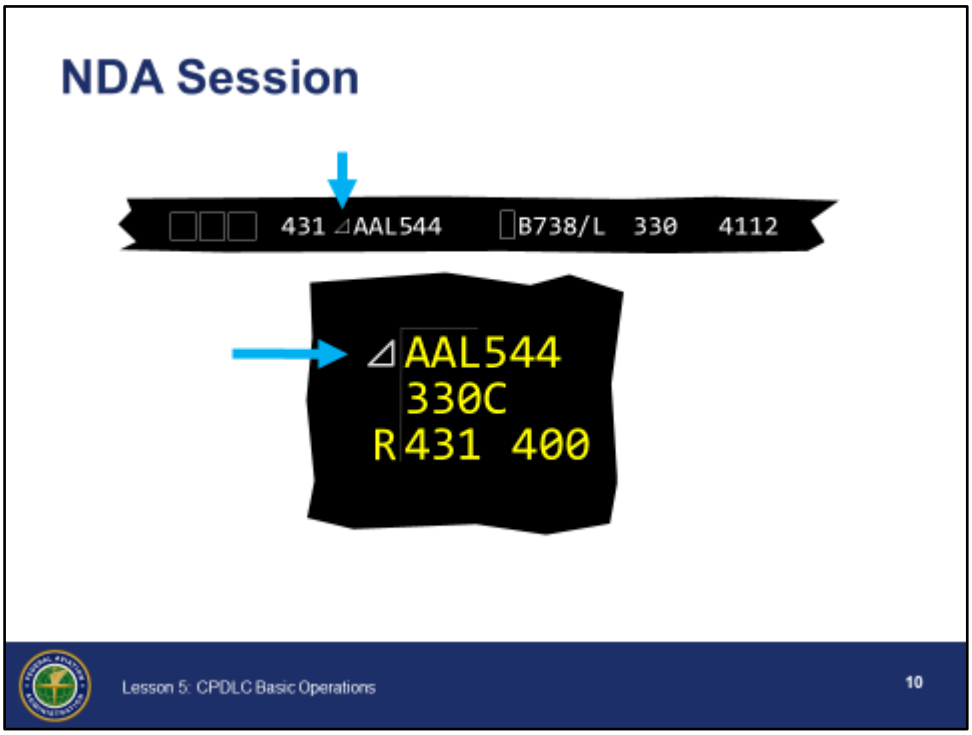
    NOTE: For departures from non-TDLS airports, the system will wait until the aircraft reaches an adapted altitude in en route airspace before automatically starting the session. This prevents the audible alarm that sounds in the flight deck when a CPDLC message is received from distracting the flight crew during the departure phase of flight.

- Once a session is started it will typically remain active throughout the en route portion of the flight
- Sessions can also be started manually by controllers

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

NDA Session

TI 6110.101, sec. 6



- There are two types of CPDLC sessions:
  - Next Data Authority (NDA)
  - Current Data Authority (CDA)

NDA SESSION - An NDA session exists when the connection is between the aircraft and the next ground system that will exchange CDPLC messages with the aircraft.

- An NDA session is intended to ensure there is no loss of CPDLC service for an aircraft as it transitions from one ground system to the next

  Example: An aircraft in Canadian airspace inbound to US airspace. While in Canadian airspace the aircraft would have a CDA session with the Canadian CPDLC ground system and an NDA session with the US ground system. Once the Canadian CDA session is terminated, the US NDA session will automatically become a CDA session.

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REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

NDA Session (Cont'd)

TI 6110.101, sec. 6

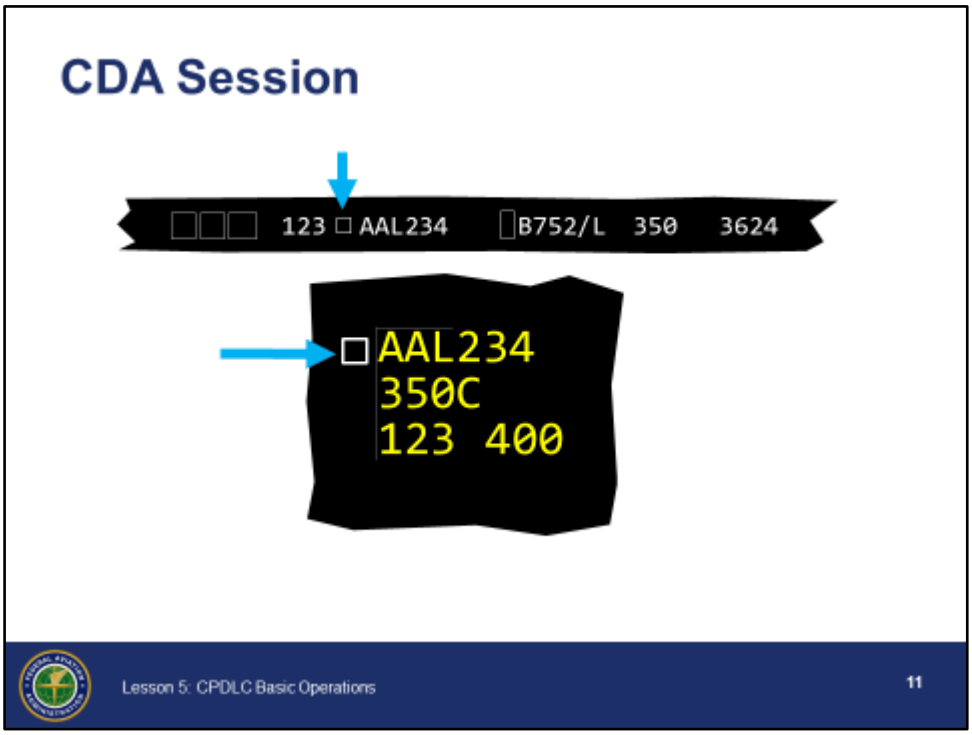
⊙ NDA Session indicator is:

- A white triangle to the left of the call sign
  - Displayed on both the FDB and ACL
- Typically seen only when working adjacent to Canadian and ATOP airspace
- Also displayed momentarily when an active flight logs on to KUSA and the session is first established

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

CDA Session

TI 6110.101, Figure 6-6, and sec. 6.1.2.2



CDA SESSION - A CDA session exists when the connection is between the aircraft and the ground system that is currently permitted to exchange CPDLC messages with the aircraft.

⊙ CDA Session indicator is:

- A white square to the left of the call sign
  - Displayed on both the FDB and on the ACL
- The most frequently seen session indicator for most U.S controllers

NOTE: If an FDB does not include either a CDA or an NDA Session indicator, that aircraft does not have a session established and is unable to communicate via CPDLC.

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

CPDLC Eligibility

TI 6110.101, sec. 6

- Once a CDA session has been established with the aircraft, the CPDLC system ensures that only one control position at a time can communicate with that aircraft
- The one control position allowed to communicate with the aircraft via CPDLC is said to have eligibility
- Eligibility for an aircraft is transferred automatically within the facility as the aircraft proceeds from sector to sector
  - The facility assigning eligibility to sectors is called the Logical Data Authority (LDA)
  - When an aircraft is handed off to a new ERAM facility, the receiving ERAM facility becomes the LDA
  - Assignment of LDA between ERAM facilities is accomplished by the active NAP

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REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

CPDLC Eligibility (Cont'd)

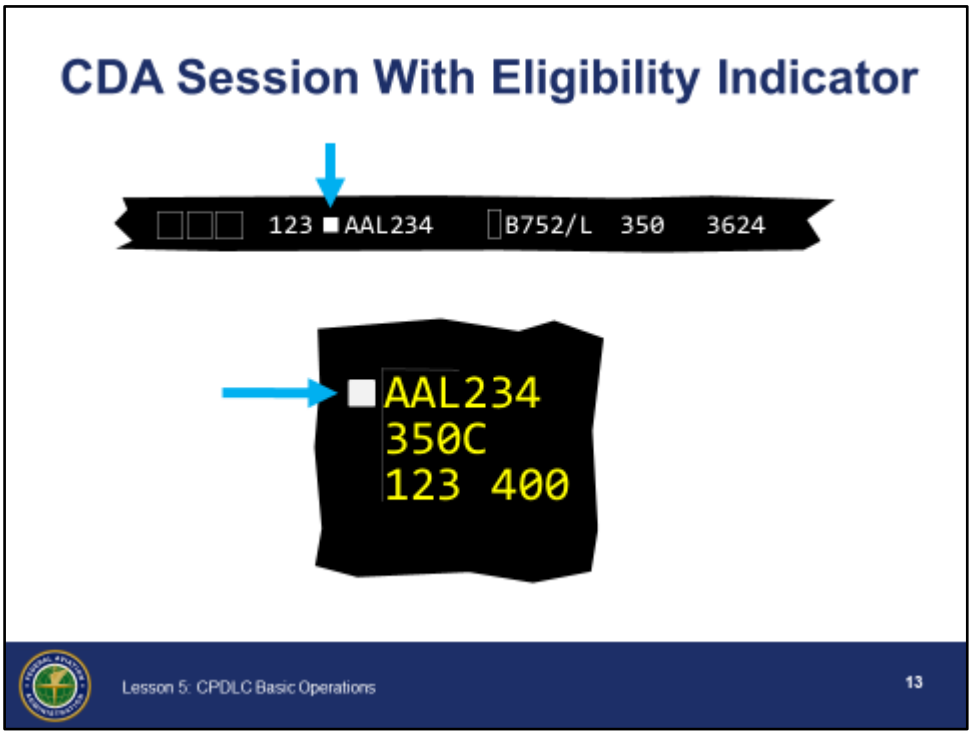
TI 6110.101, sec. 6

- Controllers have two options for manual control of CPDLC eligibility:
  - Manually release eligibility and let the system automatically reassign to another sector
  - Manually steal eligibility
    - Stealing eligibility is specific to CPDLC and is not the same thing as stealing track control
    - It is possible to steal eligibility without having track control
    - Stealing track control does not assign you CPDLC eligibility

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

CDA Session With Eligibility Indicator

TI 6110.101, sec. 6.1.2.3



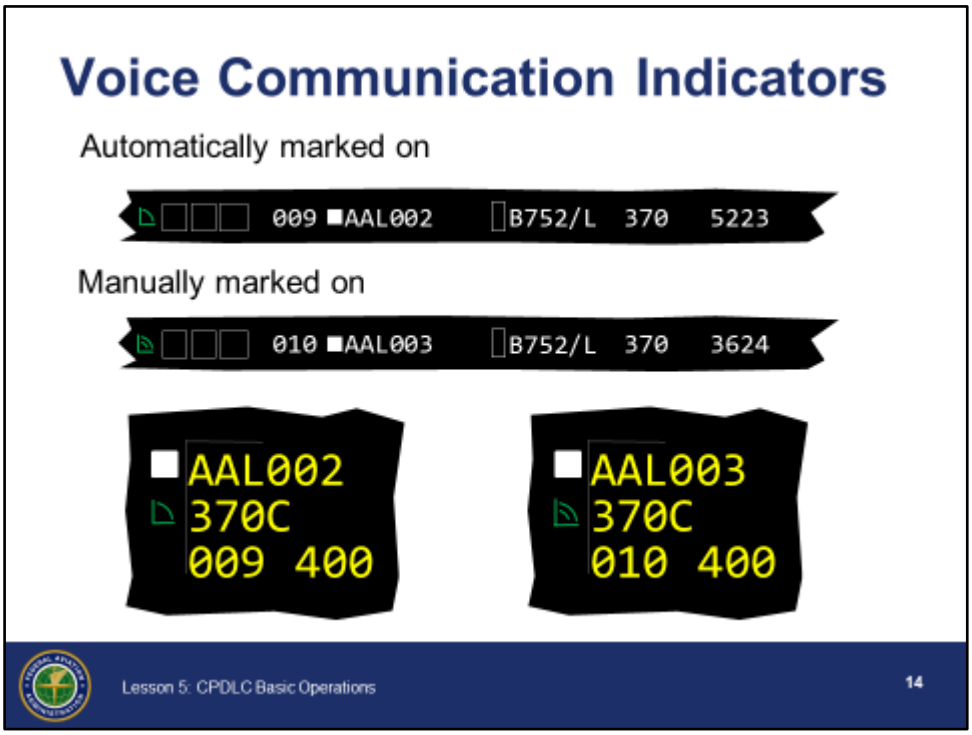
- Eligibility is indicated by a filled-in CDA Session indicator
  - Displayed on both the ACL and the FDB
    - The sector with eligibility for an aircraft will always have an FDB displayed

Ask students whether the controller working AAL234 would be able to communicate with the aircraft using CPDLC. The answer is no. Two of the three requirements have been met, the aircraft has a CDA session and the sector has eligibility. The third requirement has not been met. The aircraft must be marked on frequency, which is the next topic.

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

Voice Communication Indicators

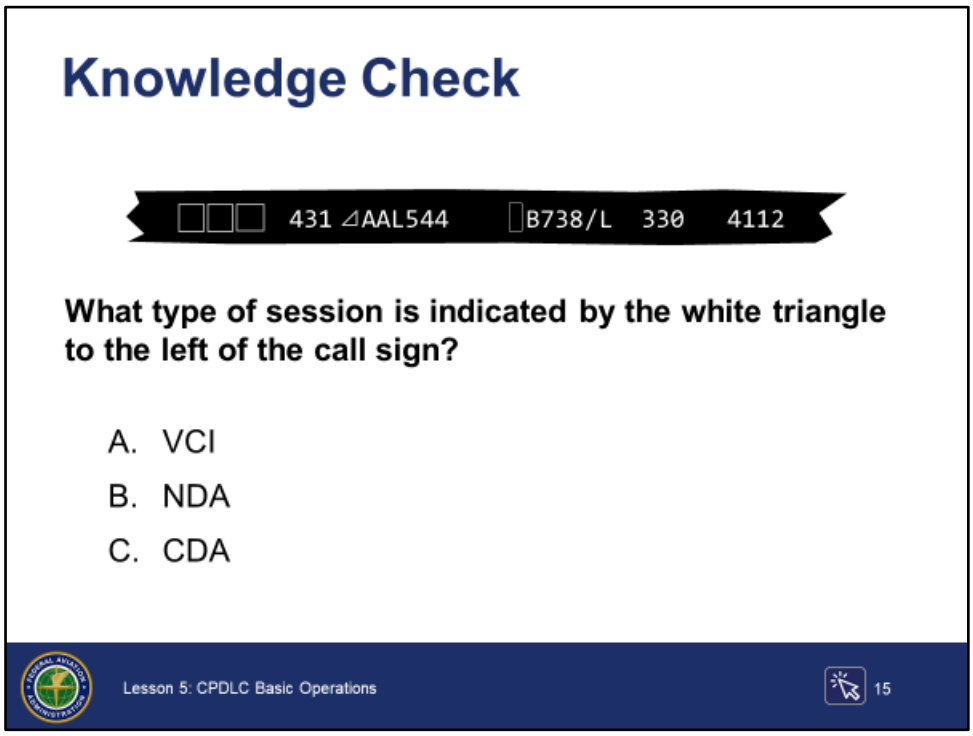
TI 6110.101, secs. 5.2.1, 5.3, 6, 7



- The third condition that must be satisfied in order for a sector to be able to communicate with an aircraft via CPDLC is that the aircraft be marked on frequency
- CPDLC will automatically mark the aircraft on frequency at the receiving sector when a pilot downlinks a WILCO response to a MONITOR Transfer of Communication (TOC) uplink
  - This feature is part of a silent check-in
- A Voice Communication Indicator (VCI) with a single arc indicates an aircraft that was automatically marked on frequency, instead of the double arc used to manually mark an aircraft on frequency
  - A Trackball Pick (TBP) or Trackball Enter (TBE) on the single arc VCI will mark the aircraft off frequency
    - TBP or TBE again to manually mark the aircraft on frequency
    - If a manually added VCI is displayed, it cannot be converted to an automatic indicator

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

Knowledge Check

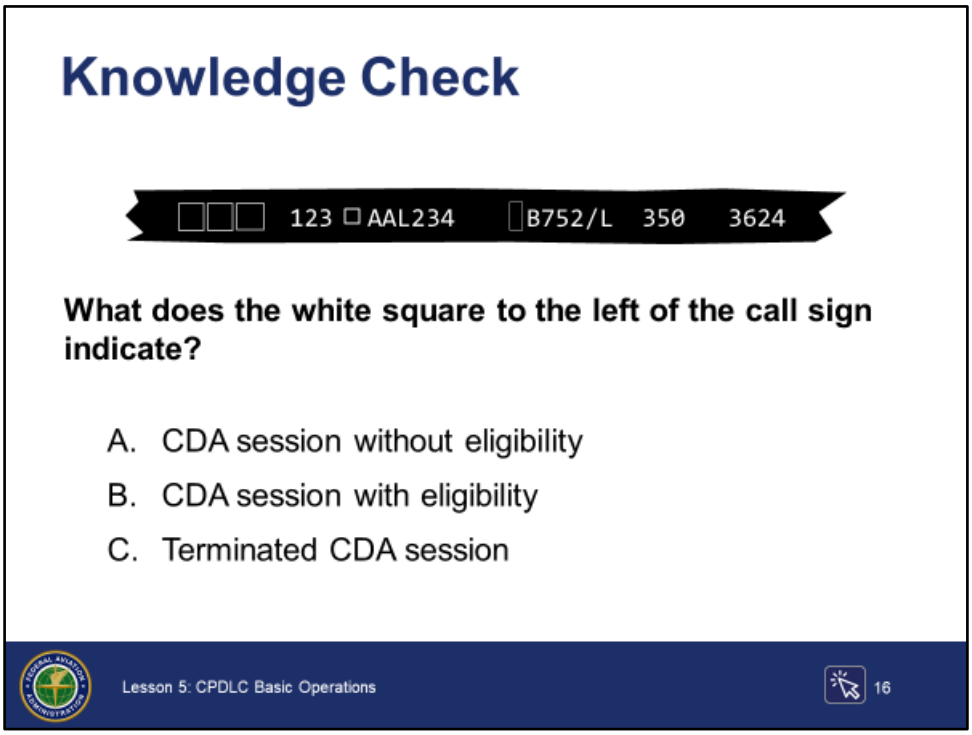


Question: What type of session is indicated by the white triangle to the left of the call sign?

Answer: *B. NDA*

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

Knowledge Check

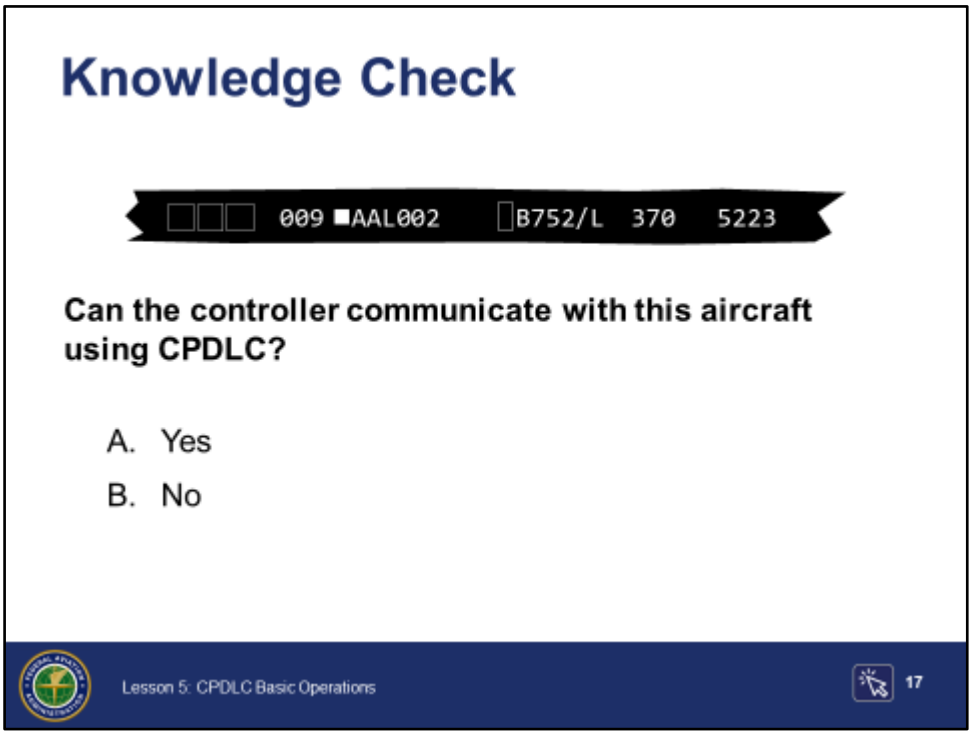


Question: What does the white square to the left of the call sign indicate?

Answer: *A. CDA session without eligibility*

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

Knowledge Check



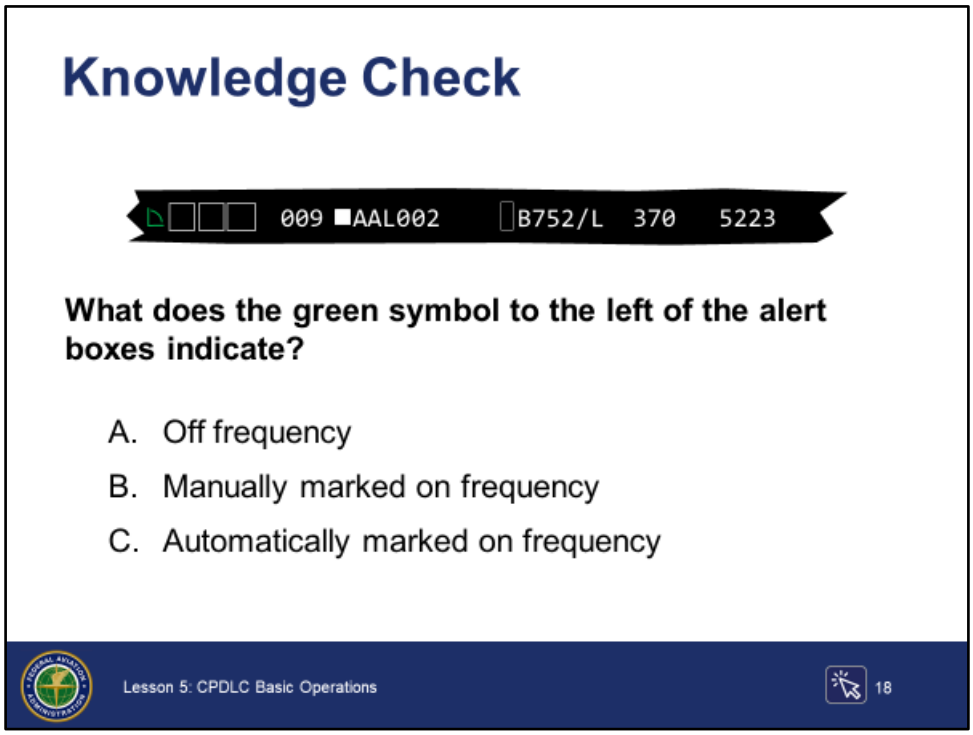
Question: Can the controller communicate with this aircraft using CPDLC?

Answers: *B. No, two of the three requirements for exchanging CPDLC messages have been satisfied, but the aircraft has not been marked on frequency.*

Ask the students what the other two requirements are, i.e., 1) CPDLC session must be established, 2) Sector must be assigned CPDLC eligibility.

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

Knowledge Check

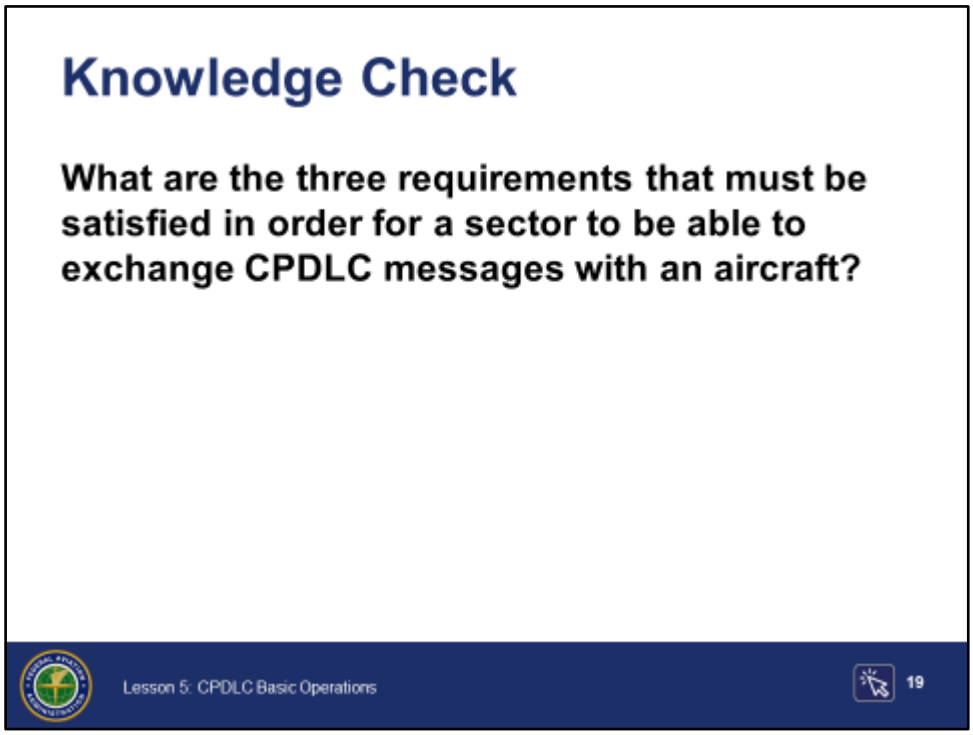


Question: What does the green symbol to the left of the alert boxes indicate?

Answers: *C. Automatically marked on frequency*

REQUIREMENTS FOR EXCHANGING CPDLC MESSAGES *(CONT'D)*

Knowledge Check



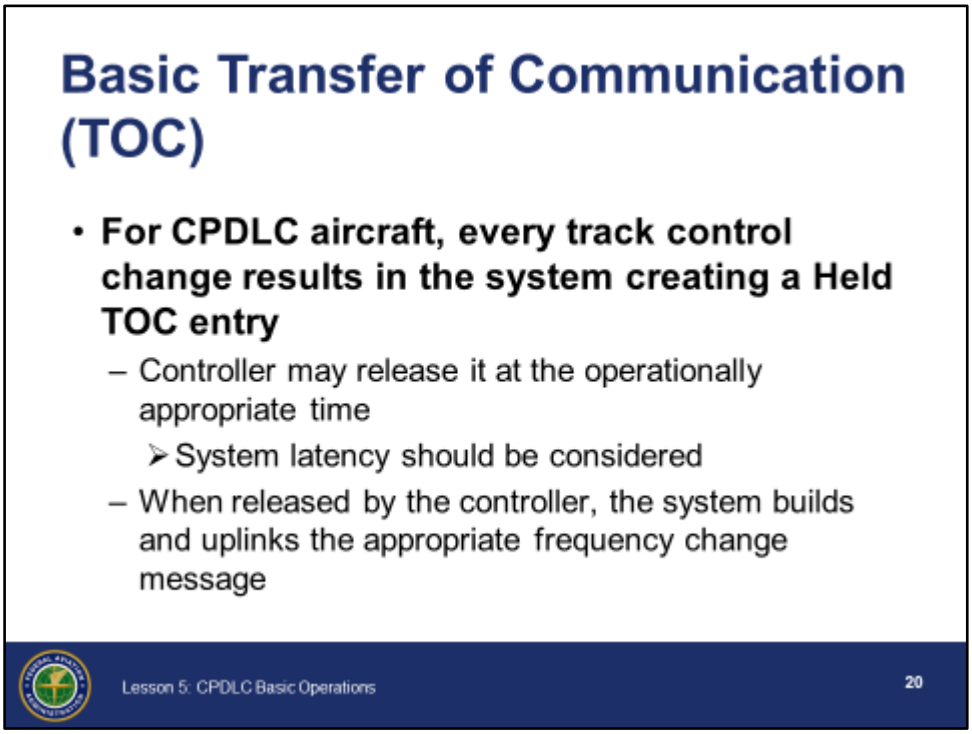
Question: What are the three requirements that must be satisfied in order for a sector to be able to exchange CPDLC messages with an aircraft?

Answer: *The aircraft must have a session established; the sector must be assigned eligibility; and the aircraft must be marked on frequency.*

BASIC TRANSFER OF COMMUNICATION (TOC)

Basic Transfer of Communication (TOC)

TI 6110.101, sec. 7



HELD TOC - A TOC uplink generated after an outbound handoff is accepted that has not been released to the aircraft to transfer CPDLC to the next sector/facility.

⊙ For CPDLC aircraft, every track control change results in the system creating a Held TOC entry

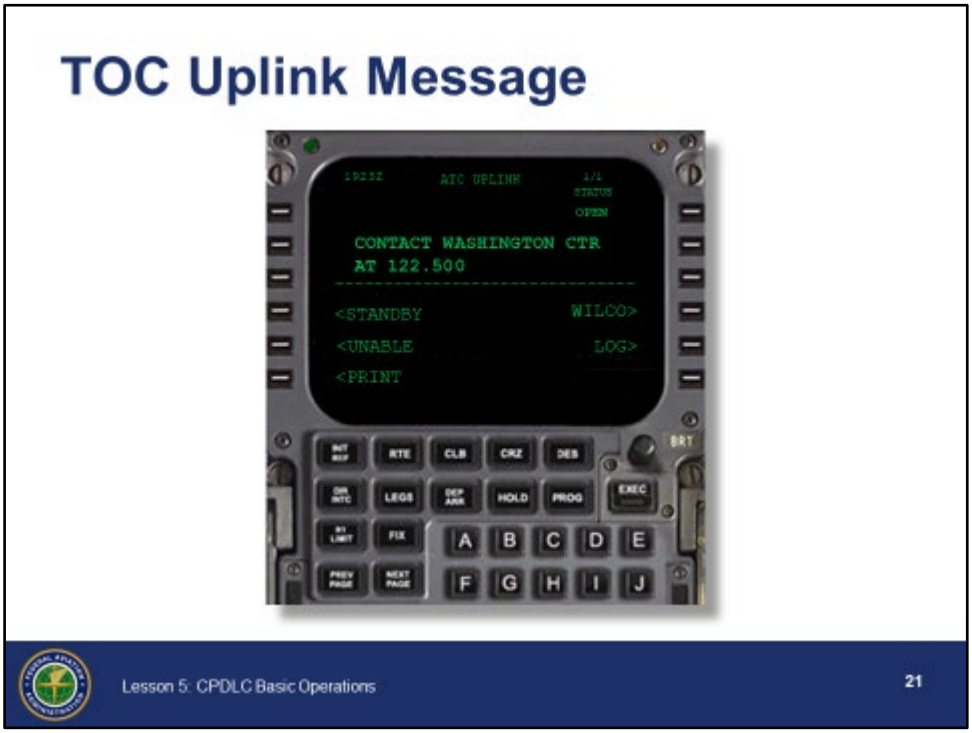
- The controller may release it at the operationally appropriate time
  - System latency should be considered

  NOTE: The term System Latency refers to the amount of time that elapses from the time an uplink command is entered to the time a pilot response is received. It must always be considered by the controller when using CPDLC.
- When released by the controller, the system builds and uplinks the appropriate frequency change message

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

TOC Uplink Message

TI 6110.101, sec. 7

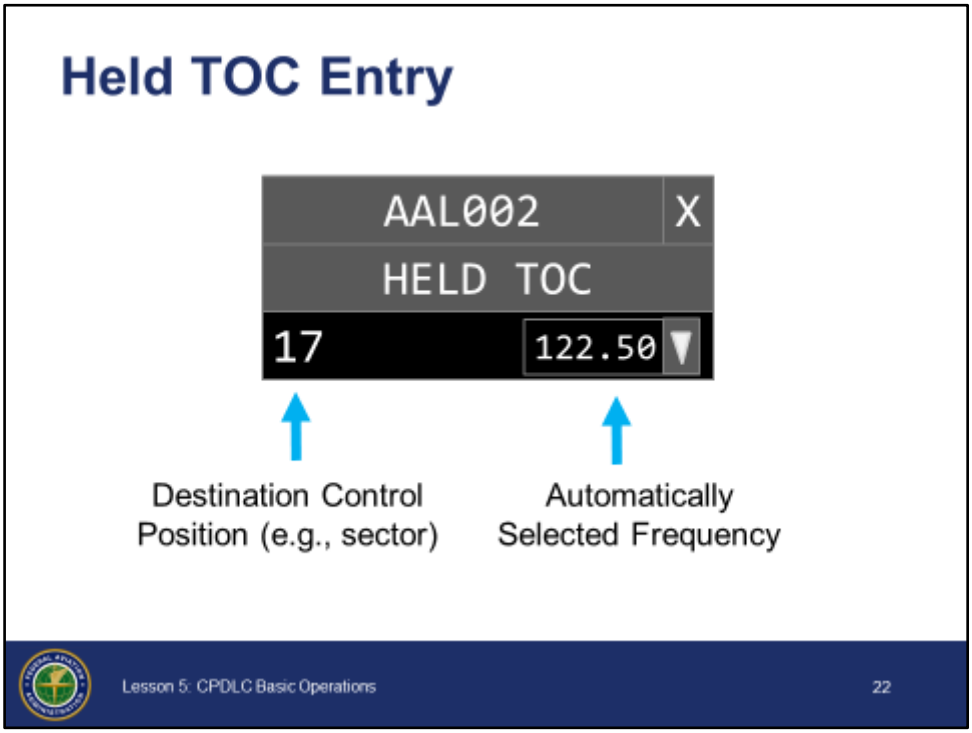


- A TOC uplink instructs the flight crew to either CONTACT or MONITOR Air Traffic Control (ATC) on a specified frequency
- A CONTACT instruction means the flight crew must check-in via voice
  - After the flight crew checks-in, the controller must manually mark the aircraft on frequency to communicate via CPDLC
- A MONITOR instruction means the flight crew must switch to the specified frequency but will not check-in via voice
  - This is considered a silent check-in and includes a confirmation of assigned altitude and, if necessary, an Altimeter Setting uplink
  - When a pilot responds to the TOC uplink with a WILCO, it is assumed the switch has been made to the new frequency
  - The ACL and FDB entry at the receiving sector will display the Auto On Frequency indicator (Auto VCI)

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Held TOC Entry

TI 6110.101, sec. 7.2

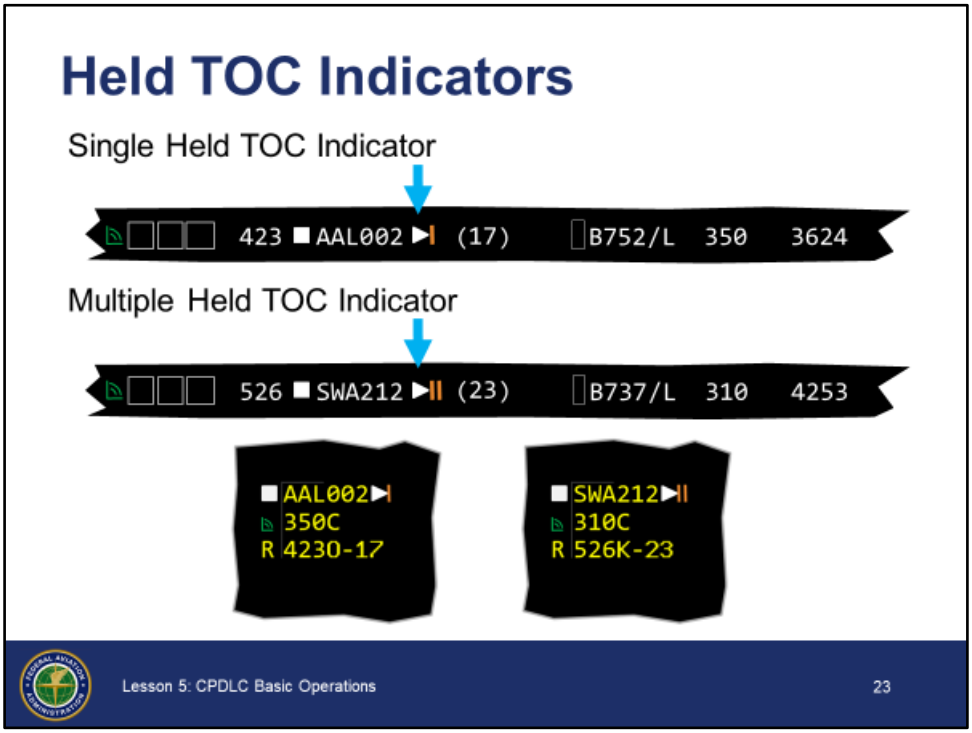


- Whenever a track control change is completed, the system will automatically create an entry in the Held TOC menu
  - Track control changes include both handoffs and stolen tracks
- A normal Held TOC entry includes a destination control position, which could be any of the following:
  - Internal sector
  - Adjacent center and sector
  - External facility and control position (e.g., TRACON)
- A normal Held TOC entry also includes an automatically selected frequency appropriate for the destination control position

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Held TOC Indicators

TI 6110.101, sec. 7.2.1



- Single Held TOC Indicator:
  - Is displayed at the sector with eligibility whenever there is a single Held TOC available for release
  - Is a white triangle with a single orange vertical line
  - Appears to the right of the call sign on both the ACL and the FDB

NOTE: If multiple track control changes take place before the single Held TOC is released, the system will add a separate Held TOC entry for each additional track control change. This allows the controller an opportunity to select which Held TOC to release.

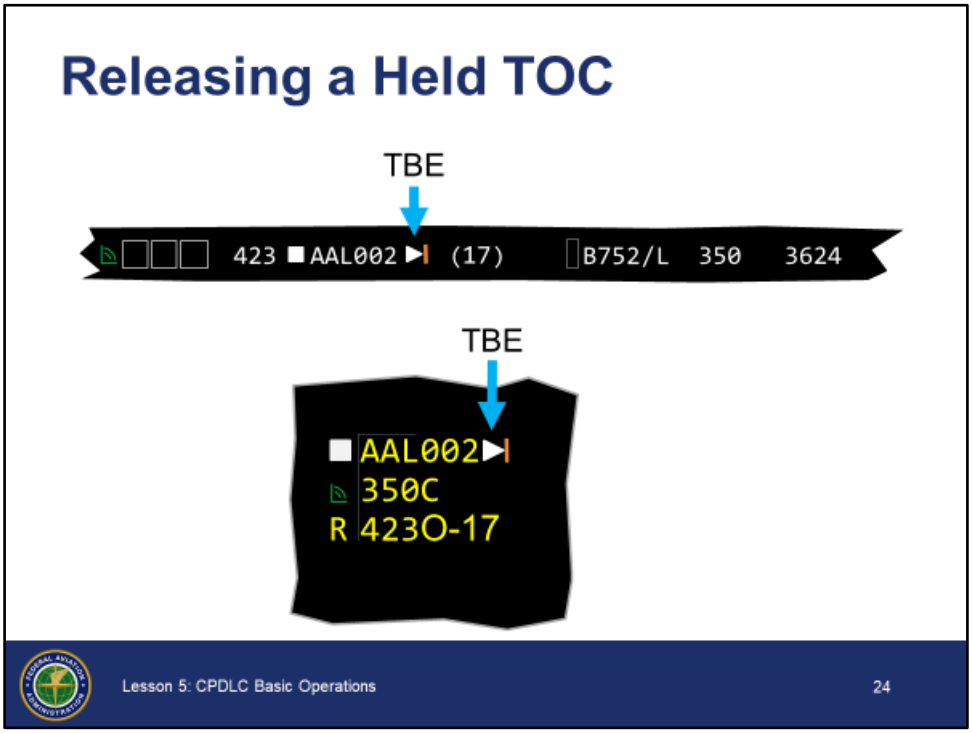
- Multiple Held TOC indicator:
  - Is displayed at the sector with eligibility whenever there are multiple Held TOCs available for release
  - Is a white triangle with two orange vertical lines
  - Appears to the right of the call sign on both the ACL and the FDB
- Held TOC indicators can be selected to open the Held TOC Menu

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Releasing a Held TOC

TI 6110.101, sec. 7.2

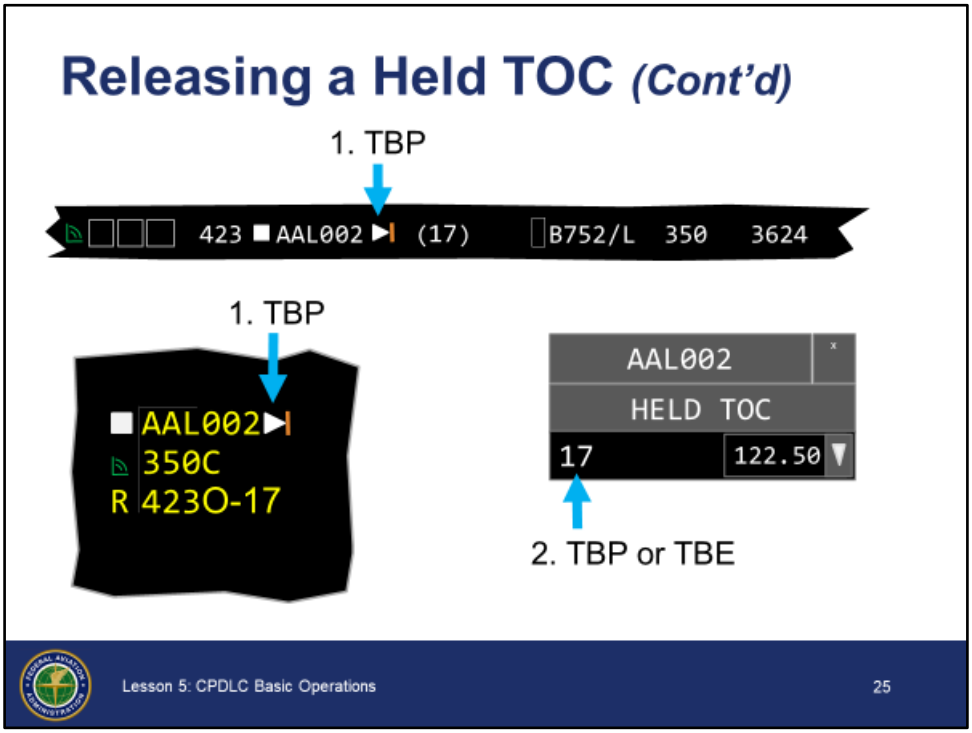
TI 6110.108, p. 28



- There are three options for releasing a Held TOC
  - Using the Held TOC indicator
  - Using the Held TOC Menu
  - Keyboard entry
- For the first option, TBE on the Held TOC indicator to release a single Held TOC

Releasing a Held TOC (Cont'd)

TI 6110.101, sec. 7.2

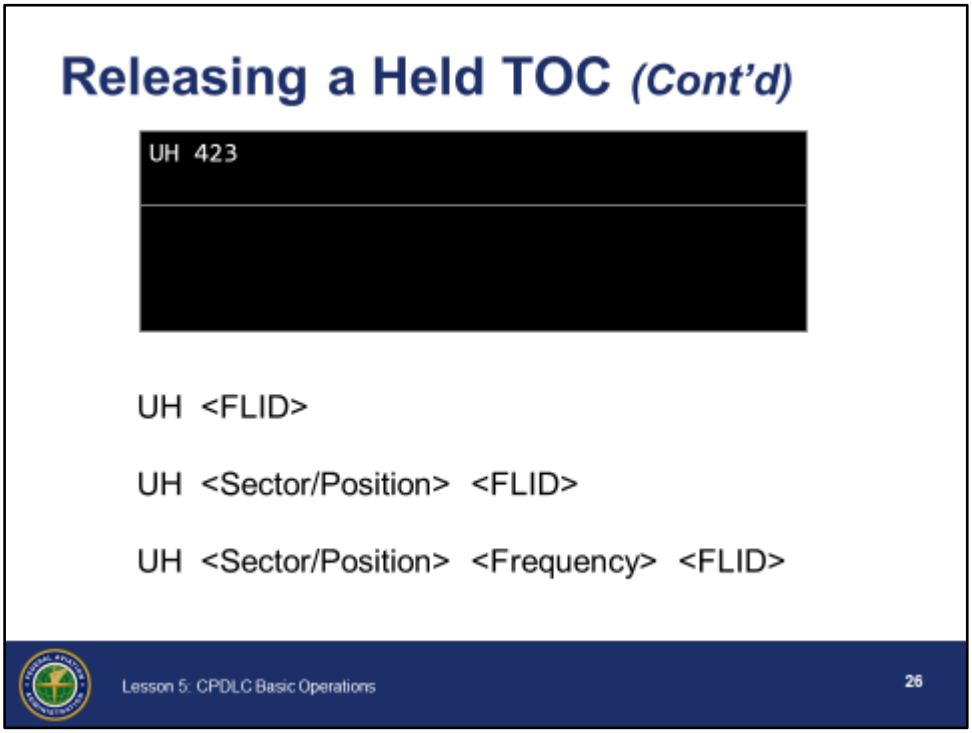


- For the second option, use the Held TOC Menu
  - This option can be used with either the single Held TOC or the multiple Held TOC indicators
- To open the Held TOC Menu for a single Held TOC:
  - TBP on the desired single Held TOC indicator
- To open the Held TOC Menu when there are multiple Held TOCs:
  - TBP or TBE on the desired multiple Held TOC indicator
- Once the menu is open, TBP or TBE on the desired destination control position to release the Held TOC

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Releasing a Held TOC (Cont'd)

TI 6110.101, sec. 6.2.3.14



⊙ For the third option, use the keyboard to release a Held TOC with the UH command

Syntax: UH <FLID> (for single Held TOC)

UH <Sector/Position> <FLID>

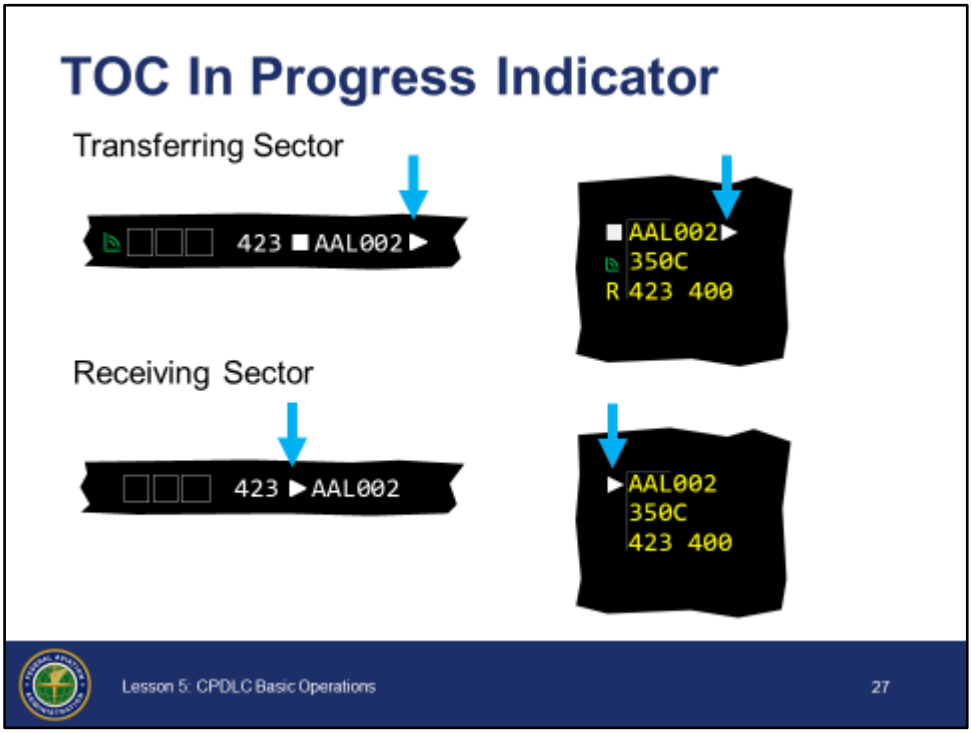
UH <Sector/Position> <Frequency> <FLID>

- The <Sector/Position> field can be one of the following:
  - Local sector (e.g., 17)
  - Sector at an adjacent center (e.g., T44)
  - Facility designator and optional control position (e.g., R, R1E)
- The <Frequency> field can be any adapted VHF or HF frequency
  - Use the format ddd.d(d)

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

TOC In Progress Indicator

TI 6110.101, sec. 7

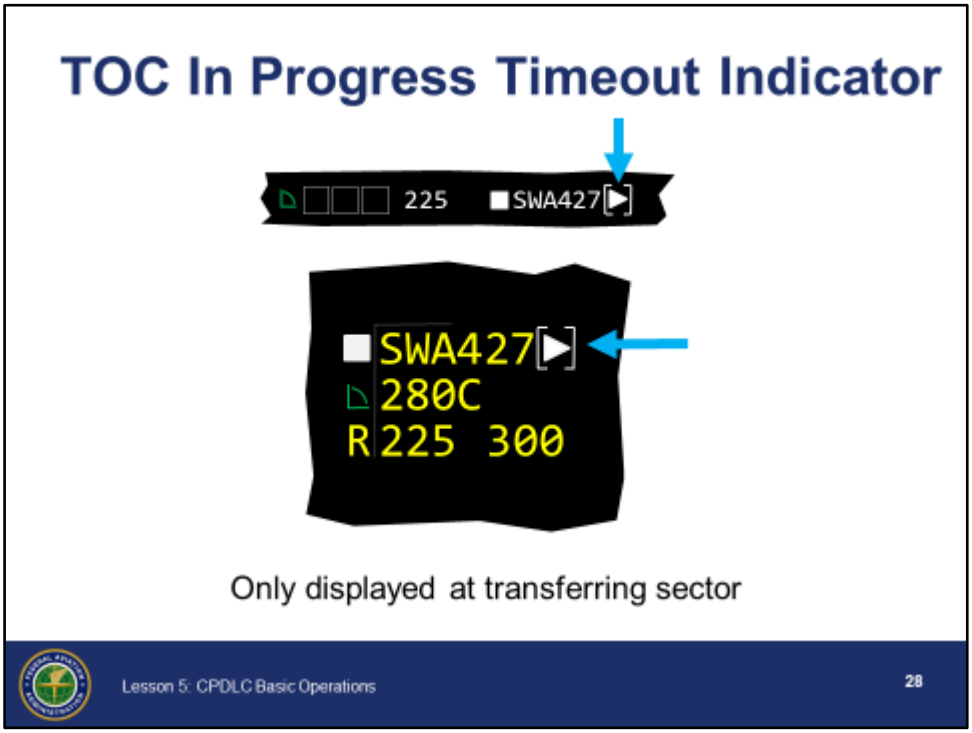


- Once the controller releases the Held TOC, the system will uplink the TOC message to the aircraft
  - During the period between release of the Held TOC and receipt of a response from the aircraft, a TOC In Progress indicator will be displayed on the ACL and FDB
  - Transferring sector TOC In Progress indicator
    - White triangle to the right of the call sign with orange vertical line removed
  - Receiving sector TOC In Progress indicator
    - CDA Session indicator (without eligibility) is replaced by a white triangle to the left of the call sign

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

TOC In Progress Timeout Indicator

TI 6110.101, sec. 7

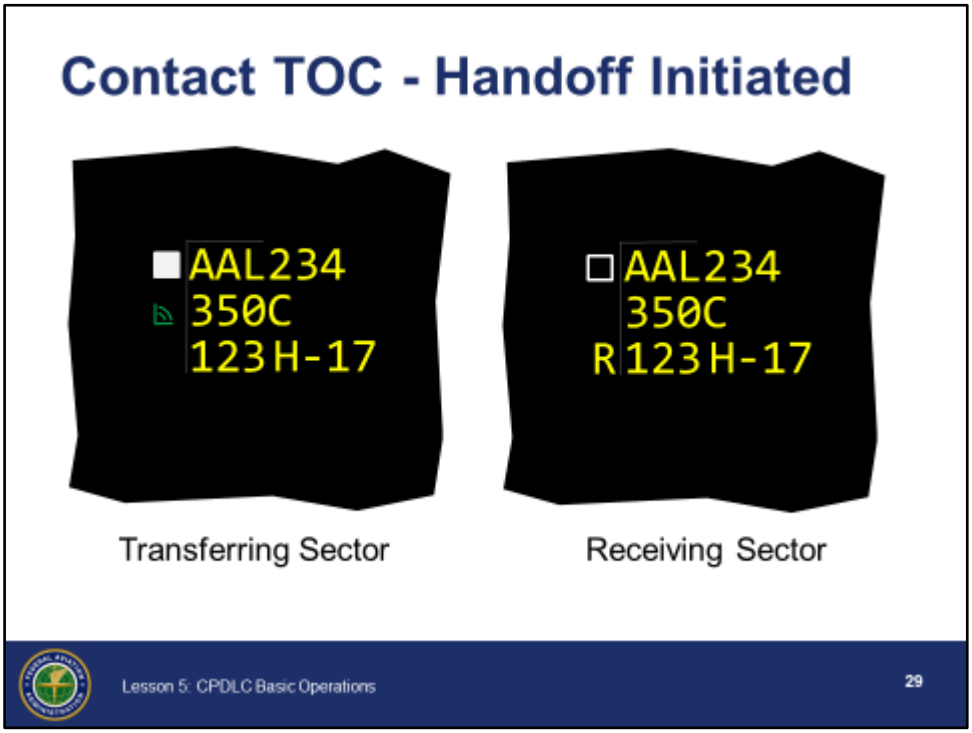


- If an adapted amount of time passes without a pilot response to a TOC uplink, the TOC In Progress indicator will change to the TOC In Progress Timeout indicator
  - On the ACL and FDB, white brackets will be added to either side of the TOC In Progress indicator
  - The TOC Timeout indicator is only displayed at the transferring sector
  - Since the uplink is still open, no other uplink may be entered for that aircraft

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Contact TOC - Handoff Initiated

TI 6110.101, sec. 7



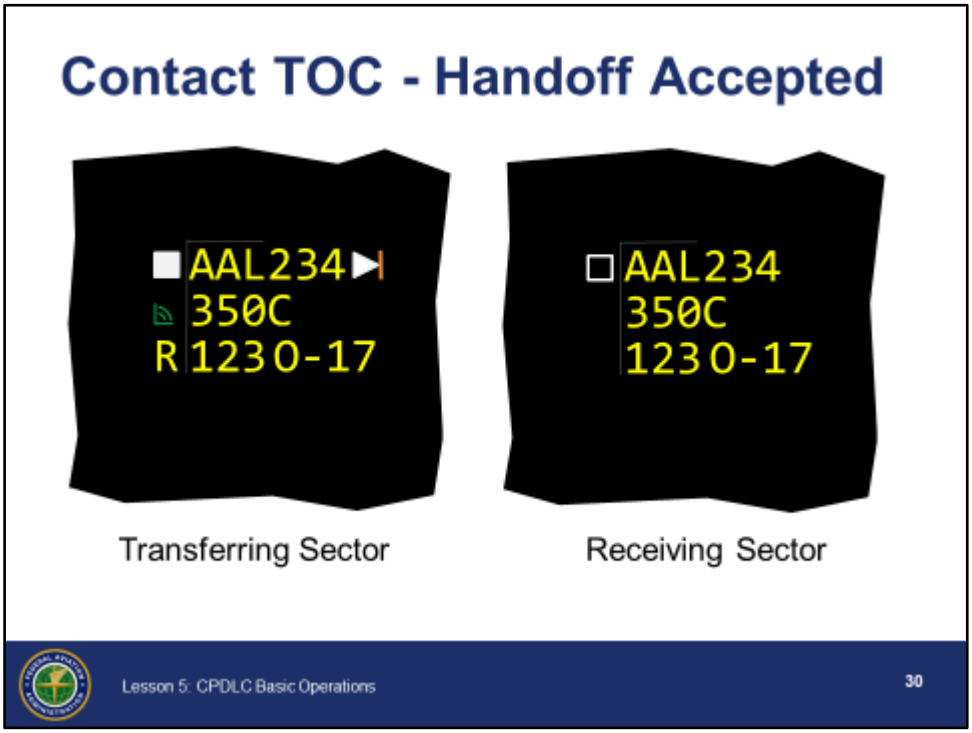
NOTE: This slide and the following four slides depict a typical Transfer of Communication using CPDLC, when the instruction being sent in the uplink is CONTACT. The slides depict only the FDB. However, the same CPDLC changes would be occurring on the ACL.

- A Contact TOC instructs the pilot to check in via voice
- When the transferring sector initiates the handoff, they will see:
  - CDA Session With Eligibility indicator
  - On frequency indicator (this example has a Manual On Frequency indicator (VCI) but it could be the automatic version)
- The receiving sector will see:
  - CDA Session indicator (without eligibility)

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Contact TOC - Handoff Accepted

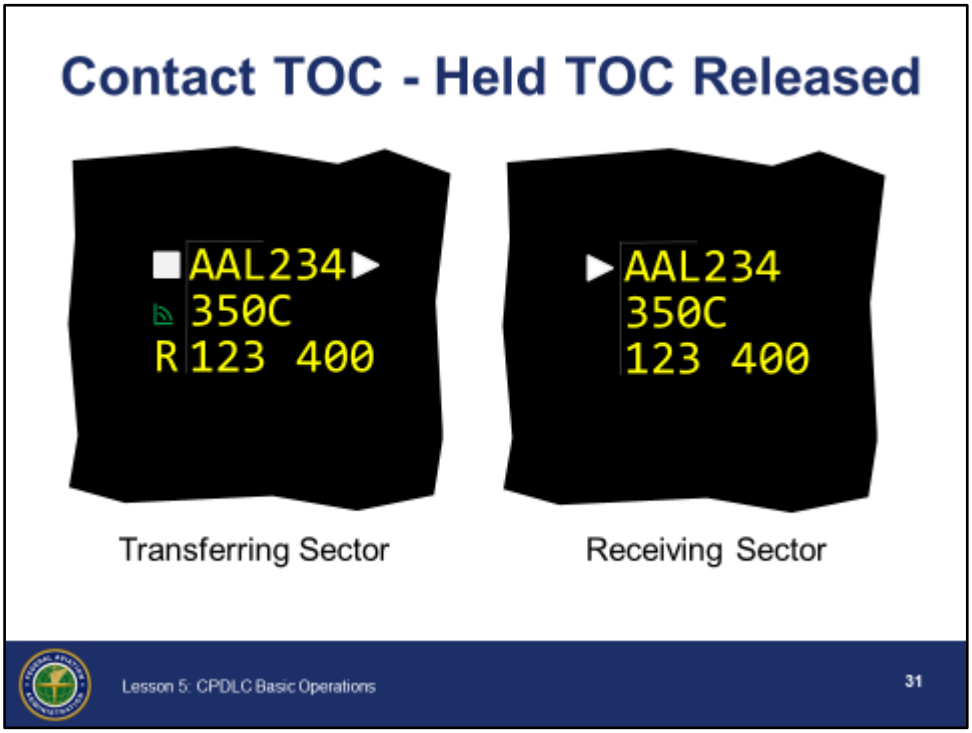
TI 6110.101, sec. 7.2



- Once the receiving sector accepts the handoff, track control changes to the receiving sector and the system builds a Held TOC message
  - Release of the Held TOC is controlled by the sector with eligibility (i.e., the transferring sector)
  - The transferring sector will see:
    - Single Held TOC indicator
    - CDA Session With Eligibility indicator
    - On frequency indicator
  - The receiving sector will see:
    - CDA Session indicator (without eligibility)

Contact TOC - Held TOC Released

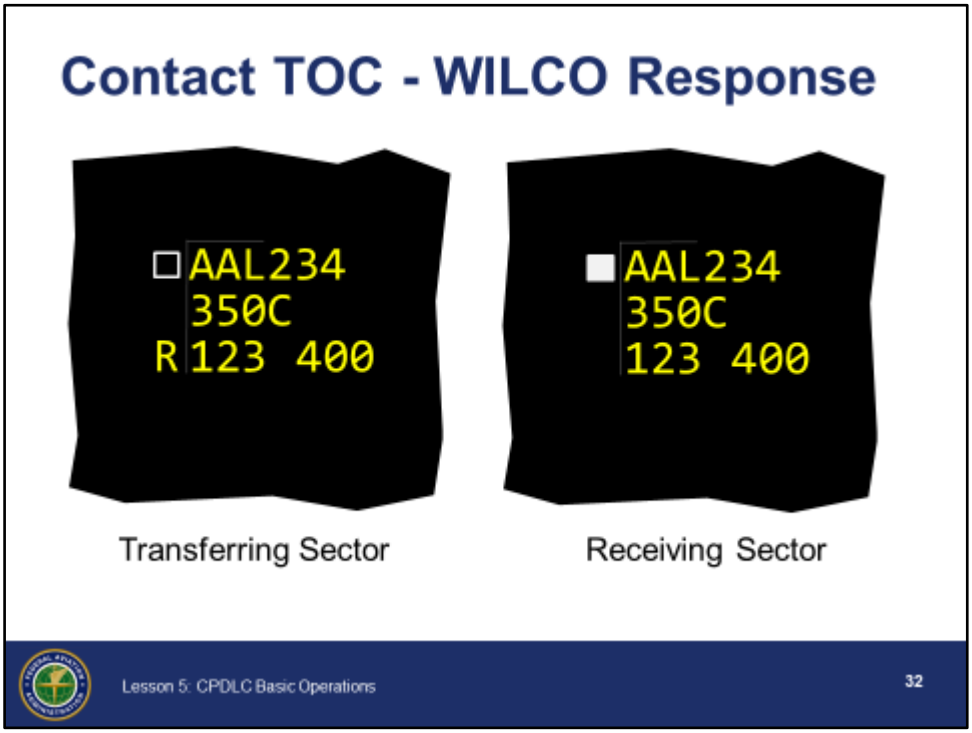
TI 6110.101, sec. 7.2



- After the transferring controller releases the Held TOC, the TOC In Progress indicator:
  - Is displayed at transferring and receiving sectors
  - Will remain until a response is received
  - The transferring sector will see:
    - TOC In Progress indicator to the right of the call sign
    - CDA Session With Eligibility indicator
    - Manual On Frequency indicator (VCI)
  - The receiving sector will see:
    - TOC In Progress indicator to the left of the call sign
      - Replaces CDA Session indicator (without eligibility)

Contact TOC - WILCO Response

TI 6110.101, sec. 7.2



- When a WILCO response is received from the aircraft, the system will automatically transfer eligibility to the receiving sector
- The transferring sector will see:
  - CDA Session indicator (without eligibility)
  - Removal of:
    - VCI
    - TOC In Progress indicator
- The receiving sector will see:
  - CDA Session With Eligibility indicator
  - Removal of:
    - TOC In Progress indicator

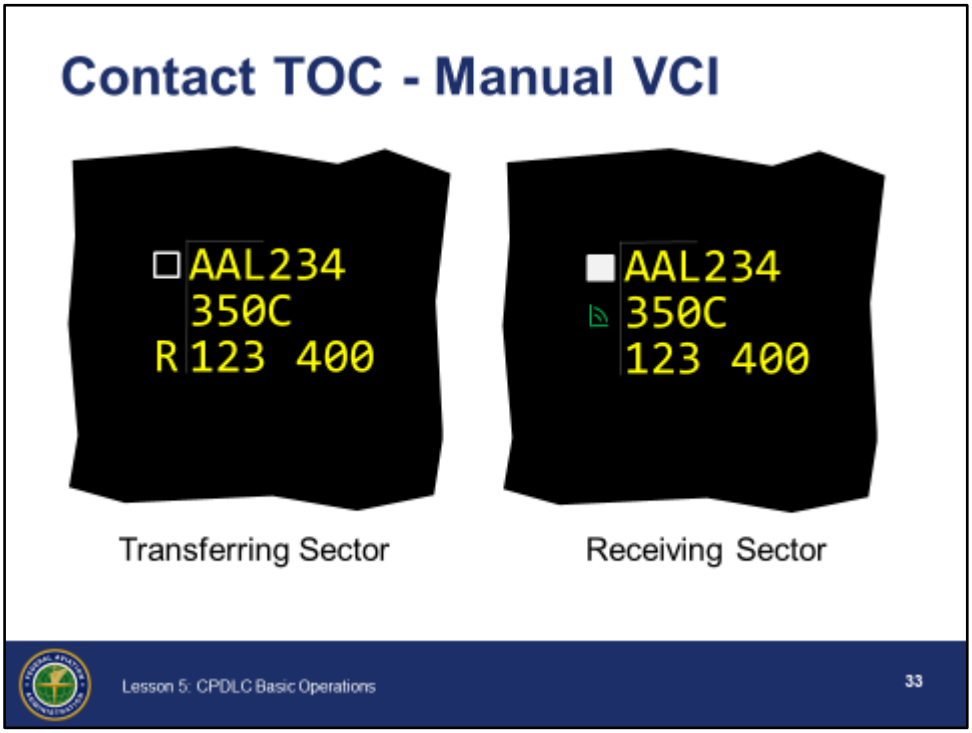
NOTE: At this point the receiving sector still cannot communicate with the aircraft using CPDLC, because the aircraft has not been marked on frequency.

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Contact TOC - Manual VCI

JO 7110.65, par. 2-1-17

TI 6110.101, sec. 7.2

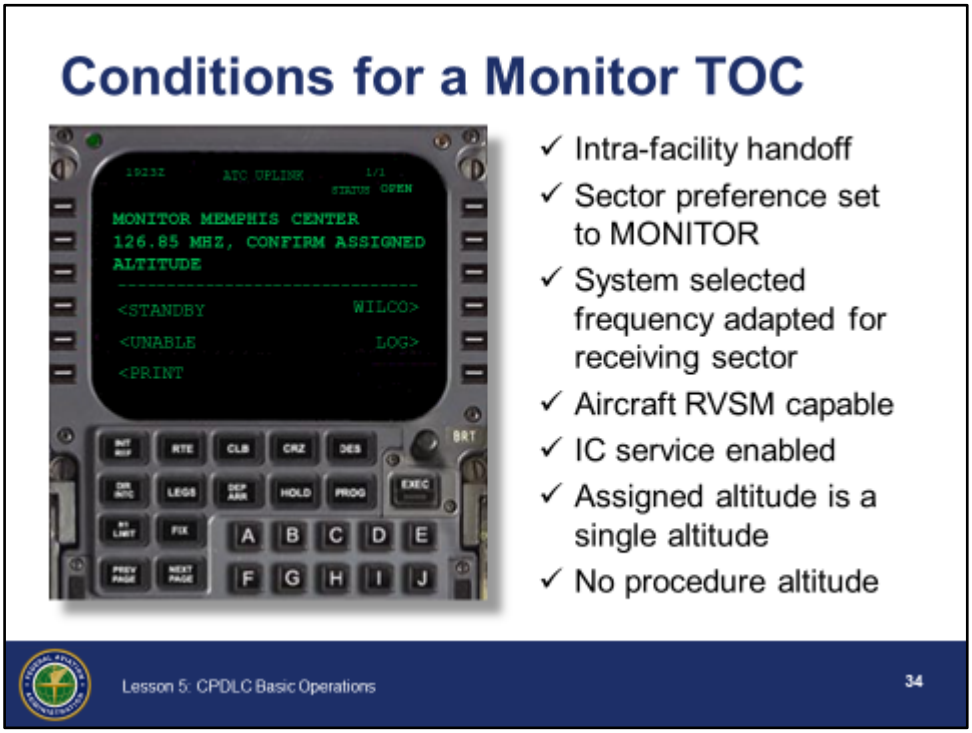


- Once the aircraft checks in via voice:
  - Manually mark the aircraft on frequency, then
    - You may communicate with the aircraft via CPDLC

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Conditions for a MONITOR TOC

TI 6110.101, sec. 7



- A Monitor TOC instructs the pilot to monitor the assigned frequency
- When a Held TOC is released, the system will automatically determine whether to uplink a CONTACT or a MONITOR instruction. The system makes the determination by checking seven conditions.
  - If all seven conditions are satisfied, the system will send a MONITOR instruction
  - If any condition is not satisfied, the system will send a CONTACT instruction
- The seven conditions for a Monitor TOC are:
  1. Handoff must be an intra-facility handoff
     - Altitude downlinks may be affected by system latency, and since Mode C altitudes can change quickly during climbs and descents, pilots must report their current altitude via voice
     - Handoffs to another ARTCC or to a TRACON will always result in a CONTACT message

Continued on next page

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Conditions for a MONITOR TOC (Cont'd)

TI 6110.101, sec. 7

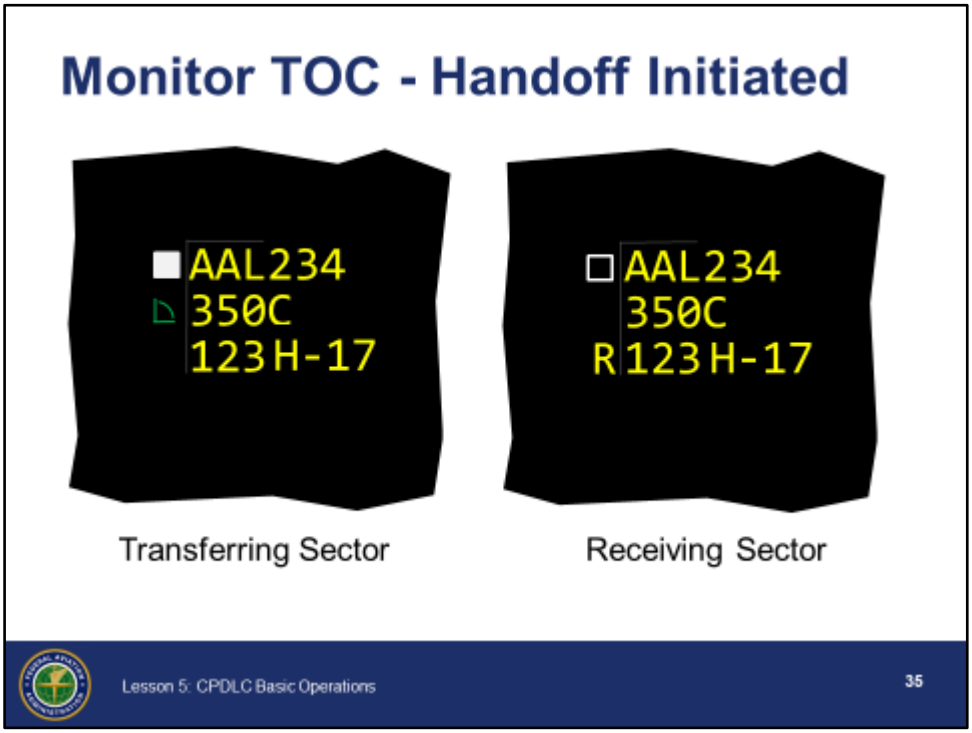
2. Sector preference is set to MONITOR
   - Each controller can establish personal preferences using the Sector Settings View
   - With the Sector Settings View the controller can set up:
     - CONTACT or MONITOR as the initial sector check-in TOC for the sector
     - EXCEPT SECTOR setting, which specifies sectors that will check-in using the method not specified for the sector
3. System selected frequency for the uplink must be an adapted frequency for the receiving sector
   - Frequencies routinely used by a sector will be in adaptation and automatically selected
   - A manually entered frequency that is not adapted for a sector would be an unusual situation, which results in a CONTACT instruction
4. Aircraft must be RVSM capable
   - Non-RVSM capable aircraft will always receive a CONTACT instruction regardless of assigned altitude
5. Initial Contact (IC) service must be enabled
   - The IC service provides the processing required to automatically compare an aircraft's downlinked altitude to the altitude displayed in the FDB to verify they match
6. Assigned altitude must be a single altitude
   - The IC service does not support confirming altitudes other than a single altitude

     Example: If the aircraft has an assigned block altitude, the system cannot send the Confirm Assigned Altitude (CAA) uplink and so a CONTACT instruction will be uplinked.
7. Aircraft must not have a procedure altitude in the data block
   - The IC service does not verify procedure altitudes

Explain procedure altitude.

Monitor TOC - Handoff Initiated

TI 6110.101, sec. 7.2



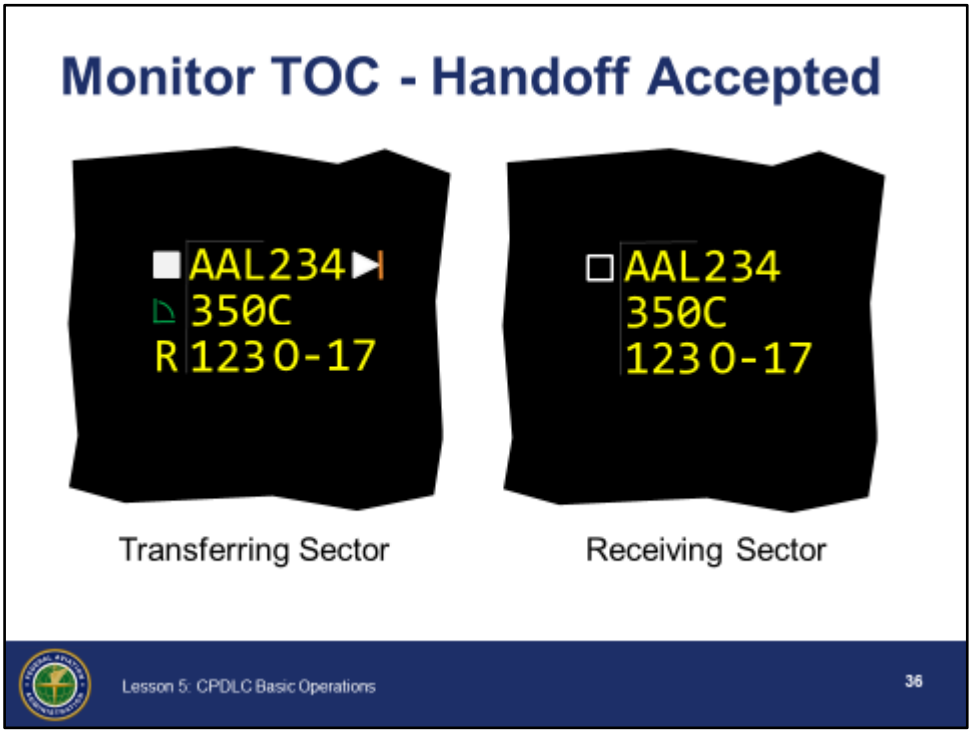
NOTE: The following four slides depict a typical Transfer of Communication using CPDLC when the instruction being sent in the uplink is MONITOR. The slides depict only the FDB. However, the same CPDLC changes would be occurring on the ACL.

- When the transferring sector initiates the handoff, they will see:
  - CDA Session With Eligibility indicator
  - Either an Auto or a Manual On Frequency indicator (VCI)
- The receiving sector will see:
  - CDA Session indicator (without eligibility)
- When a MONITOR instruction is sent, the system adds a Confirm Assigned Altitude instruction to the message

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Monitor TOC - Handoff Accepted

TI 6110.101, sec. 7.2

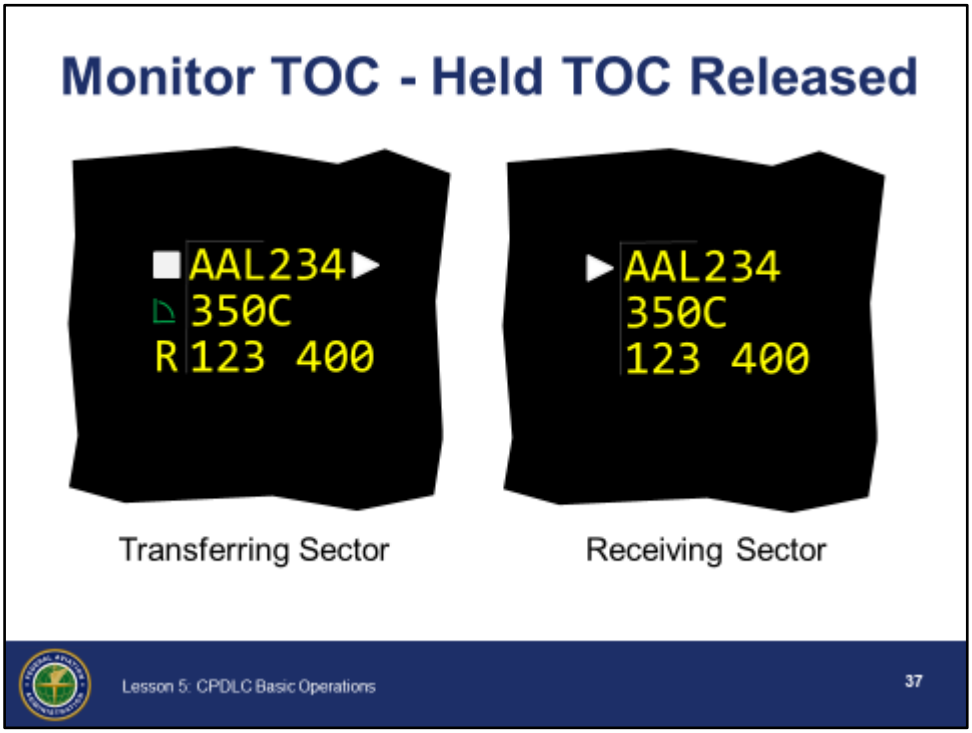


- Once the receiving sector accepts the handoff, track control changes to the receiving sector and the system builds a Held TOC message
  - Release of the Held TOC is controlled by the sector with eligibility
- The transferring sector will see:
  - CDA Session With Eligibility indicator
  - Auto or Manual On Frequency indicator (VCI)
  - Single Held TOC indicator
- The receiving sector will see:
  - CDA Session indicator (without eligibility)

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Monitor TOC - Held TOC Released

TI 6110.101, sec. 7.2

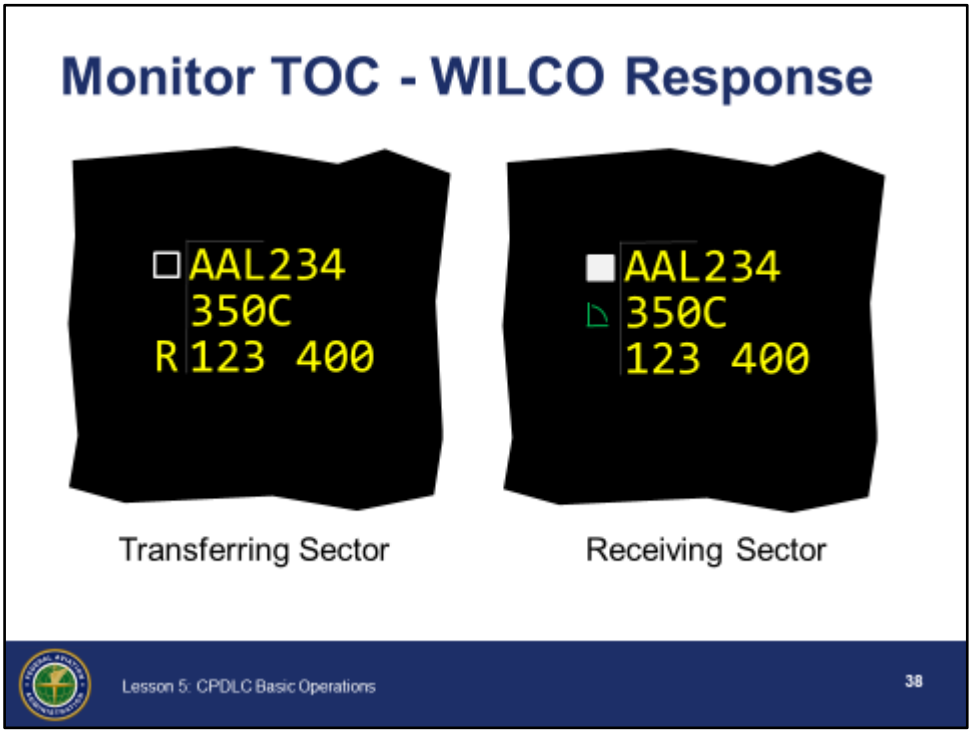


- After the transferring controller releases the Held TOC, the TOC In Progress indicator is displayed at the transferring and receiving sectors
  - The indicator will remain until a response is received
- The transferring sector will see:
  - CDA Session With Eligibility indicator
  - Auto or Manual On Frequency indicator (VCI)
  - TOC In Progress indicator
- The receiving sector will see:
  - TOC In Progress indicator
    - Replaces CDA Session indicator (without eligibility)

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Monitor TOC - WILCO Response

TI 6110.101, sec. 7



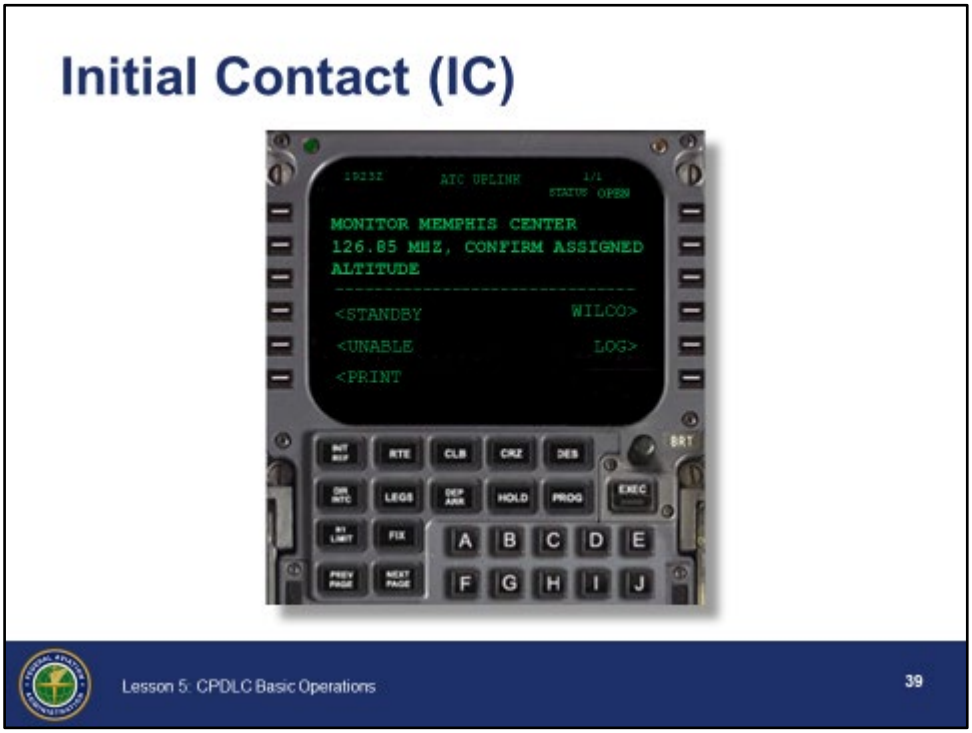
- When a WILCO response is received from the aircraft, the system will automatically transfer eligibility to the receiving sector
- The transferring sector will see:
  - CDA Session indicator (without eligibility)

  NOTE: The Auto or Manual On Frequency indicator (VCI) is automatically removed, as well as the TOC In Progress indicator.
- The receiving sector will see:
  - CDA Session With Eligibility indicator
  - Auto On Frequency indicator (Auto VCI)
- The receiving controller now has the ability to communicate with the aircraft via CPDLC

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Initial Contact (IC)

TI 6110.101, sec. 12



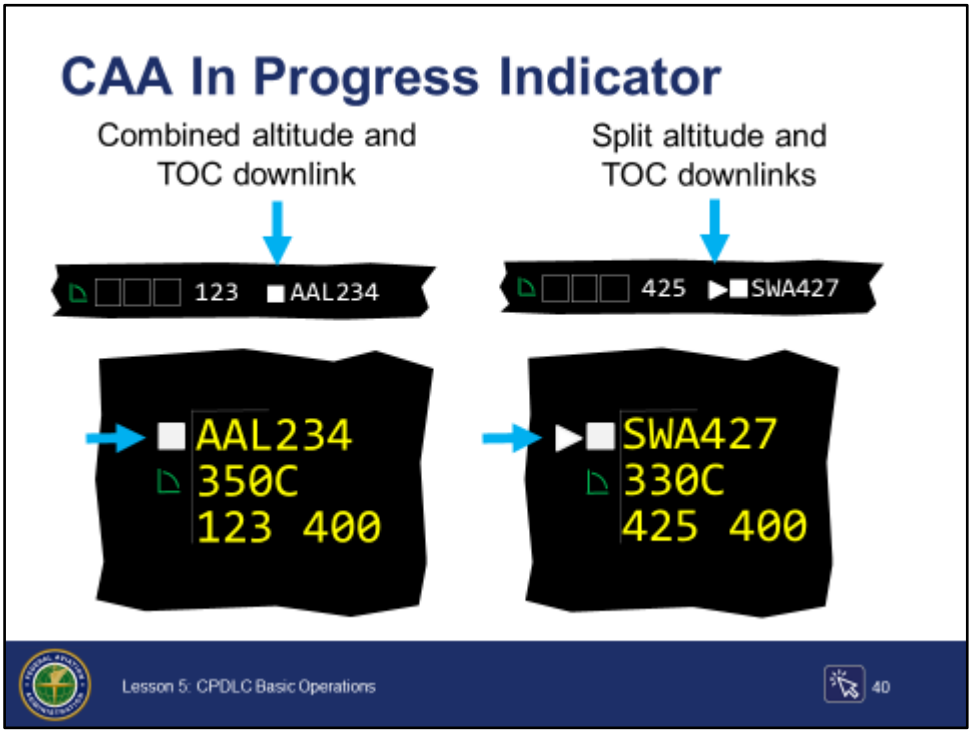
- When a MONITOR instruction is sent to the aircraft, the system will add CONFIRM ASSIGNED ALTITUDE (CAA) to the uplink message
  - This requires the pilot to downlink the flight's ATC cleared altitude and replaces the pilot voice check-in procedure
- The ground system checks whether the pilot downlinked assigned altitude matches the altitude displayed in that flight's data block or, when applicable, a locally adapted waiver altitude
- The system provides indications to the sending and receiving controllers if the downlinked assigned altitude does not match the FDB or adapted waiver altitude

NOTE: The waiver altitude is communicated to the aircraft but is not entered as an altitude into ERAM. Waiver altitude will be covered in further detail in the next lesson.

BASIC TRANSFER OF COMMUNICATION (TOC)
(CONT'D)

Initial Contact (IC) (Cont'd)

TI 6110.101, sec. 12.4

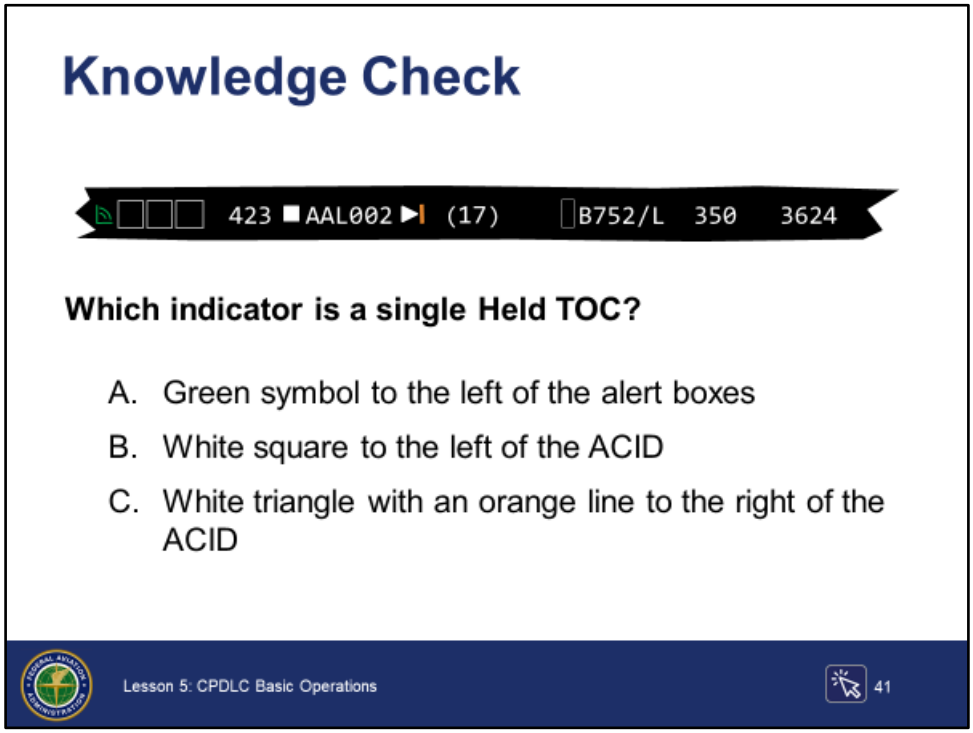


Slide is animated, 1 click. Click where indicated by click icon.

- Depending on an aircraft's avionics, the altitude downlink may come combined with the pilot's response to the TOC or a pilot may have to send two separate messages
  - If the altitude response is combined with the TOC response:
    - There is no special indicator
    - If the CDA Session With Eligibility indicator and the auto on frequency indications appear (after the WILCO response by the aircraft), and no mismatch coding is displayed, the altitudes match
  - If the downlinked altitude response comes as a separate message (also referred to as split IC):
    - CAA In Progress indicator is displayed, then
      - If indicator is removed and no mismatch coding is displayed, the altitudes match

Click to reveal the results of receiving a separate downlinked matching altitude.

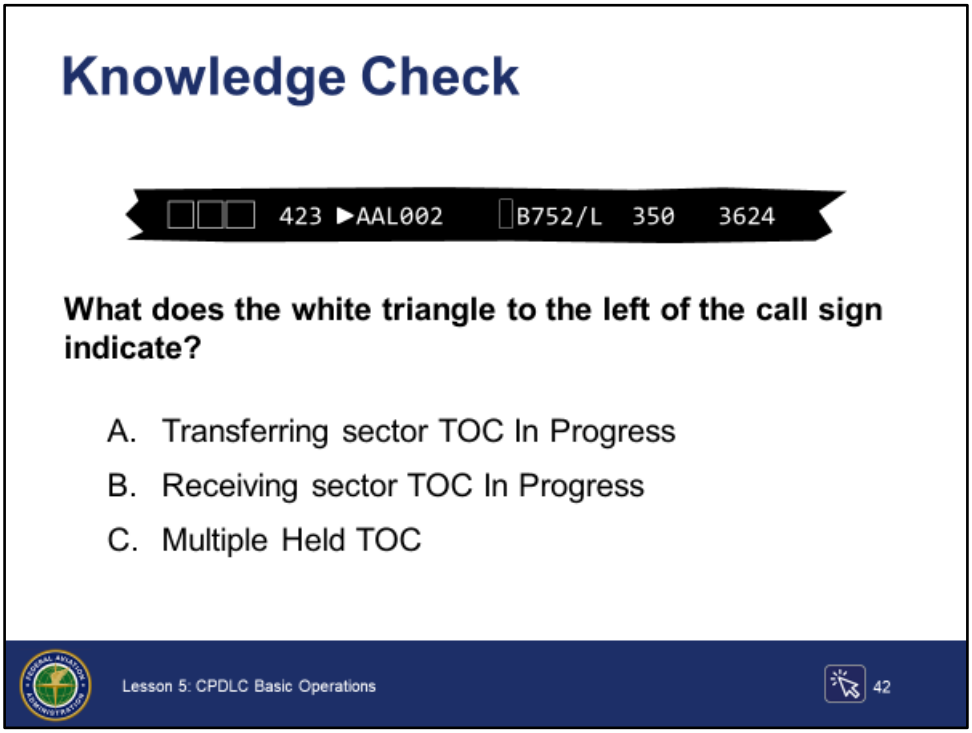
Knowledge Check



Question: Which indicator is a single Held TOC?

Answer: *C. White triangle with an orange line to the right of the ACID*

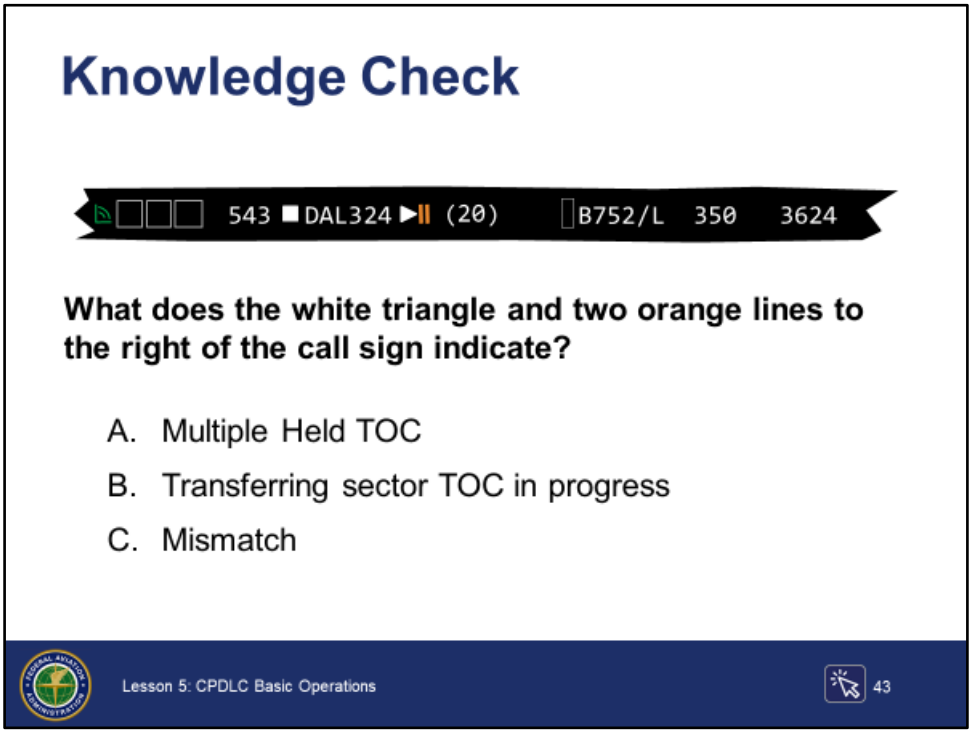
Knowledge Check



Question: What does the white triangle to the left of the call sign indicate?

Answer: *B. Receiving sector TOC In Progress*

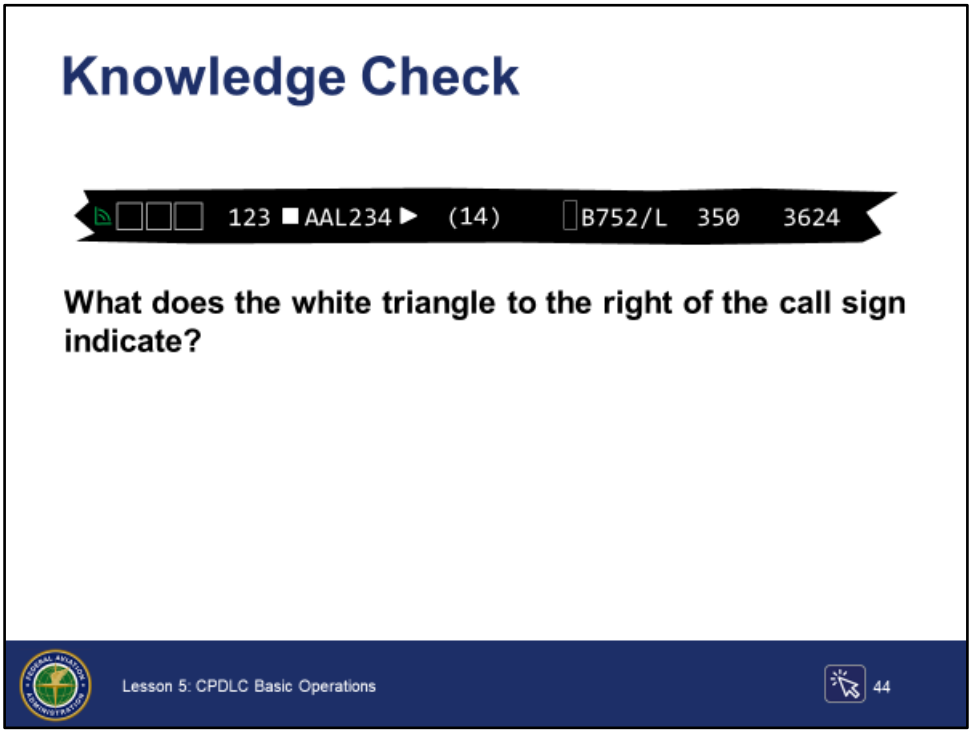
Knowledge Check



Question: What does the white triangle and two orange lines to the right of the call sign indicate?

Answer: *A. Multiple Held TOC*

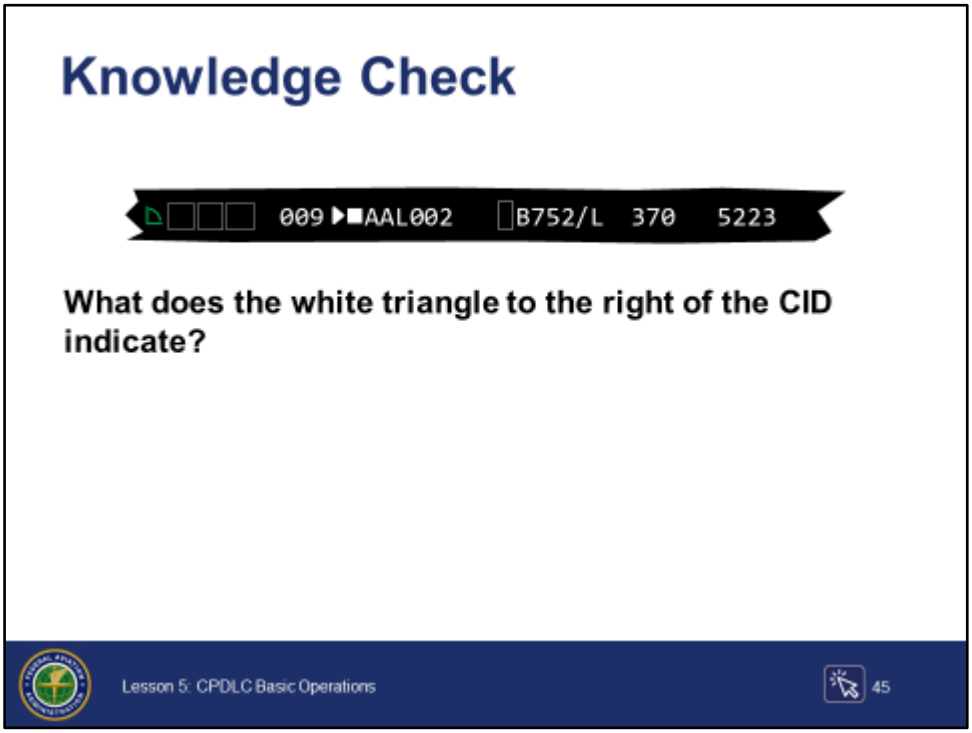
Knowledge Check



Question: What does the white triangle to the right of the call sign indicate?

Answer: *It is an indication to the transferring sector that there is a TOC In Progress and the system is waiting for a pilot response.*

Knowledge Check



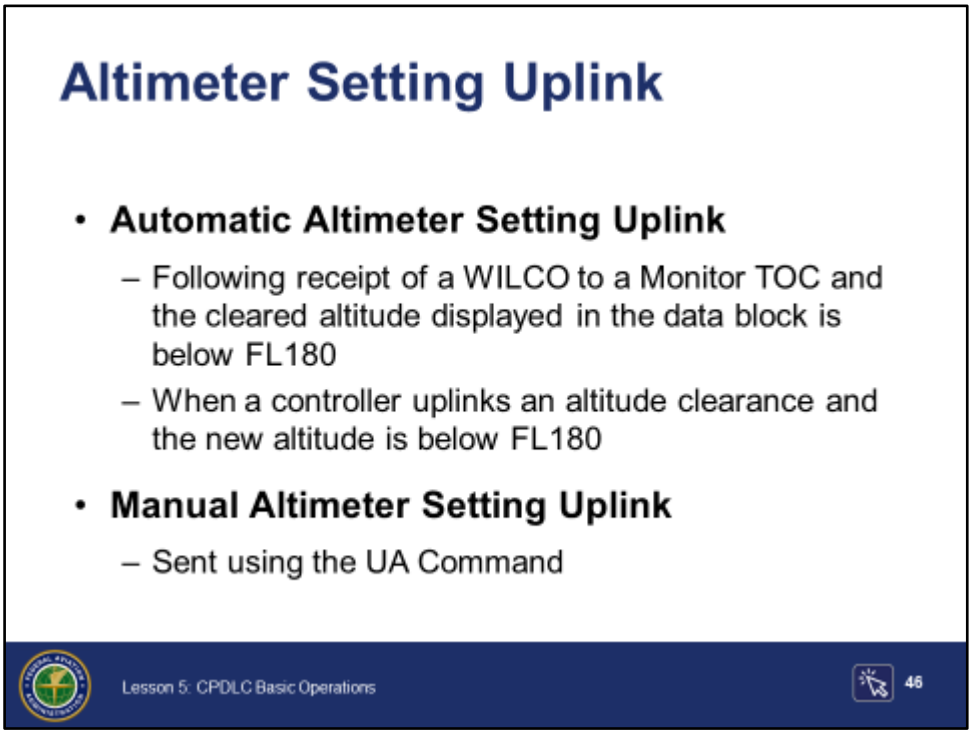
Question: What does the white triangle to the right of the CID indicate?

Answer: *It is a CAA In Progress indicator when the downlinked altitude is separate from the TOC response.*

ALTIMETER SETTING UPLINK

Altimeter Setting Uplink

TI 6110.101, secs. 6.2.3.10, 9.1



Slide is animated, 2 clicks. Click where indicated by click icons.

⊙ CPDLC provides the capability to automatically or manually uplink an altimeter setting to the aircraft

- Automatic Altimeter Setting uplinks are sent in either of the following cases:
  - Following receipt of a WILCO to a Monitor TOC and the cleared altitude displayed in the data block is below FL180

Click to reveal the next bullet.

  - When a controller uplinks an altitude clearance and the new altitude is below FL180

Click to reveal the last bullets.

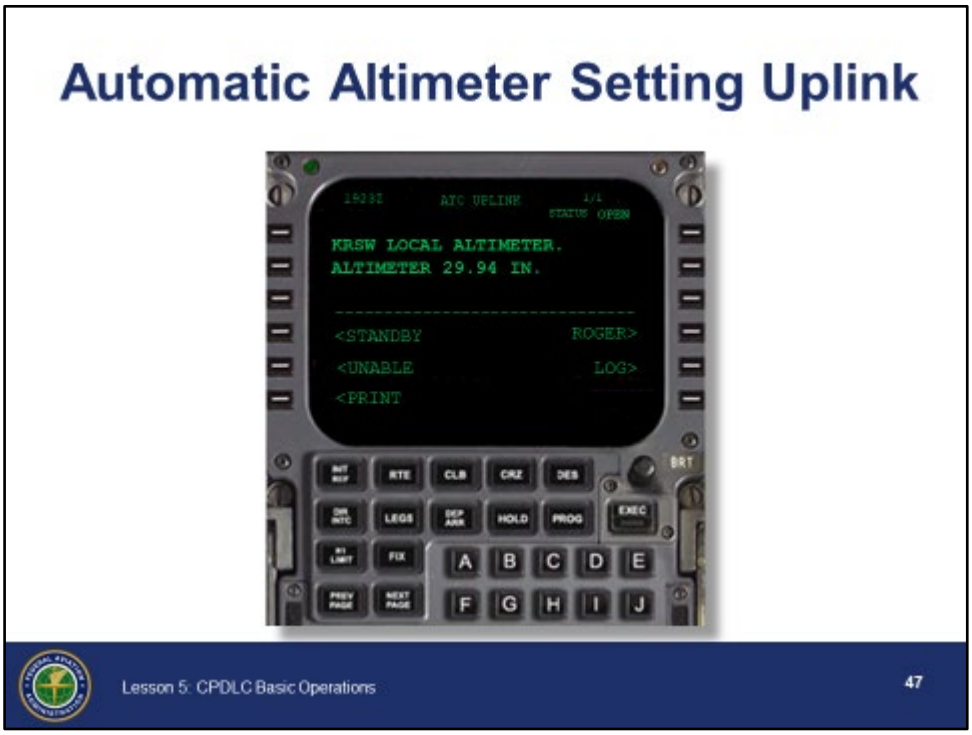
- Manual Altimeter Setting uplink
  - Sent using the UA command

ALTIMETER SETTING UPLINK *(CONT'D)*

Automatic Altimeter Setting Uplink

TI 6110.101, sec. 9.1

TI 6110.100, sec. 2.6



- The system will automatically determine the appropriate reporting station to use in the automatic Altimeter Setting uplink based on the aircraft trajectory:
  - If the current aircraft trajectory position is below FL180, or the FDB is displaying a local interim altitude below FL180, the system will select the adapted reporting station for the current surveillance sort cell

SURVEILLANCE SORT CELL (SSC) - An adapted airspace volume that is used to designate which surveillance sensor is to be used to track targets in that area. The sensors used can be ADS-B, surveillance radar, or secondary radar.

NOTE: There are two altimeter stations, primary and secondary, assigned to each SSC.

  - If the aircraft trajectory is predicted to descend below FL180 at some future point in the sector, the system will select the adapted reporting station for the SSC where the aircraft is predicted to descend below FL180

Continued on next page

ALTIMETER SETTING UPLINK *(CONT'D)*

Automatic Altimeter Setting Uplink (Cont'd)

TI 6110.100, sec. 2.6

- If the aircraft is in hold or in delay, the system will select the adapted reporting station for the SSC containing the current hold or delay position

⊙ If there is no aircraft trajectory, the system will not be able to automatically determine the appropriate reporting station and no automatic Altimeter Setting uplink will be sent

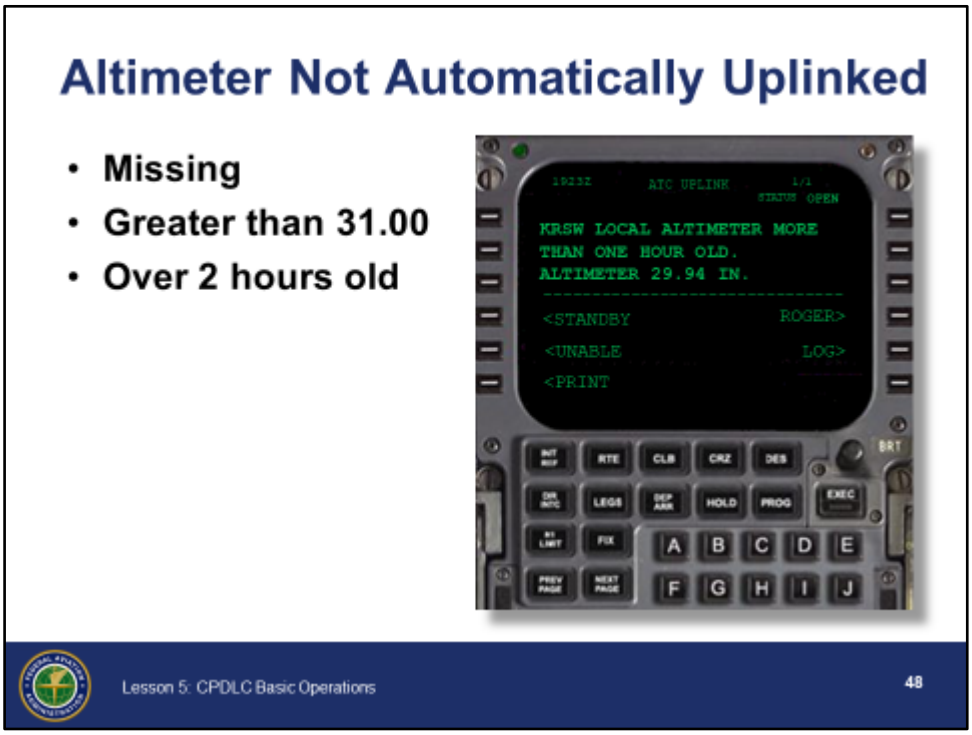
ALTIMETER SETTING UPLINK *(CONT'D)*

Altimeter Not Automatically Uplinked

TI 6110.101, secs. 6.2.3.10, 9

JO 7110.65, pars. 2-7-1, 2-7-2

JO 7110.125, par. 8.m.



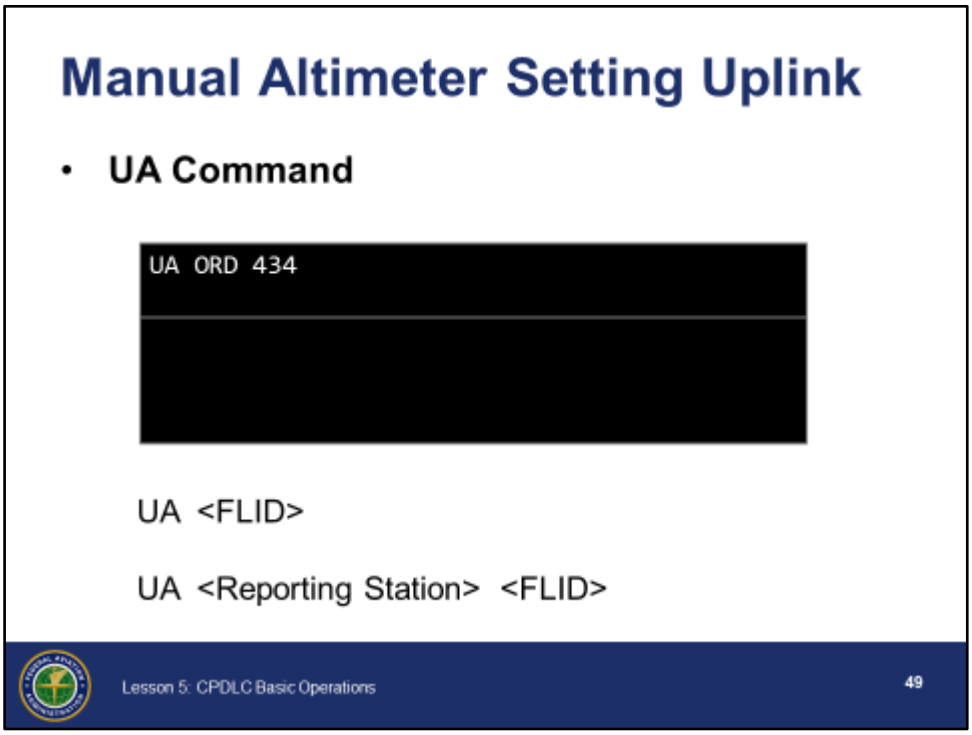
- Once CPDLC has automatically selected the appropriate reporting station, the system will try to obtain the altimeter setting data for that reporting station
- If the altimeter setting data is obtained and is valid:
  - Altimeter Setting uplink is sent to the aircraft
    - Normal pilot response is ROGER
- If the altimeter setting data is more than one hour old:
  - Altimeter Setting uplink will include the statement MORE THAN ONE HOUR OLD
- If the altimeter setting data is not valid for any of the following reasons, no automatic Altimeter Setting uplink will be sent:
  - Missing altimeter data
  - Altimeter setting is greater than 31.00
  - Altimeter setting is over 2 hours old
- If no automatic uplink is sent, as a result of invalid altimeter data, the controller is still responsible for providing the altimeter setting data to the aircraft

ALTIMETER SETTING UPLINK *(CONT'D)*

Manual Altimeter Setting Uplink

TI 6110.101, secs. 6.2.3.10, 9.2, 9.4

TI 6110.108



Have the students refer to the TI 6110.108, En Route Automation Modernization Quick Reference Cards.

- The UA command is used to manually uplink an altimeter setting
  - There are two keyboard options:

    Syntax: UA <FLID>

    – Automatically selects the reporting station based on the aircraft's current location

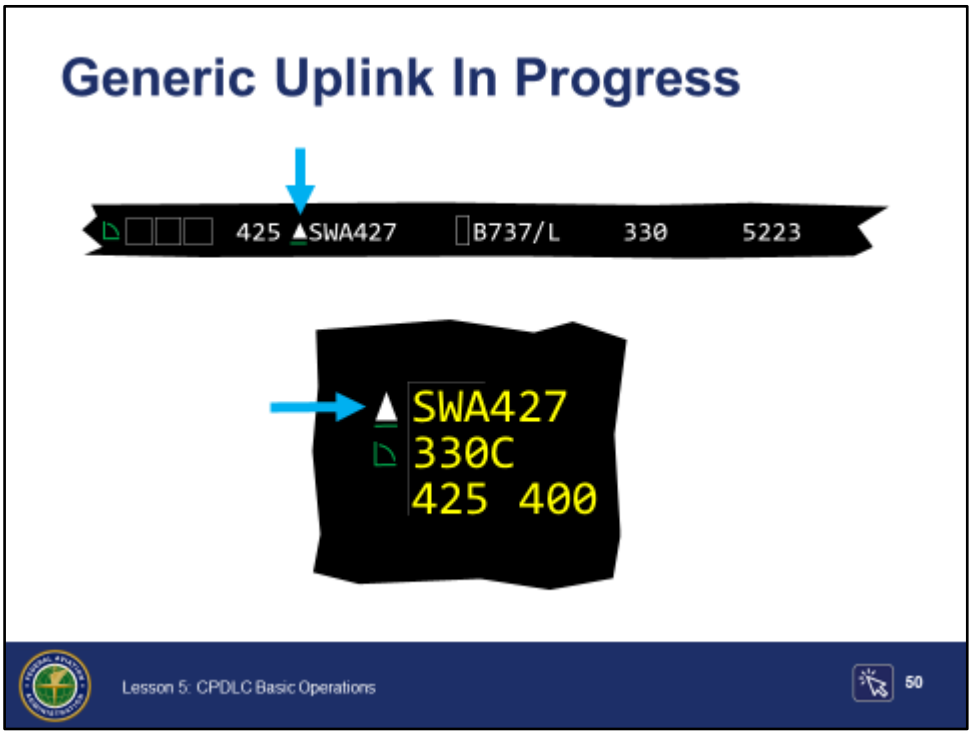
    Syntax: UA <Reporting Station> <FLID>

    – Uplinks the altimeter setting for the specified reporting station
- Manual Altimeter Setting uplinks will be rejected for the following reasons:
  - An interfacility handoff has been completed
  - Missing or old (over 2 hours) altimeter data
  - Altimeter greater than 31.00
  - Reporting station is not in local facility adaptation

ALTIMETER SETTING UPLINK *(CONT'D)*

Generic Uplink In Progress

TI 6110.101, sec. 6.2.2.1.1



Slide is animated, 1 click. Click where indicated by click icon.

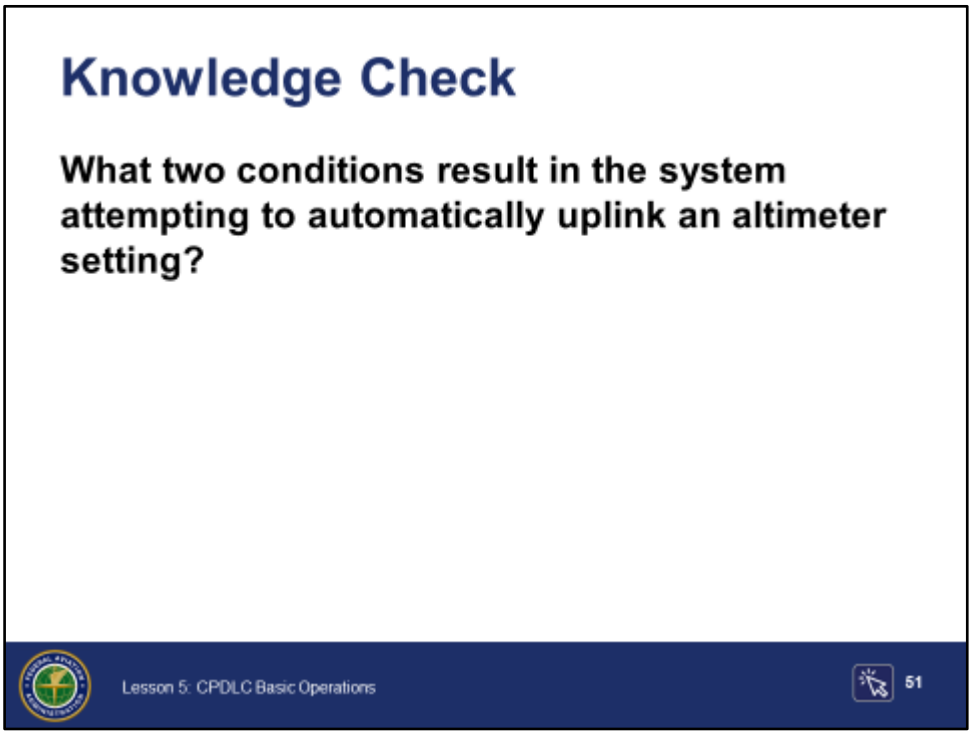
- When an altimeter setting is manually uplinked, the Generic Uplink In Progress indicator will replace the CDA Session With Eligibility indicator in both the data block and the ACL
  - The indicator is a white triangle pointing up with a green underline and will continue to be displayed until a pilot response is received
- There is no indication when an altimeter is automatically sent following a WILCO to a monitor TOC

Click to simulate the results of a manual uplinked altimeter setting.

- If the automatic Altimeter Setting uplink is part of an altitude clearance, the altitude Uplink In Progress indicator will be displayed
  - A manual Altimeter Setting uplink may be sent while waiting for a pilot response to an automatic Altimeter Setting uplink

ALTIMETER SETTING UPLINK *(CONT'D)*

Knowledge Check



Question: What two conditions result in the system attempting to automatically uplink an altimeter setting?

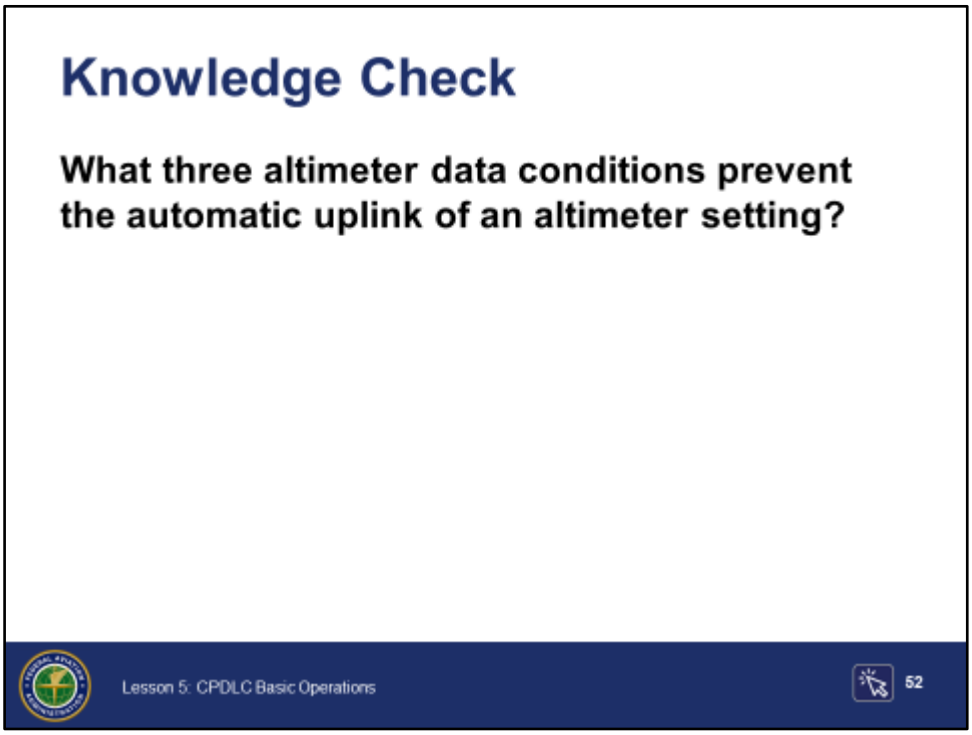
Answer:

1) Receipt of a WILCO to a MONITOR TOC and the cleared altitude displayed in the FDB is below FL180;

2) Altitude clearance uplink descending through FL180

ALTIMETER SETTING UPLINK *(CONT'D)*

Knowledge Check

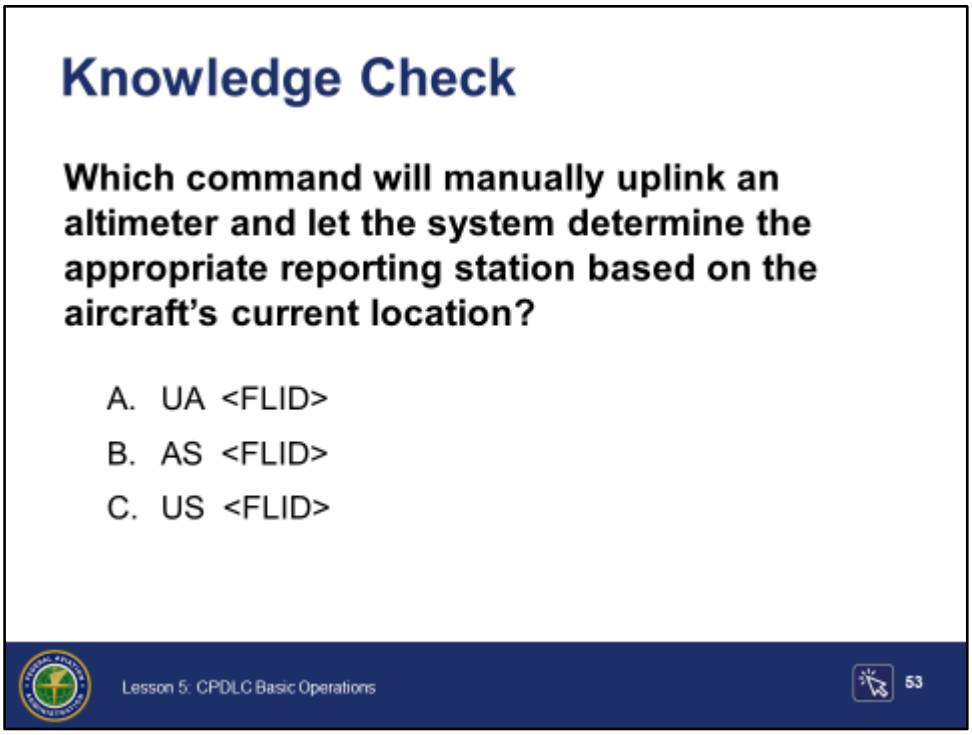


Question: What three altimeter data conditions prevent the automatic uplink of an altimeter setting?

Answer: *Missing altimeter; altimeter greater than 31.00; altimeter is over two hours old*

ALTIMETER SETTING UPLINK *(CONT'D)*

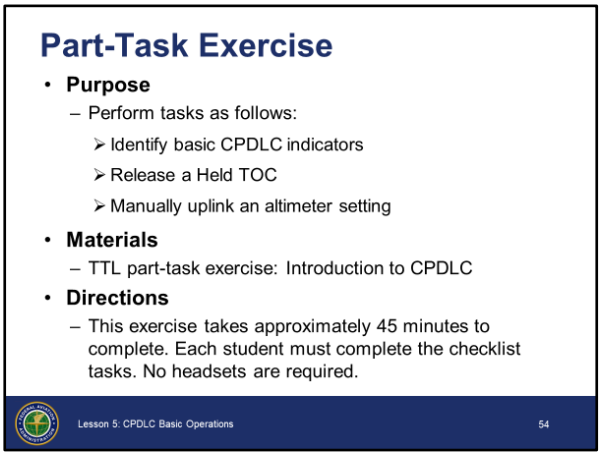
Knowledge Check



Question: Which command will manually uplink an altimeter and let the system determine the appropriate reporting station based on the aircraft's current location?

Answer: *A. UA <FLID>*

PART-TASK EXERCISE: INTRODUCTION TO CPDLC



Purpose

Perform tasks as follows:

- Identify basic CPDLC indicators
- Release a Held TOC
- Manually uplink an altimeter setting

Materials

Handout: *HO01_L05*

- TTL part-task exercise: Introduction to CPDLC

TTL scenario: *55054003_L05_S##*

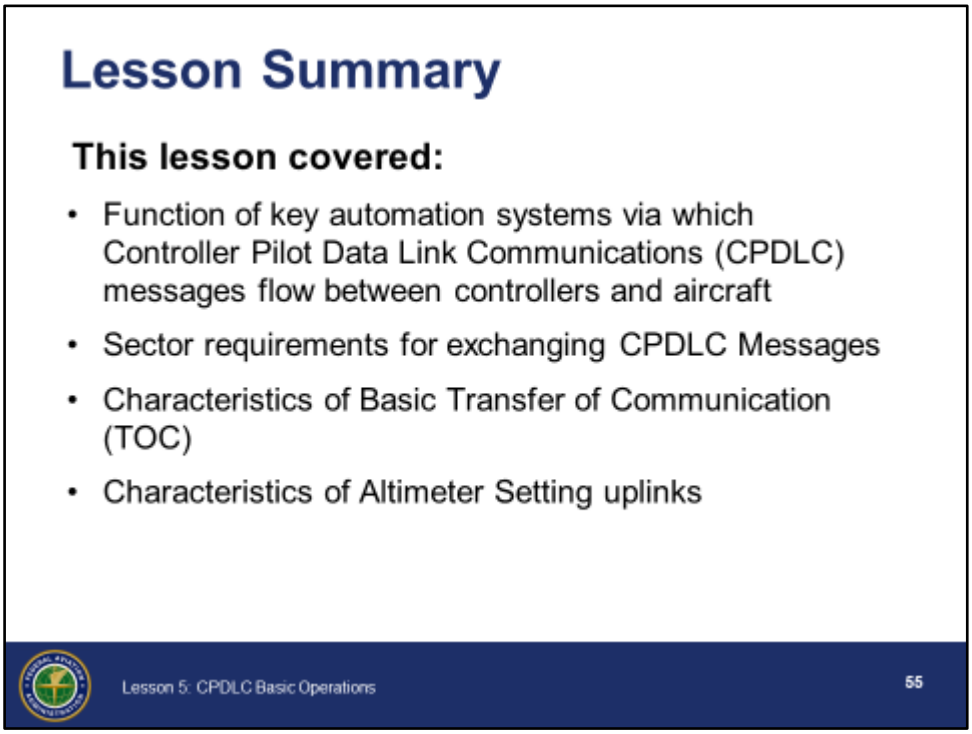
Directions

This exercise takes approximately 45 minutes to complete. Each student must complete the checklist tasks. No headsets are required.

Provide instruction as required. Check off each task after completion. No ghost pilots are required.

CONCLUSION

Lesson Summary



Review and elaborate briefly on the following topics. Ask students if they have questions about any of the concepts covered in the lesson.

This lesson covered:

- Function of key automation systems via which Controller Pilot Data Link Communications (CPDLC) messages flow between controllers and aircraft
  - Local CPDLC
  - National CPDLC
  - Coverage area
  - Pilot response options
    - WILCO (available for clearance or instruction messages)
    - ROGER (available for informational messages)
    - STANDBY
    - UNABLE

Continued on next page

CONCLUSION *(CONT'D)*

Lesson Summary (Cont'd)

- Requirements for exchanging CPDLC messages
  - CPDLC Session
  - NDA Session
  - CDA Session
  - CPDLC Eligibility
  - CDA Session With Eligibility indicator
  - Voice Communication Indicator (VCI)
- Basic Transfer of Communication
  - TOC Uplink message
  - Held TOC entry
  - Held TOC indication
    - Single
    - Multiple
  - Releasing a Held TOC
    - UH command
  - TOC In Progress indicator
  - TOC In Progress Timeout indicator
  - Contact TOC
    - Handoff initiated
    - Handoff accepted
    - Contact TOC - Held TOC released
    - Contact TOC - WILCO response
    - Contact TOC - Manual VCI
  - Conditions for a MONITOR TOC

Continued on next page

CONCLUSION *(CONT'D)*

Lesson Summary (Cont'd)

- Monitor TOC
  - Handoff initiated
  - Handoff accepted
  - Held TOC released
  - Monitor TOC - WILCO response
- Initial Contact (IC)
  - CAA In Progress indicator

⊙ Altimeter Setting uplink

- Automatic Altimeter Setting uplink
- Altimeter not automatically uplinked
- Manual Altimeter Setting uplink
- Generic Uplink In Progress

 *Hand out and administer the End-of-Lesson Test. Provide feedback on missed items, including why particular answers are correct, as well as why some responses are incorrect.*