



NAVIGATION INSTRUMENTATION – DME

1. Introduction

Distance Measuring Equipment (DME) is defined as usually coupled with a VOR or an ILS beacon to enable aircraft to measure their position relative to that beacon.

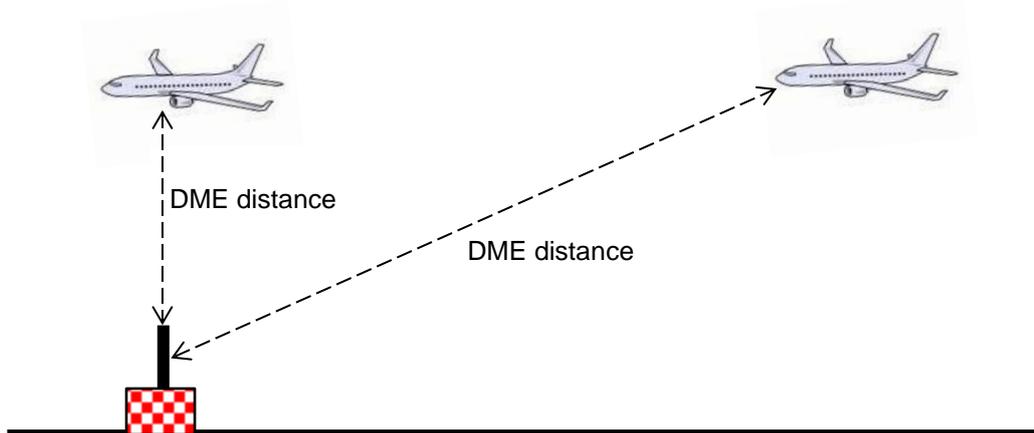
Distance Measuring Equipment (DME) is defined as a combination of ground and airborne equipment which gives a continuous slant range distance-from-station readout by measuring the time-lapse of a signal transmitted by the aircraft to the station and responded back.

DMEs can also provide groundspeed and time-to-station readouts by differentiation.

2. DME ground equipment

DME ground and on-board equipment use the UHF radio frequency band between 962MHz and 1213MHz.

An aircraft can compute its distance to the beacon from the delay of the signal perceived by the aircraft's DME equipment using the speed of light.



The distance measured by the aircraft is the direct path between the aircraft and the antenna of the DME. It is not the ground distance!

When an aircraft is above the DME, DME indicates the height of the aircraft and not zero.

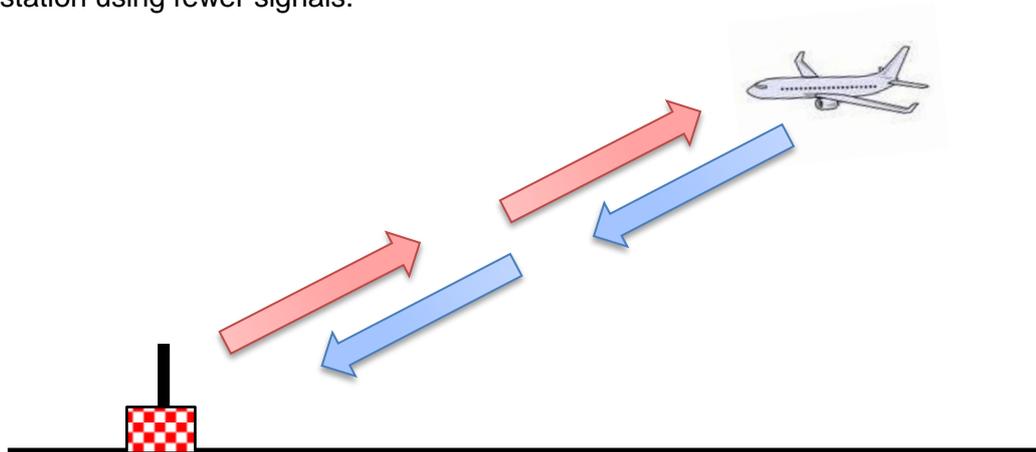
Figure: a DME installation near an airfield.

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DME works like a receiver and re-emitter like a transponder:

- The aircraft transmits a paired pulse spaced about 12µs or 36µs on the UHF frequency.
- The DME on the ground receives it and transmits with a constant delay of 50µs on an UHF frequency (with ± 63 MHz offset) a paired pulse spaced 12µs or 36µs
- When 50% of the signals emitted have been received by the aircraft's receiver, aircraft instrument can compute the signal in order to find the propagation time and then, calculate the distance.

The aircraft has also two modes for DME tracking: One for searching the station and another for tracking the station using fewer signals.



The need of bilateral communication between the base DME station and aircraft implies that the DME station has a limit of about one hundred aircraft in order to prevent the overload of the station. The DME station will adjust its receiver sensibility in order to filter the farthest aircraft.

The precision of the measure is 0.25 NM ± 1.25% of the distance calculated.

3. DME on charts

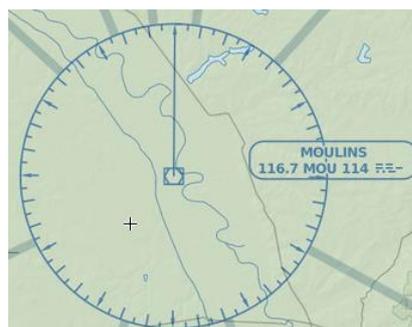
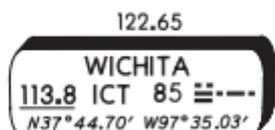
The symbol of the DME radio navigation beacon on charts is usually a square.



Associated with the DME figure, you can have additional information written in a rectangle:

- Full clear name of the DME
- Frequency in MHz and/or DME channel
- 3 letter call sign of the DME
- Morse code of the call sign

DME channel and paired VHF frequency are shown



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4. DME on-board equipment

4.1. Frequency selector

The NAV frequency selector is the control unit where pilots select DME frequencies. The DME frequency is usually "paired" with VOR or ILS or localizer (LOC) frequencies. Selection of the appropriate VOR or ILS frequency automatically tunes the DME attached (if existing).



Figures: 2 examples of a DME/NAV frequency selector:



Figure: example of a frequency selector located in FMC

4.2. Indicator instruments

There are several types of instruments for receiving a DME:

4.2.1. Standalone instrument

A standalone instrument is an instrument that displays only DME related information.

This instrument can be like the example below and can be found on beechcraft propellers for example.



The information displayed are:

- Distance in NM between aircraft and DME station
- Speed of the aircraft in Knots
- Time to reach the station if you navigate direct to the DME station

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4.2.2. DME displayed on RMI instrument

In more complex aircraft, like business jet and some airbus, cockpits have dual RMI equipment installed. This equipment is paired with a VOR/NDB remote magnetic indicator, and when a DME station can be found, the distance in NM is displayed at the top of the instrument.



Figure: Dual RMI of airbus aircraft

4.2.3. DME displayed on electronic navigation instrument

In many modern jets and propeller aircraft, electronic navigation instruments are usually used. These modern electronic navigation instruments are all-in-one instruments to display:

- VOR and paired DME distance
- ILS and paired DME distance
- NDB
- Navigation fixes
- FMC route
- Traffic (TCAS)
- Weather



Figure: Two examples of electronic navigation instruments: Boeing like and Beechcraft like

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