



CHALLENGER 350

BD-100-1A10

NAVIGATION

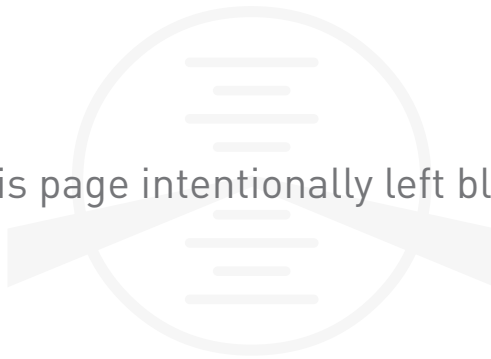
STUDY GUIDE · CARD SYSTEM

A flashcard-style study guide for the CL350 ATA 34 Navigation chapter. Covers VHF/NAV radios, GPS/GNSS, IRS, FMS, weather radar, transponder, TCAS II, TAWS/EGPWS, and ADS-B — one focused topic per card.

ATA 34 · NAVIGATION

Section NAV · Revision: Original

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01

FIVE THINGS YOU MUST KNOW

The five highest-value facts for the oral. Memorize numbers cold.

300 nm	Weather radar maximum range (RTA-4114)
Dual FMC-6200	Rockwell Collins flight management computers
32 aircraft	TCAS II simultaneous displayable intruders
7 modes	TAWS/GPWS protection modes (Modes 1–7)
WAAS/LPV	SBAS-based precision approach capability

TIP Five baseline facts spanning the navigation suite (ATA 34). The cards ahead break each system into precision facts for ready recall.



VHF COM & NAV RADIOS · STUDY CARDS

VHF COM FREQUENCY RANGE

What is the CL350 VHF COM operating range?

- 118.000 to 136.991 MHz
- 8.33 kHz spacing (Europe) / 25 kHz standard
- Dual COM radios installed standard

VOR/LOC FREQUENCY RANGE

VOR and localizer operating range?

- 108.00 to 117.95 MHz
- 50 kHz spacing — 160 channels
- LOC deviation displayed on PFD during approach

GLIDESLOPE RECEIVER

GS frequency range and pairing?

- 329.15 to 335.00 MHz
- 40 channels with 150 kHz spacing
- Auto-paired with localizer frequency selection

MARKER BEACON

Fixed frequency and tone cadences?

- Fixed frequency: 75.00 MHz
- Outer 400 Hz · Middle 1300 Hz · Inner 3000 Hz
- HI/LO sensitivity selectable on NAV CONTROL menu

NAV-4000 vs NAV-4500

What functions does each receiver have?

- AV-4000: VOR/LOC/GS/MKR + ADF in single unit
- NAV-4500: VOR/LOC/GS/MKR only (no ADF module)
- Both support auto-tune from FMS or manual via CDU

DME SYSTEM

Architecture, range, and DME HOLD?

- DME-4000: 3-channel unit (pilot/copilot/FMS)
- Operating freq 962–1213 MHz; max range 300 nm
- DME HOLD splits paired tuning for independent ops

VHF/NAV — FREQUENCY QUICK REFERENCE

- VHF COM: 118.000–136.991 MHz | Emergency: 121.50 MHz
- VOR/LOC: 108.00–117.95 MHz | 50 kHz / 160 channels
- Glideslope: 329.15–335.00 MHz | 150 kHz / 40 channels
- Marker Beacon: 75.00 MHz fixed | Outer/Middle/Inner tones
- DME: 962–1213 MHz | 300 nm max range | 3-channel DME-4000
- ADF: 190–1799 kHz + maritime distress bands (2088–2094 / 2179–2185 kHz)

GPS / IRS · STUDY CARDS

GPS RECEIVERS

How many and minimum satellites required?

- Dual GPS sensors for redundancy
- Minimum 4 satellites for navigation solution
- 3 satellites + calibrated baro altitude acceptable

SBAS PROVIDERS

SBAS regions and LPV capability?

- WAAS (N. America/Hawaii); EGNOS (Europe)
- MSAS (Japan); GAGAN (India)
- Enables LPV approach capability

GPS POSITION MONITORING

GNSS Control page functions?

- Displays POS DIFF between each GPS and FMS position
- Manual enable/disable for each GPS sensor
- Disabled sensor stays off until manually re-enabled

IRS CONFIGURATION

Technology and capabilities?

- Dual IRS — laser ring gyro technology
- Attitude, heading, position, and velocity output
- SET POS command updates IRS position from FMS

IRS ATTITUDE MODE

When does IRS operate in attitude mode?

- Fallback when navigation data unavailable
- Provides attitude and heading reference only
- Auto cross-side switching on IRS failure

DEAD RECKONING

When does FMS enter DR mode?

- No navigation sensor data available
- Estimates position from last known pos/hdg/airspeed
- FMS DR displayed — RNAV operations prohibited



FMS ARCHITECTURE · STUDY CARDS

FMC-6200 COMPUTERS

Processor and power source?

- Dual FMC-6200 with PowerPC 460EX processor
- IAPS 1 powers left FMC; IAPS 2 powers right FMC
- Cross-channel data comparison for integrity

FMS SENSOR PRIORITY

Which sensors does the FMS use?

- GPS/GNSS — primary when available
- DME/DME and VOR/DME — supplementary
- IRS — supplementary; DR when all others fail

FMS NAV SOURCE MIN (POST-20664)

Minimum sensor for FMS nav?

- One GNSS; OR two DMEs; OR one VOR/DME; OR one IRS
- Airplanes 20501–20663 NOT incorporating SB 350-34-012: two GNSSs required
- RNAV prohibited with DR, IRS ONLY, or CHK POS

PILOT WAYPOINTS

How many pilot-defined waypoints?

- Up to 100 pilot-defined waypoints
- Route names up to 10 characters
- DBU-5010E transfers data via USB

RNP CAPABILITIES

What RNP levels does the CL350 support?

- RNP 4 (oceanic), RNP 2 (en-route), RNP 1 (terminal)
- RNP APCH — GNSS non-precision approach
- RNP AR APCH — ≥ 0.3 nm precision (SB 350-34-009)

LPV APPROACH REQUIREMENTS

What is required to commence LPV?

- Dual PFD and dual FMS required
- Two GNSS/SBAS sensors to commence (one to continue)
- LPV APPR annunciation must show on PFD

FMS — KEY NUMBERS AT A GLANCE

- 100 pilot waypoints | 10-char route names | PowerPC 460EX processor
- RAIM: 5 sats to detect error; 6 sats to isolate to individual satellite
- RNP leg max: RNP-1 $\rightarrow$ 200 nm; RNP-2 $\rightarrow$ 400 nm; RNP-4/10 $\rightarrow$ 500 nm
- CDI scales: RNP APCH 0.3 nm; RNP-1 1.0 nm; RNP-2 2.0 nm; RNP-4 4.0 nm
- FMS latitude limit: prohibited above N82° / S82° (region variations apply)
- Performance database PN: 096-5327-001 (S/N 20578 and subsequent)

TAWS / EGPWS MODES · STUDY CARDS

TAWS ARCHITECTURE

What three systems are integrated?

- GPWS Modes 1–6 — ground proximity warnings
- Terrain/obstacle awareness with worldwide database
- Windshear detection — Mode 7

MODE 1 — EXCESSIVE DESCENT RATE

Alert altitudes and aural?

- Active below 2,500 ft AGL
- Alert: amber GND PROX + 'SINKRATE SINKRATE'
- Warning: red PULL UP + continuous 'PULL UP'

MODE 3 — ALTITUDE LOSS AFTER T/O

When active and aural?

- After takeoff/go-around, gear/flaps not in landing config
- Aural: 'DON'T SINK, DON'T SINK' (once, repeats at 20% degradation)
- Inhibited above 1,500 ft AGL radio altitude

MODE 4A vs 4B

Speed thresholds and aural?

- Mode 4A (gear up): >190 kts → 'TOO LOW TERRAIN'; <190 kts → 'TOO LOW GEAR'
- Mode 4B (gear down, flaps not [dg]): >159 kts → 'TOO LOW TERRAIN'; <159 kts → 'TOO LOW FLAPS'
- Mode 4A alert: 30–500 ft AGL; Mode 4B: 30–245 ft AGL

MODE 5 — BELOW GLIDESLOPE

Two-tone levels and muting?

- Soft alert: 1.3–2.0 dots below GS → quiet 'GLIDESLOPE'
- Hard alert: >2.0 dots below GS → full-volume 'GLIDESLOPE'
- Can be muted with GS switch OFF on TAWS panel

MODE 7 — WINDSHEAR

Active window and alert types?

- Active 10–1,500 ft AGL during takeoff and landing
- Increasing performance: 'CAUTION WINDSHEAR'
- Decreasing performance: 'WINDSHEAR WINDSHEAR'

TAWS MODES — ONE-LINE SUMMARY

- Mode 1: Excessive descent rate — <2,500 ft AGL — SINKRATE / PULL UP
- Mode 2: Excessive terrain closure — 2A (flaps up) / 2B (flaps down or ILS) — TERRAIN / PULL UP
- Mode 3: Altitude loss after T/O or go-around — DON'T SINK
- Mode 4A/B/C: Unsafe terrain clearance (gear/flap config) — TOO LOW TERRAIN/GEAR/FLAPS
- Mode 5: Below glideslope — GLIDESLOPE (soft 1.3–2.0 dots / hard >2.0 dots)
- Mode 6: Altitude callouts (100/50/30 ft) + bank angle alert — BANK ANGLE
- Mode 7: Windshear 10–1,500 ft AGL — CAUTION WINDSHEAR / WINDSHEAR WINDSHEAR
- TCF: Terrain clearance floor around airports — database >3,500 ft runways



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WEATHER RADAR · STUDY CARDS

RTA-4114 MULTISCAN

Band, range, and scan arc?

- X-band, max 300 nm detection range
- Scan: $\pm 60^\circ$ of heading (120° total arc)
- Manual tilt $\pm 15^\circ$; auto tilt $\pm 30^\circ$

RADAR COLOR CODING

What do the weather colors mean?

- Black: little/no rain; Green: moderate rain
- Amber: less severe; Red: heavy; Magenta: very heavy or turbulence
- Turbulence also shown in magenta

AUTO MODE FEATURES

What does AUTO mode provide?

- Multiscan: multiple tilt angles for best picture
- GCS eliminates 98% of ground returns (auto-ON; resets in 30 sec)
- PAC (yellow arc) + overflight protection + smart scan

WX+T vs TURB MODE

Turbulence detection limits?

- WX+T: 4-color wx + turbulence up to 40 nm
- TURB mode: turbulence-only, limited to 40 nm
- After 30 sec in TURB mode, auto-selects WX+T

TARGET ALERT (TGT)

When does TGT annunciate?

- AUTO mode, no on-side wx overlay selected
- Searches 7–50 nm; cyan TGT turns yellow on alert
- TGT flashes 5 sec then steady; TRB shown in yellow if turbulence

RADAR FAULT INDICATIONS

What faults display on radar status line?

- WX FAIL: loss of radar video bus — all data removed
- WX FAULT: precipitation/turbulence detection degraded
- AUTO FAULT: auto mode unavailable — switch to MAN

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TRANSPONDER & ADS-B · STUDY CARDS

TSS-4100 TRANSPONDER

Configuration and modes?

- Dual TSS-4100 Mode S transponders
- Mode A, C, and S capability
- ADS-B Out compliant per 14 CFR 91.227

TRANSPONDER IDENT

IDENT duration and activation?

- 18-second IDENT transmission duration
- Activated via control wheel switches
- Beacon codes 0000–7777 selectable

TRANSPONDER MODES

What are the mode selections?

- STBY: transponder in standby, not transmitting
- ALT ON: altitude reporting enabled
- 2-second delay prevents transient mode changes

ADS-B OUT

What does ADS-B Out broadcast?

- Position, velocity, and intent automatically
- Certified per 14 CFR 91.227
- ADS-C used for oceanic operations

TCAS II · STUDY CARDS

TCAS II VERSION 7.1

Tracking capacity and RA inhibit?

- Tracks up to 32 displayable intruders simultaneously
- Coordinated RAs with other TCAS-equipped aircraft
- RA inhibited: below 900 ft AGL descending / below 1,100 ft AGL climbing

TCAS ALERT TYPES

What is the difference between TA and RA?

- TA (Traffic Advisory): awareness only — ‘TRAFFIC TRAFFIC’
- RA (Resolution Advisory): vertical guidance on PFD VSI
- Red (RA) and amber (TA) threat symbology on displays

TCAS OPERATIONAL MODES

What modes are selectable?

- TA/RA: full protection active
- TA ONLY: traffic advisories without resolution advisories
- ABV/NORM/BLW altitude filter for display range

TCAS DISPLAY

Where is TCAS traffic shown?

- Traffic on both PFD and MFD
- Relative or absolute altitude display selectable
- Range rings for distance reference



ROAAS & TAWS PANELS · STUDY CARDS

ROAAS ARCHITECTURE

Where is ROAAS hosted and what does it use?

- Hosted on TAWS computer
- Uses TAWS database for available runway length
- FOLD (factored operational landing distance) as basis

ROAAS IN-AIR ALERTS

What are the two in-air alert levels?

- CAUTION RWY LENGTH: 450–200 ft above runway elevation
- WARNING RWY LENGTH: below 200 ft to touchdown
- CAUTION = single aural; WARNING = continuous aural

ROAAS ON-GROUND ALERTS

What are the two on-ground alert levels?

- CAUTION DECELERATE: 3 sec prior to predicted runway overrun
- WARNING DECELERATE: stopping point at or beyond runway end
- Active touchdown to 40 kt ground speed

TAWS CONTROL PANEL

What are the inhibit switches?

- GS switch: mutes glideslope warnings
- FLAPS switch: mutes flap-related GPWS warnings
- TERRAIN switch: deselects terrain awareness function

TERRAIN DISPLAY COLORS

What do terrain display colors mean?

- Solid red: terrain satisfying warning alert criteria
- Solid amber: terrain satisfying caution alert criteria
- Dot pattern (green/amber/red): terrain significantly close

ROAAS / TCAS / TAWS — KEY NUMBERS

- ROAAS armed: within 4.5 nm and 1,000 ft above landing runway
- ROAAS runway selection: aircraft track within 20° of runway centerline
- ROAAS min runway: 3,000 ft ($\geq$ 3,000 ft qualifies; ROAAS NOT AVAIL below 3,000 ft)
- TCAS displays up to 32 intruders; RA inhibited below 900 ft AGL descending / 1,100 ft AGL climbing
- TAWS Mode 1 active below 2,500 ft AGL
- Mode 6 bank angle alert: 10° at 30 ft AGL → 55° at 2,450 ft AGL

EICAS · CAUTION + ADVISORY

CAUTION MESSAGES

Timely crew awareness/action needed

Message	Meaning	Inhibits
XPDR 1 FAIL	Transponder 1 inoperative when XPDR 2 also failed (both failed simultaneously) (no inhibit, Ch 17)	—
XPDR 2 FAIL	Transponder 2 inoperative when XPDR 1 also failed (no inhibit, Ch 17)	—

ADVISORY MESSAGES

Crew awareness - no immediate action required

Message	Meaning	Inhibits
XPDR 1 FAIL	Transponder 1 failure when only XPDR 1 inoperative (no inhibit, Ch 17)	—
XPDR 2 FAIL	Transponder 2 failure when only XPDR 2 inoperative (no inhibit, Ch 17)	—
ROAAS FAIL	Runway Overrun Awareness and Alerting System has failed (TO/LAND inhibit, Ch 17)	TO/LAND
ROAAS NOT AVAIL	ROAAS unavailable — runway < 3,000 ft or required data missing	TO/LAND
ROAAS/RAAS FAIL	Combined ROAAS/RAAS system failure	
ROAAS/RAAS NOT AVAIL	Combined ROAAS/RAAS unavailable	
TAWS BASIC FAIL	TAWS basic functionality lost — Modes 1–6 unavailable	TO/LAND
TAWS SYSTEM FAIL	Complete TAWS system failure	TO/LAND
TAWS TERR FAIL	TAWS terrain awareness function failed	TO/LAND
TAWS TERR NOT AVAIL	TAWS terrain data not available for current position	TO/LAND
TAWS WINDSHEAR FAIL	TAWS predictive windshear function failed	TO/LAND
TSS FAN FAIL	Traffic/Surveillance System cooling fan failed (no inhibit)	—



STATUS MESSAGES

Information only - no crew action required

Message	Meaning
ROAAS OFF	ROAAS manually deselected
ROAAS RCC 5 ON	ROAAS runway condition code 5 (good braking) selected
ROAAS/RAAS OFF	Combined ROAAS/RAAS manually deselected
TAWS FLAPS OFF	TAWS flap inhibit selected
TAWS GS WARN OFF	TAWS glideslope warning inhibited
TAWS TERR OFF	TAWS terrain display deselected
XPDRS IN STBY	Both transponders in standby mode

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QUICK RECALL · NUMBERS GRID

Cover the labels and recite the number; reverse and recite the label.
Repeat until automatic.

118.000–136.991 MHz VHF COM range	108.00–117.95 MHz VOR/LOC range	329.15–335.00 MHz Glideslope range	75.00 MHz Marker beacon (fixed)
300 nm DME & radar max range	962–1213 MHz DME frequency band	32 intruders TCAS displayable intruders	900/1,100 ft AGL TCAS RA inhibit (desc/ climb)
2,500 ft AGL TAWS Mode 1 active	40 nm Turbulence detection limit	4 satellites GPS min for nav solution	100 wpts FMS pilot waypoints
≥ 0.3 nm RNP RNP AR APCH precision (SB 350-34-009	±60° / ±15° Radar scan / manual tilt	GCS 98% Ground clutter suppression	18 sec Transponder IDENT duration



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