Air Navigational System – Presentation

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Agenda

- Instrument Landing System (ILS)
  - Localizer
  - Glideslope
  - Marker Beacons
- Distance Marker Equipment (DME)
- VHF Omnidirectional Range (VOR)
- Tactical Air Navigation (TACAN)
- Introducing the VIAVI AVX-10K
- Contact for Demo / Info

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Instrument Landing System
(ILS)

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Instrument Landing System (ILS)

The ILS uses radio signals to help pilots align the aircraft accurately on their approach to a runway. The FAA has set ILS categories for all U.S. airports.

ILS categories vary based on runway equipment, aircraft capabilities, weather, and pilot certification, with differences defined by Decision Height and Runway Visual Range. The higher the category permits landings in worse visibility

low visibility

ILS Categories	Runway Visual Touchdown Guidance	
	Decision Height (DH)	Runway Visual Range (RVR)
CAT 1	not lower than 200ft (60m)	not less than 1,800ft (550m)
CAT 2	not lower than 100ft (30m)	not less than 1,200ft (350m)
CAT 3A	between 100ft to 50ft	not less than 700ft (200m)
CAT 3B	between 50ft to no DH	not less than 150ft (50m)
CAT 3C	No DH limitation	No RVR limitation

* There currently are no US airports with ILS CAT 3C

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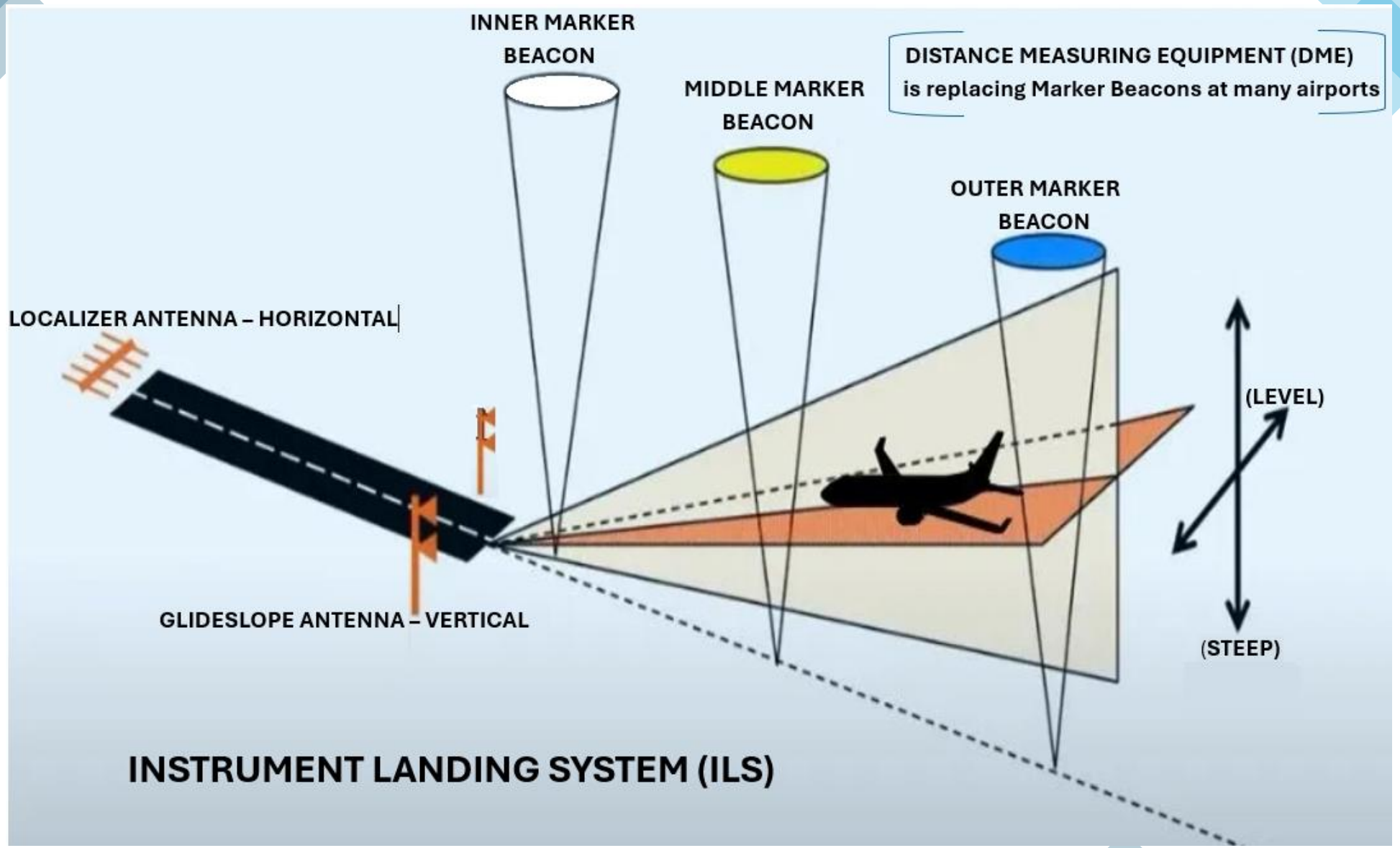
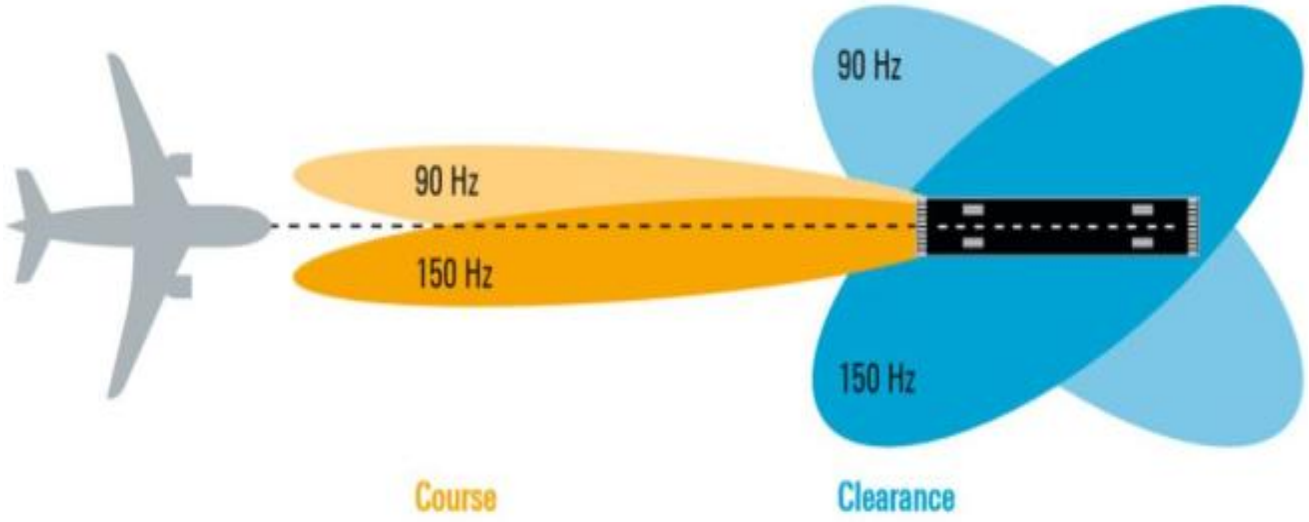

INNER MARKER BEACON
MIDDLE MARKER BEACON
OUTER MARKER BEACON
DISTANCE MEASURING EQUIPMENT (DME) is replacing Marker Beacons at many airports
LOCALIZER ANTENNA – HORIZONTAL
GLIDESLOPE ANTENNA – VERTICAL
(LEVEL)
(STEEP)
INSTRUMENT LANDING SYSTEM (ILS)

Localizer Antenna (LOC) – transmitted in VHF range



The localizer antenna is at the far end of the runway. Two intersecting beams are projected by the LOC antenna; one slightly to the right of the centerline, and the other slightly to the left. As these two beams intersect, an '**on LOC**' status is achieved, meaning the aircraft is on the correct runway centerline path

As shown in the illustration, the LOC antenna provides **horizontal** guidance. The LOC antenna uses a 90 Hz (left) and 150 Hz (right) tone in overlapping beams to guide the aircraft to the runway centerline. During approach, the aircraft uses the narrow **Coarse** beams which ensure it's aligned with the runway centerline. Once inside the airport perimeter the aircraft also uses the wider **Clearance** beams which ensure the aircraft is clear of any other aircraft, vehicles, or obstacles on the runway. Some airports use separate frequencies for the Course and Clearance signals, especially for higher ILS categories II/III which require greater precision

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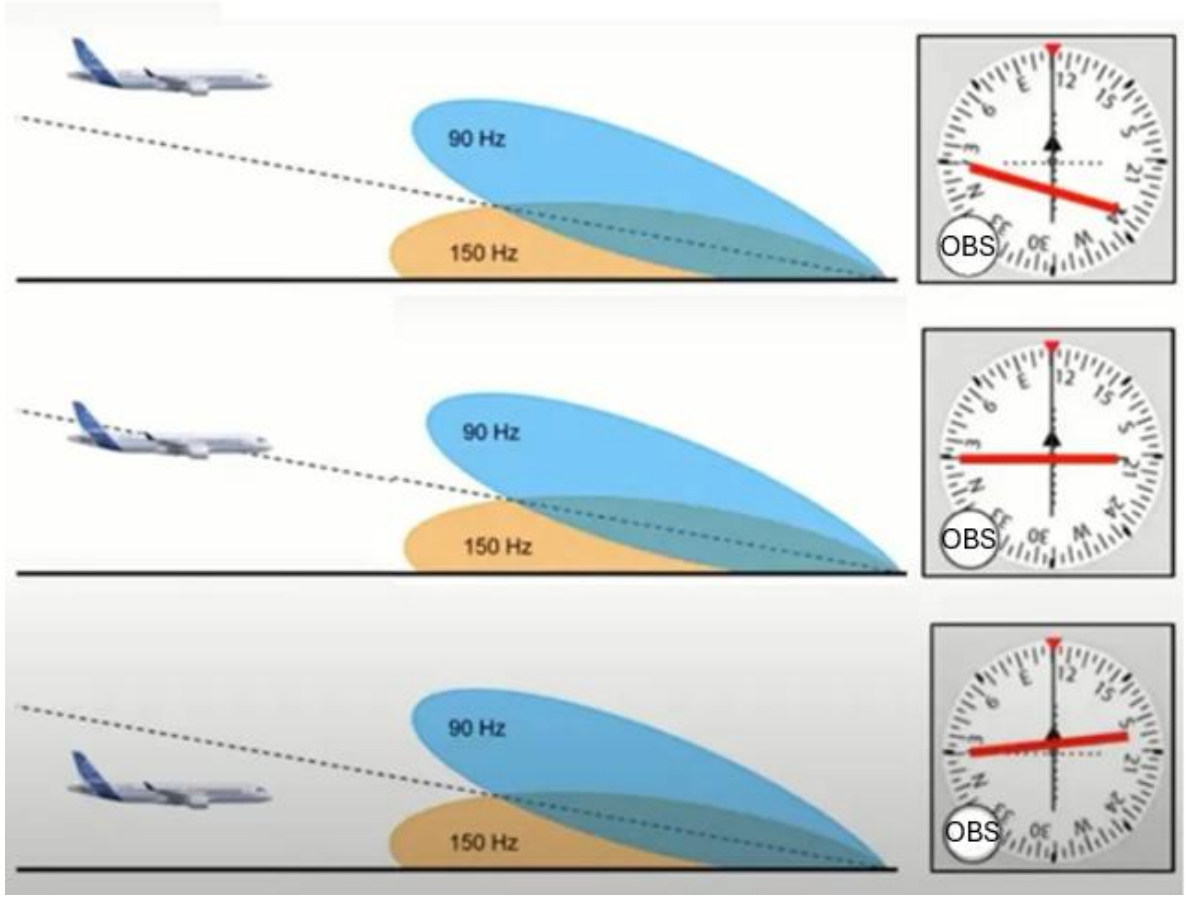
Glideslope (GS) – transmitted in the UHF range



Above Glideslope

lower decent angle

On Glideslope

maintain decent angle

Below Glideslope

elevate decent angle

GS antenna provides the aircraft's **vertical** position. An OBS (Omni Bearing Indicator) or the more advanced HSI (Horizontal Situational Indicator) in the cockpit displays the aircraft's vertical position. The GS antenna uses a 90Hz (upper) and 150Hz (lower) modulated tone in overlapping beams

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Course Deviation Indicator and Horizontal Situational Indicator

What Is a CDI?

A **CDI (Course Deviation Indicator)** is a navigation instrument that shows whether an aircraft is on course or deviating left or right.

It works with VOR or GPS signals to make sure that pilots stay aligned with their selected flight path.

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What Is an HSI?

An **HSI (Horizontal Situation Indicator)** is an advanced navigation instrument that combines a **CDI (Course Deviation Indicator)** with a heading indicator.

Its purpose is to assist pilots in tracking their course by showing both their heading and how much they need to turn to stay on track.

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HSI Instrument

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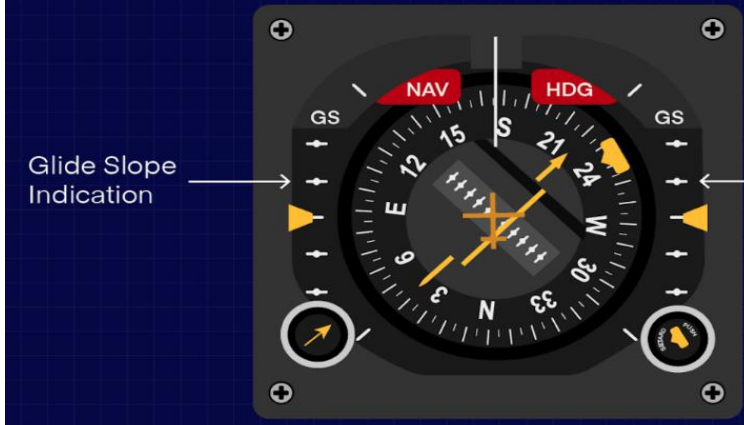
HSI displays Heading/CDI and Glideslope

HSI Instrument



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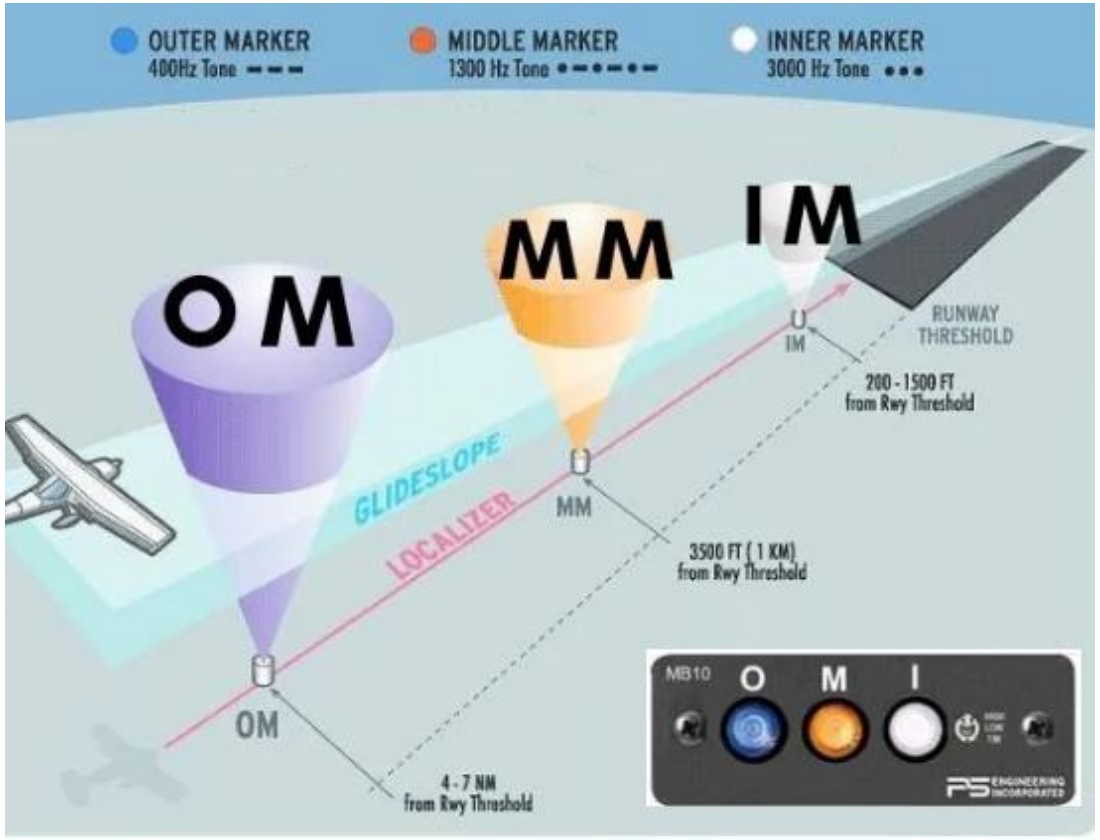
Marker Beacons – all operate at 75MHz



Marker Beacons provide distance to the runway information, where the pilot sees a light on their cockpit Marker Beacon display and hears an audio tone associated with each Marker Beacon as they fly over them.

OM – Outer Marker Beacon (Blue light) is the point where the interception of the Glideslope occurs

MM – Middle Marker Beacon (Amber light) is the point at which a landing approach switches from instrumentation to visual, Cat I ILS decision point

IM – Inner Marker Beacon (White light) – used for Cat II/III ILS approach

Marker Beacons are transmitted in a vertical, elliptical pattern, so their tone is only heard when the aircraft flies directly over them

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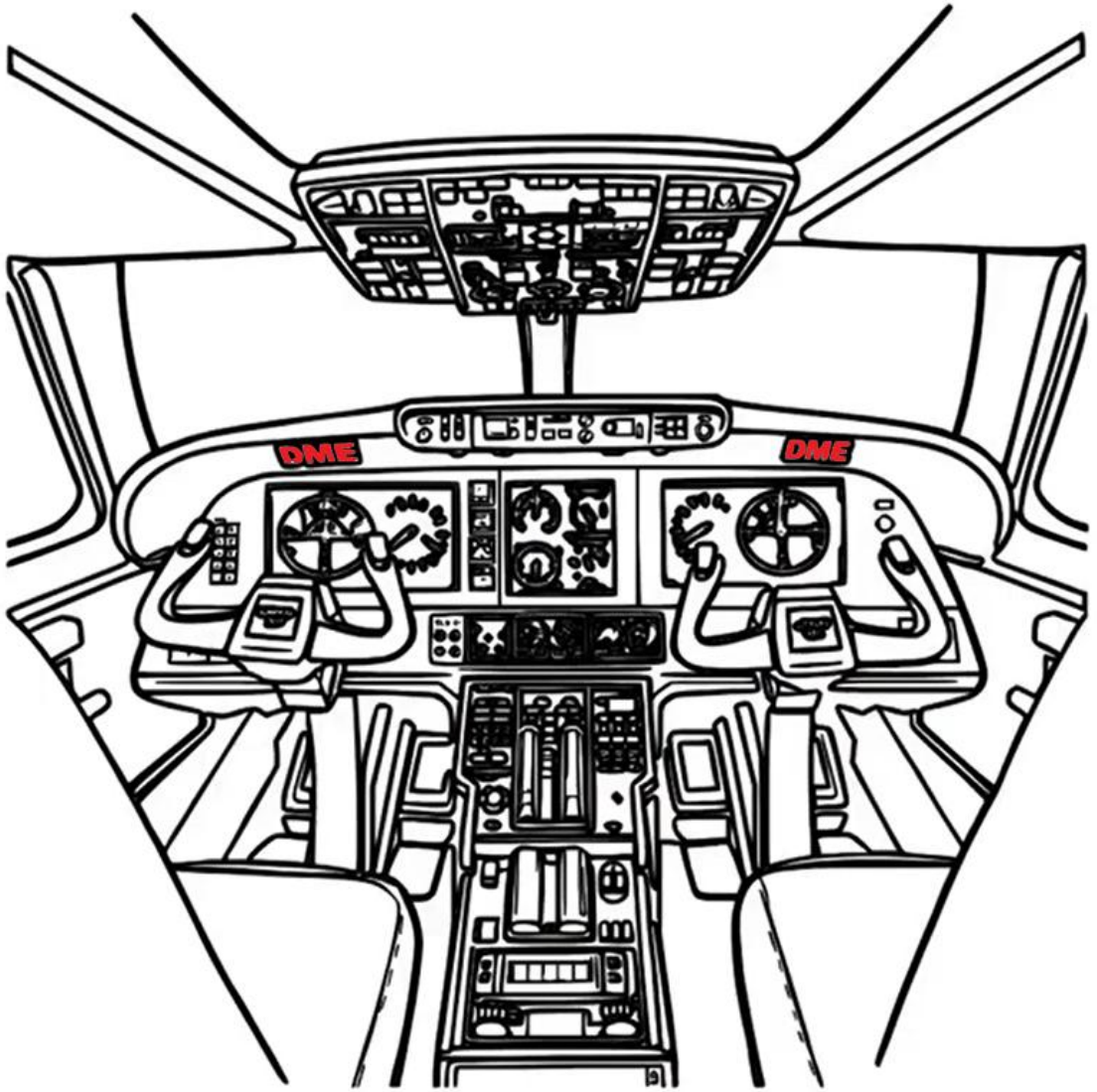
Distance Measuring Equipment
(DME)



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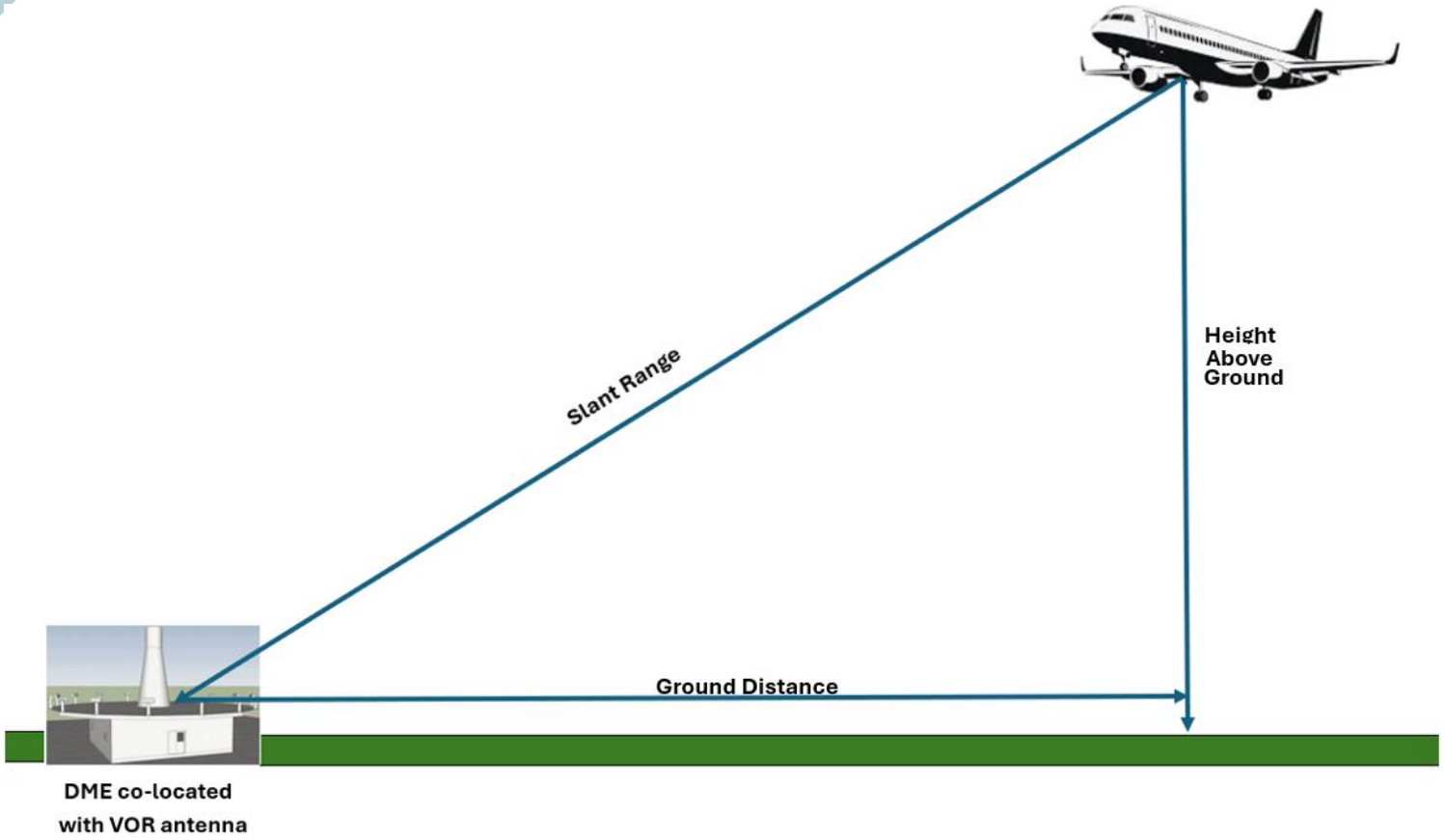
Distance Measurement Equipment (DME)



DME requires LOS between the aircraft and the ground station

DME is an aviation navigation tool used to allow pilots to measure the **slant range** distance between their aircraft and a ground-based station. It works by sending UHF radio pulse pairs from the aircraft to the ground station transponder, which then responds with its own signal. The equipment calculates the elapsed time for this exchange and translates it into the distance, which is displayed to the pilot.

Slant range – is the distance along the relative direction between two points.

Note: Slant range will be 'Zero' when aircraft is directly overhead of ground station transponder, even with the aircraft high overhead

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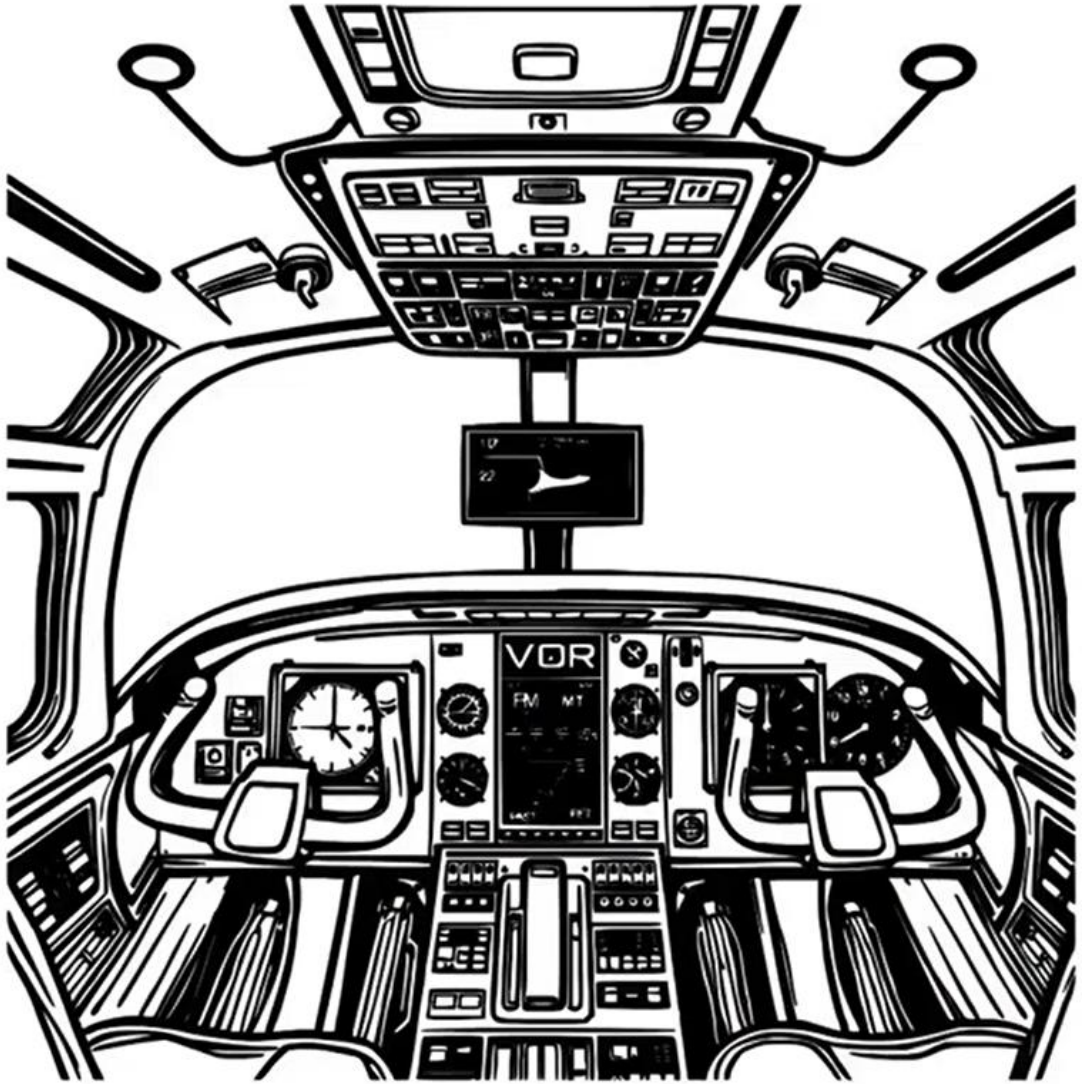
VHF Omnidirectional Range
(VOR)



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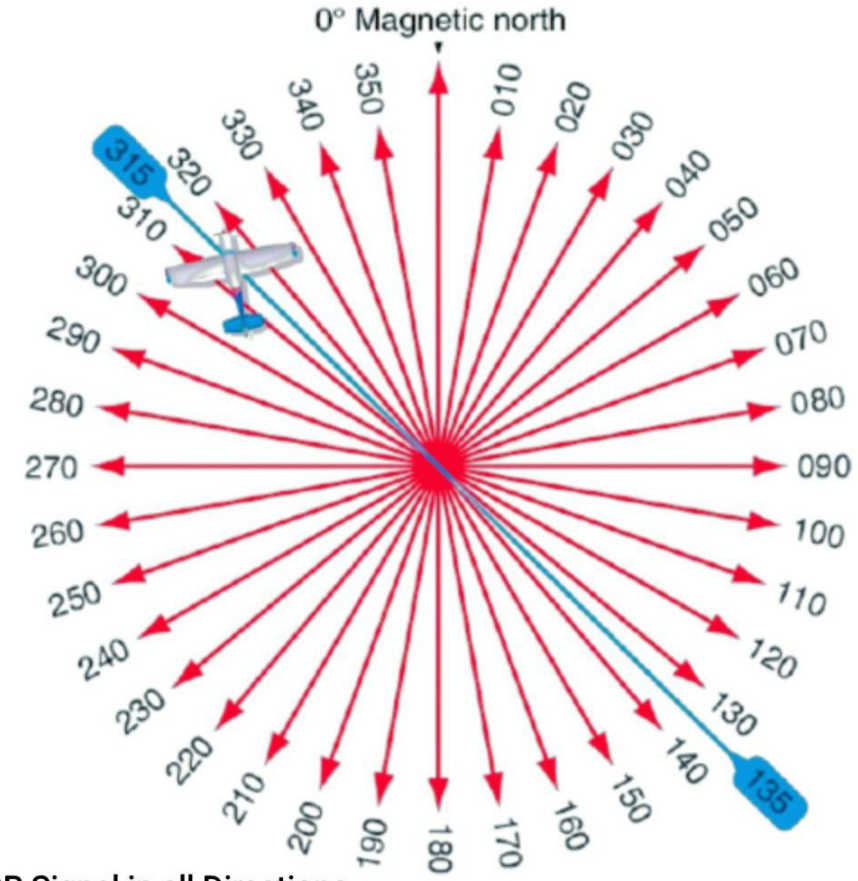
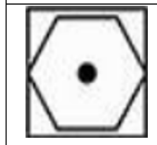
VHF Omnidirectional Range



VOR Signal in all Directions

Symbol	Description
 VOR	Provides bearing in reference to the airport transponder Commercial Aviation
 VOR/DME	Provides both bearing and distance in reference to airport transponder Commercial Aviation
 VORTAC	Provides both bearing and distance in reference to TACAN transponder Military and Commercial Aviation

VOR is a ground-based RF navigation systems that transmits two signals, one in a sweeping 360° signal and the other in an omni-directional reference signal. Many airports are moving away from VOR replacing with GPS

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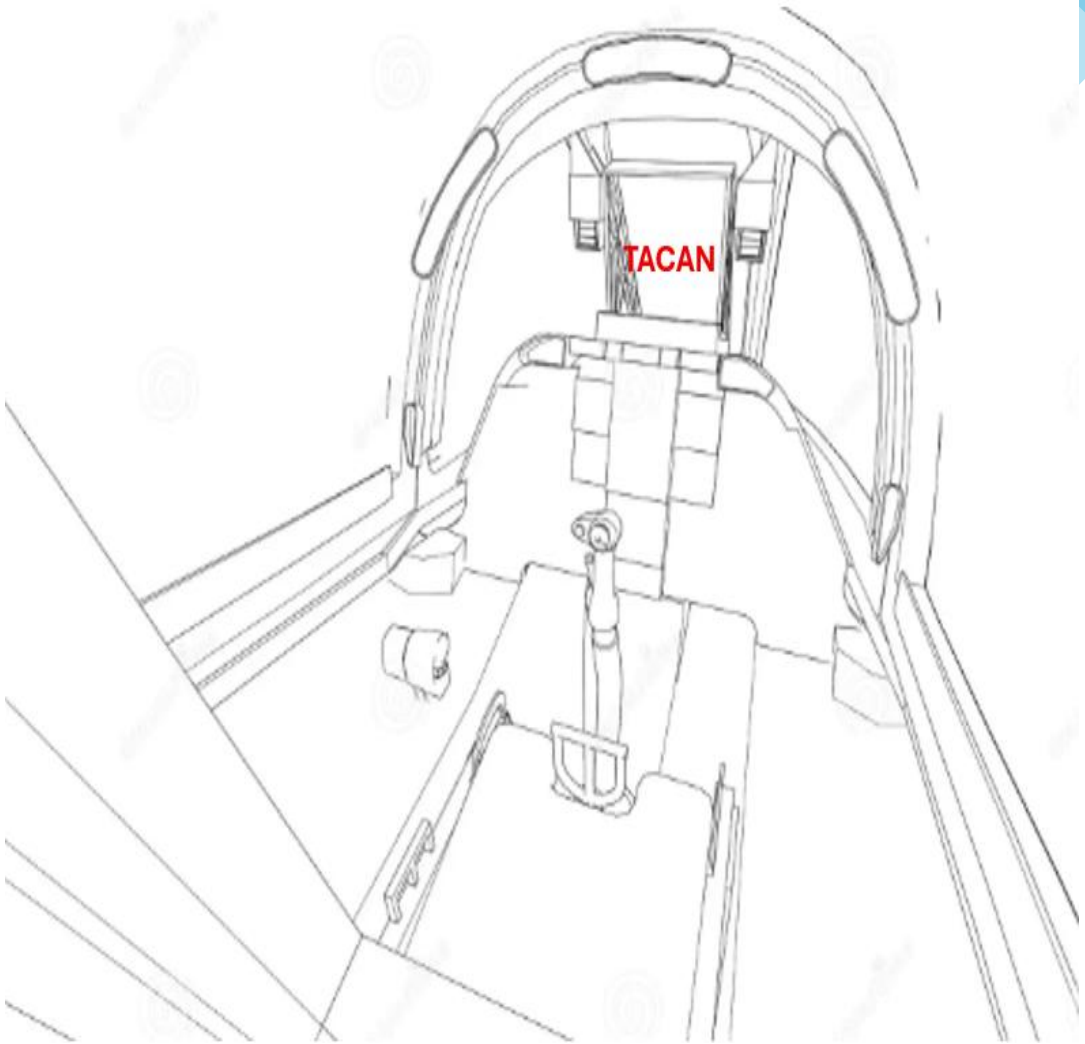
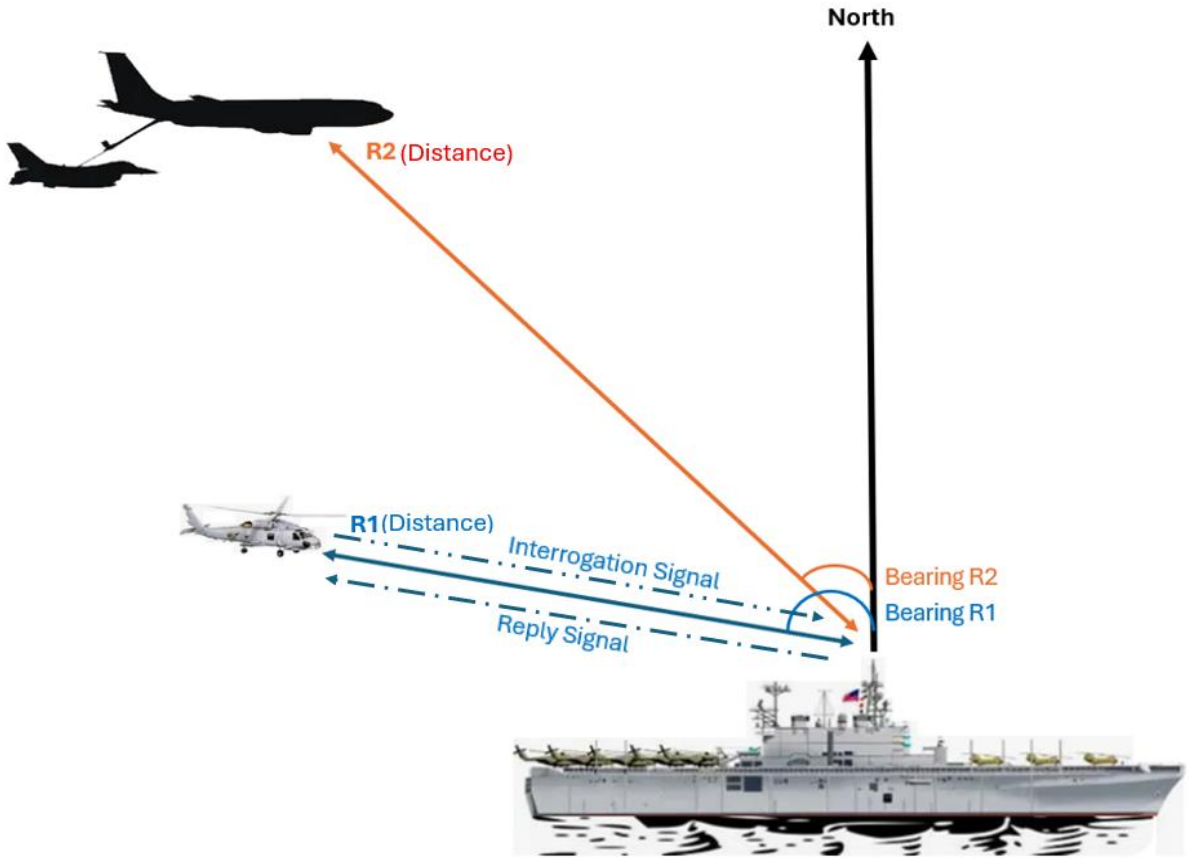
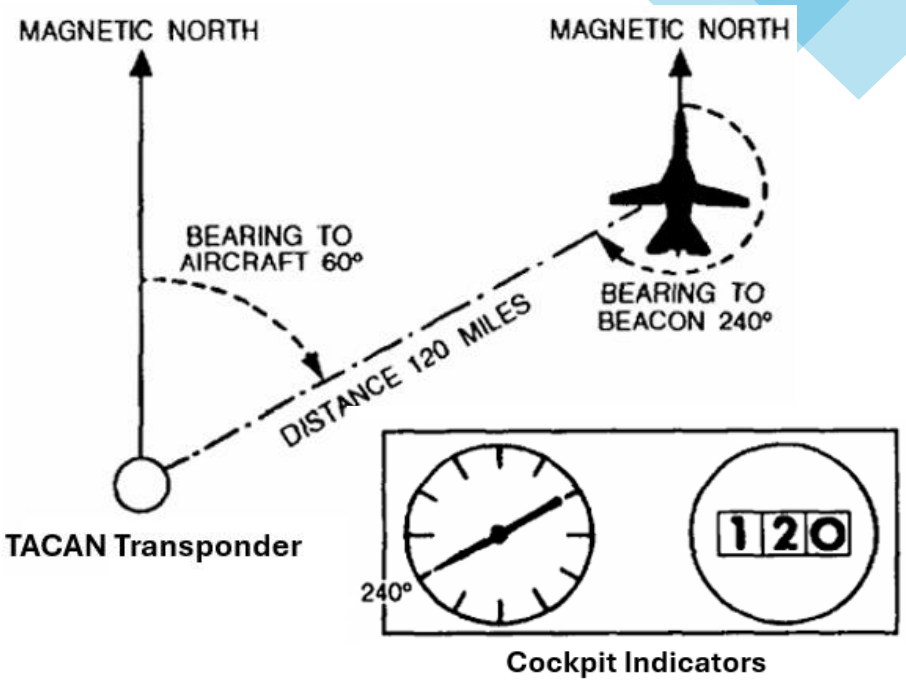
Tactical Air Navigation
(TACAN)







TACAN is a polar-coordinate type RF Navigation system that provides both distance and bearing info

TACAN is a military aircraft navigation system that provides information to a ‘moving’ destination like a ship or an aircraft tanker, in addition to just fixed military air bases

Introducing the VIAVI AVX-10K

The **VIAVI AVX-10K** Flight Line Test Set (handheld) is the preferred instrument by many aviation professionals for testing an aircraft's Navigational system.

AVX-10K is the direct replacement for the widely utilized IFR4000, IFR6000 and IFR6015 in capabilities and technical specifications for aircraft certification and testing. So, there no longer is the need to carry around multiple instruments, in addition the AVX-10K is lightweight and durable

NSN: 4920-01-724-8887

VIAVI Solutions

Product Information Letter

Subject: AVX-10K Boeing Tool Tag / AMM Reference

Boeing has approved the AVX-10K for use on all its commercial aircraft as an equivalent to the IFR4000 and IFR6000. Boeing is reviewing the various systems where the IFR4000 and IFR6000 are currently referenced to include the AVX-10K. The Boeing Tool Tag is AVX-10K.

With this approval, the following can be verified or accomplished pending formal tool tag assignment:

- Confirmation the AVX-10K is approved for use on Boeing commercial aircraft
- Confirmation the AVX-10K is approved for use in place of IFR4000 / IFR6000 and prior legacy test sets
- Updating of any local job cards and AMM if part of the normal process
- Priority request to Boeing for tool number and AMM update
- VIAVI can assist with technical support, amendments to job cards, and AMM updates if required for immediate use
- If you are currently using the IFR4000 and/or IFR6000 now, you will have no problem migrating to the AVX-10K

To help prioritize procedural updates for a specific model aircraft, operators and MROs are encouraged to submit requests to Boeing. VIAVI recommends the request be issued to all of the following:

- Send an email to pmet@boeing.com
- Send a Service Request via Boeing Communication Systems
- Contact and request via your local Boeing Representative

For any questions, please contact your representative, our Technical Assistance Team at techsupport.avcomm@viavisolutions.com or contact VIAVI Customer Service at (001) 800-835-2350.

Contact Information

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IFR4000 AVX-10K IFR6000

Boeing has approved the AVX-10K for use on all their commercial aircraft as an equivalent direct replacement to VIAVI's legacy IFR4000 and IFR6000 testers.

Boeing Tool Tag# AVX-10K

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VIAVI AVX-10K test all these Use Cases

Communications

- AM (VHF)
- FM (UHF)
- SSB (HF)
- SELCAL

Navigation

- ILS
  - LOC
  - GS
  - MB
- VOR
- DME
- TACAN

Surveillance

- Transponder Modes A, C, S
- ADS-B Out
- ADS-B In (Traffic)
  - 1030 MHz (ADS-B, ADS-R, TIS-B)
  - UAT (ADS-B, TIS-B, FIS-B)
- TCAS I/II and TAS testing
- ADS-B Monitoring
- GICB Monitoring
- UAT Monitoring

Other Test Tools

- ELT
- VSWR
- Distance to Fault

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VIAVI AVX-10K Navigation Testing

ILS — Provides simultaneous Localizer (with swept DDM), Glideslope and Marker Beacon Signals.

VOR — Generates signals over the VOR Band (108.00 to 117.95 MHz) with 30 Hz reference phase and 9960 Hz (sub-carrier frequency modulated with 30 Hz variable phase) amplitude modulated at 30% per tone. VOR bearing selection is provided in preset steps of 30° or variable steps of 0.1°.

DME — Single DME test screen provides control over DME Frequency/Channel, Range, Rate, RF level, % Reply, Squitter, Ident and Echo. UUT frequency, ERP, PRF P1/P2 width and Spacing are also displayed.

TACAN — Combines Range and Bearing control along with Range Rate and Bearing Rate including Air-to-air modes. Displays measured values on received signal.

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Want to learn more and schedule a Demo…

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- +45yrs in the Test & Measurement industry
- US Navy Veteran 1978-86

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Dualos applies our expertise and products, along with industry-leading partner solutions, to serve the Aerospace and Defense industry. We provide tailored solutions designed to address the complex testing challenges our customers encounter.

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