MICROWAVE LANDING SYSTEM

➢ MICROWAVE LANDING SYSTEM

- ✓ The Microwave Landing System (MLS) was designed to replace ILS with an advanced precision approach system that would overcome the disadvantages of ILS and also provide greater flexibility to its users.
- ✓ However, there are few MLS installations in use at present and they are likely to co-exist with ILS for a long time.
- ✓ MLS is a precision approach and landing system that provides position information and various ground to air data.
- ✓ The position information is provided in a wide coverage sector and is determined by an azimuth angle measurement, an elevation measurement and a range measurement.
- ✓ The ILS system inherently has certain disadvantages, which include the limitation of availability of 40 channels

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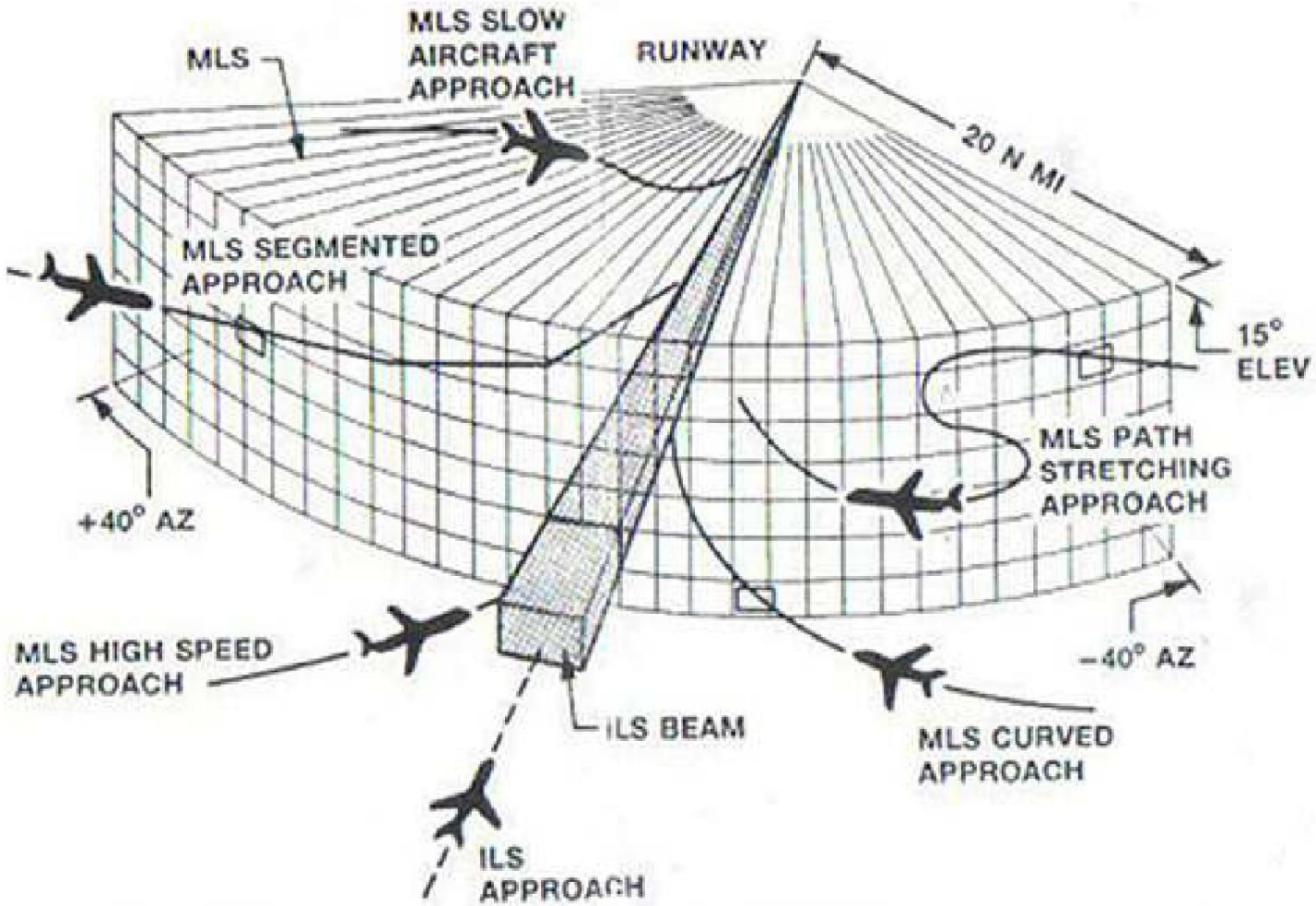

Combined representation of ILS and MLS runway approach

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- ✓ As a result, aircraft have to be sequenced and adequately separated which causes landing delays.
- ✓ There are no special procedures available for slower aircraft, helicopters, and Short Take Off and Landing (STOL) aircraft.
- ✓ The ILS system cannot be installed in hilly areas and it requires large expanses of flat, cleared land to minimize interference with the localizer and glideslope beams.
- ✓ Vehicles, taxying aircraft, low-flying aircraft and buildings have to be kept well away from the transmission sites to minimize localizer and glideslope course deviations (bending of the beams).

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- ✓ The Microwave Landing System (MLS) on the other hand offers certain significant advantages such as 200 channels availability worldwide.
- ✓ The azimuth coverage is at least± 40° of the runway on-course line (QPM) and glideslopes from .9° to 20° can be selected.
- ✓ The usable range is 20-30 nm from the MLS site.
- ✓ There is no problem with back-course transmissions; a secondary system is provided to give overshoot and departure guidance ± 20° of runway direction up to 15° in elevation to a range of 10 nm and a height of 10 000 ft.
- ✓ It operates in the SHF band, 5031 - 5090 MHZ.
- ✓ This enables it to be sited in hilly areas without having to level the site.
- ✓ Course deviation errors (bending) of the localizer and glide path caused by aircraft, vehicles and buildings are

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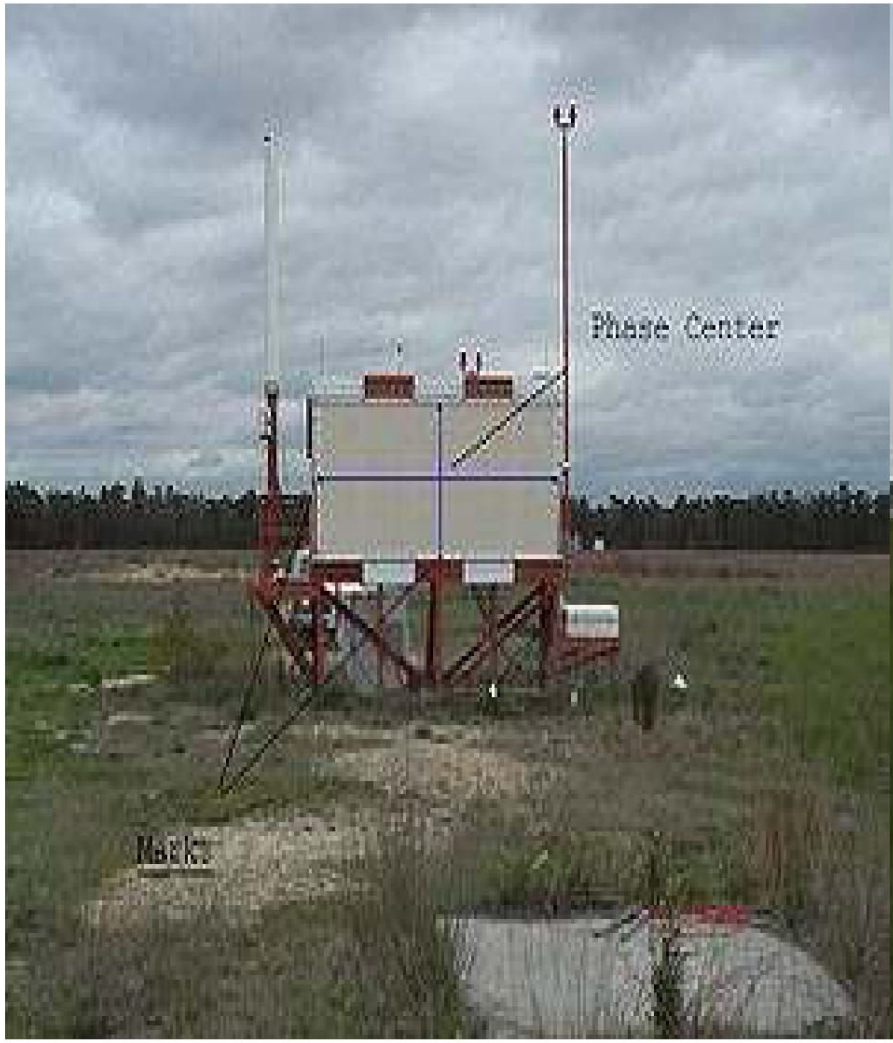

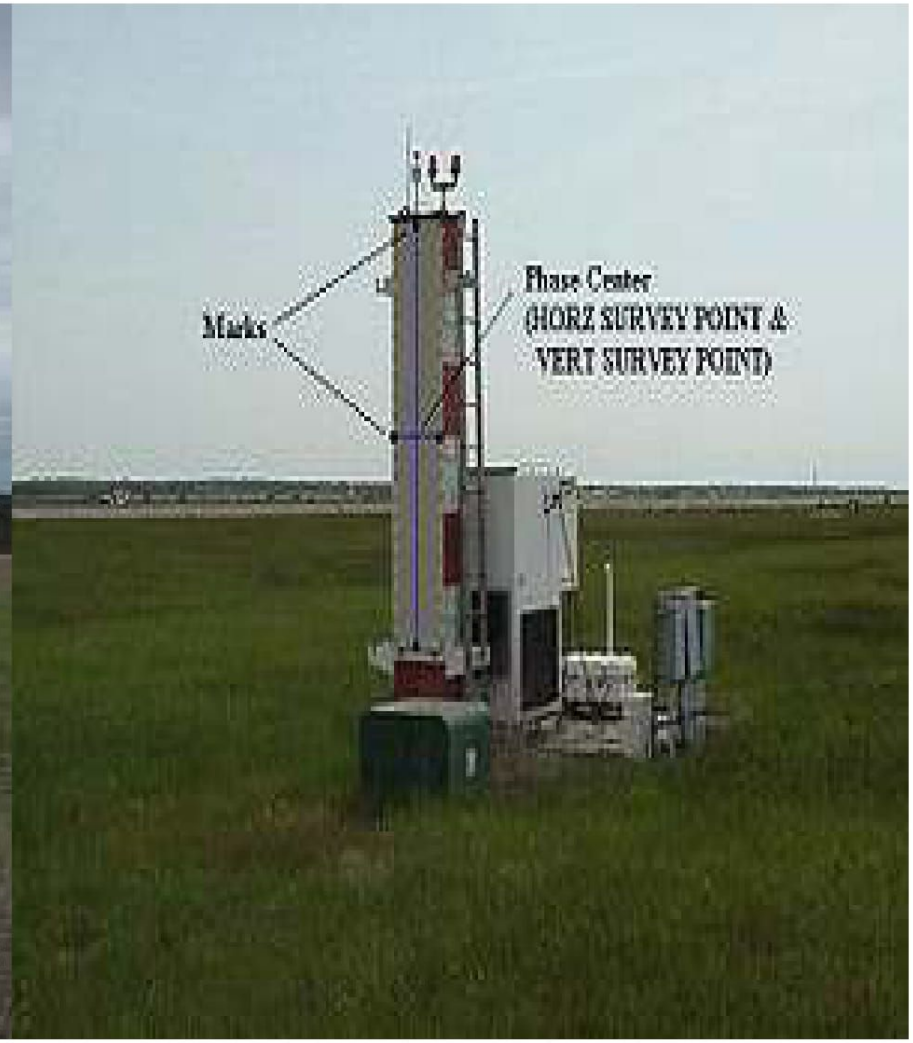

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- ✓ Because of its increased azimuth and elevation coverage aircraft can choose their own approaches.
- ✓ This will increase runway utilization and be beneficial to helicopters and STOL aircraft.
- ✓ The MLS has a built-in DME.
- ✓ The MLS is also compatible with conventional localizer and glide path instruments, EFIS, auto-pilot systems and area navigation equipment.
- ✓ The MLS is capable of giving positive automatic landing indications plus definite and continuous ON/OFF flag indications for the localizer and glideslope needles.
- ✓ The identification prefix for the MLS is an 'M' followed by two letters.
- ✓ The aim is for all MLS equipped aircraft to operate to CAT III criteria.

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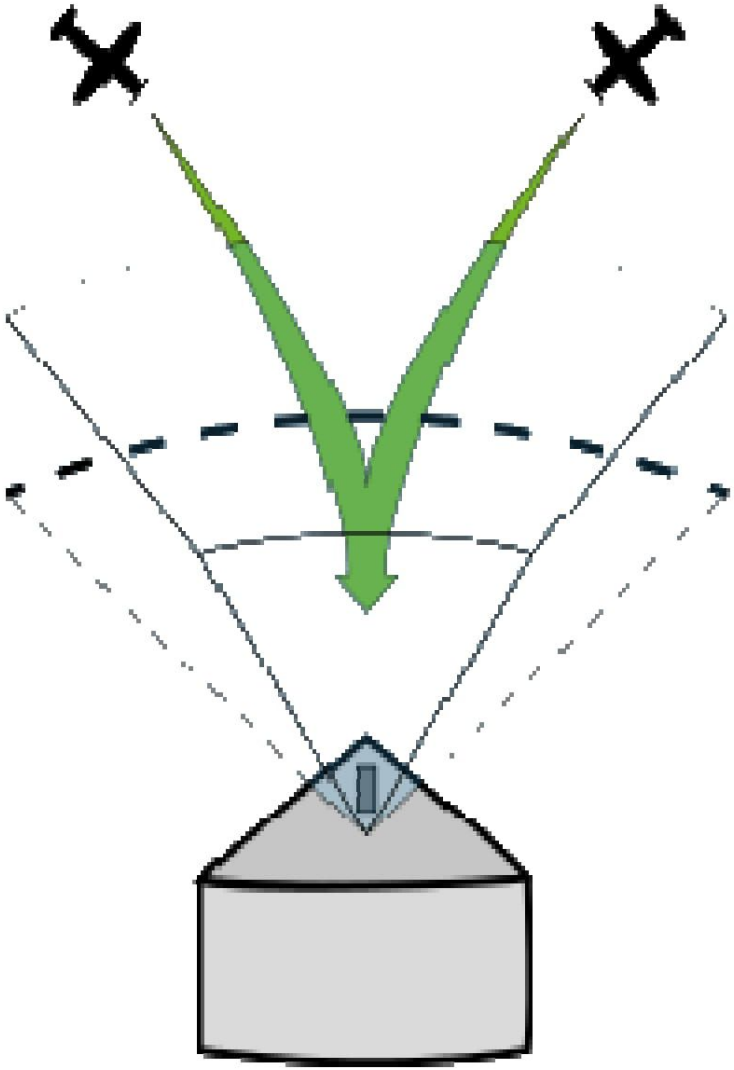
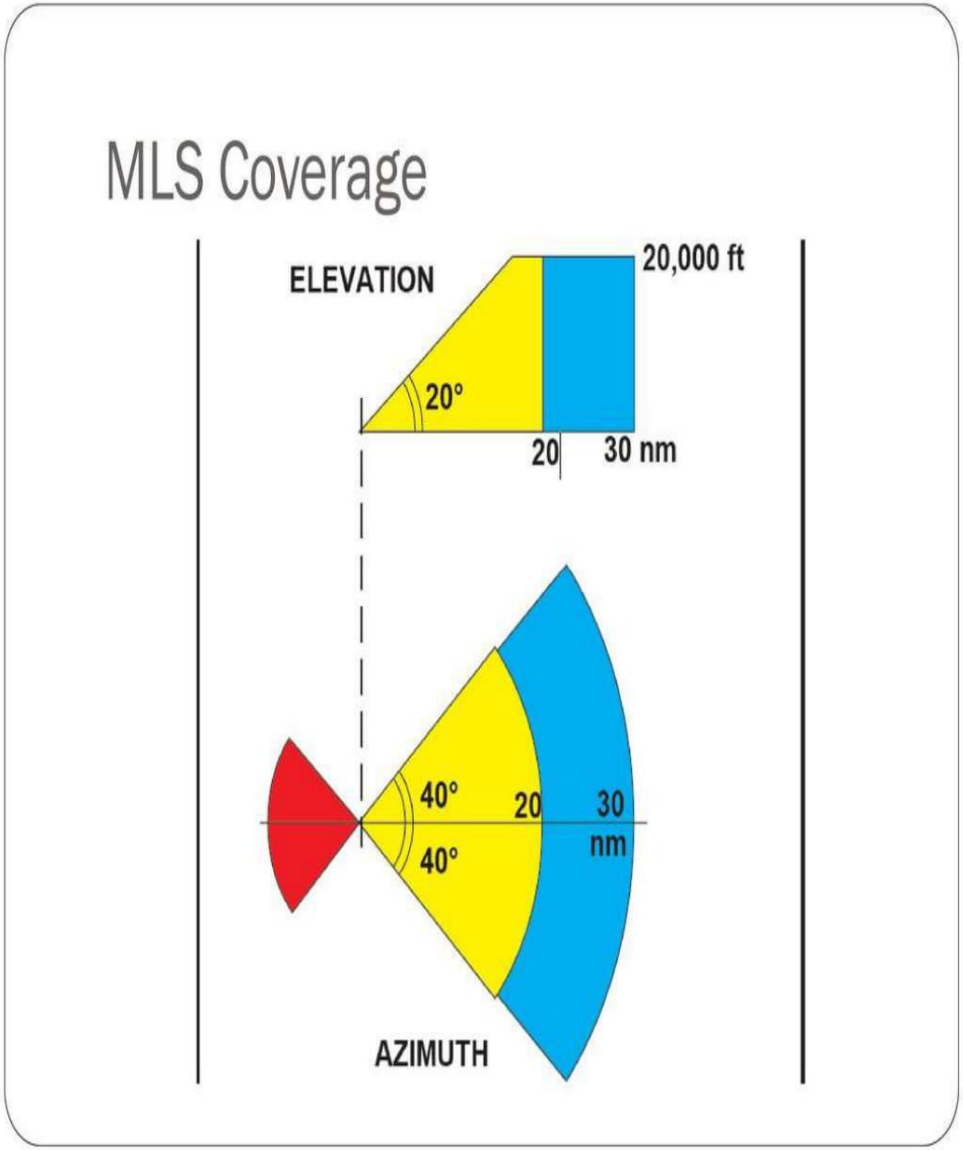
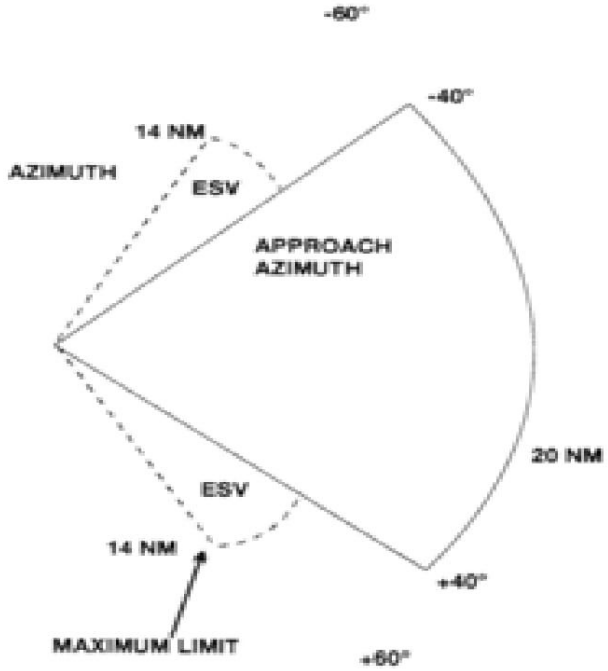




➢ MICROWAVE LANDING SYSTEM

○ OPERATIONAL FUNCTIONS

✓ The Microwave Landing System (MLS) employs the principle of Time Division Multiplexing (TDM) whereby only one frequency is used on a channel but the transmissions from the various angle and data ground equipment are synchronized to assure interference free operations on the common ra



➢ MICROWAVE LANDING SYSTEM

○ AZIMUTH GUIDANCE

- ✓ A technique called Time referenced scanning beam (T RSB) is effectively utilized in azimuth and elevation guidance.
- ✓ The aircraft computes its azimuth position in relation to the runway center-line by measuring the time interval in microseconds between the reception the 'TO' and 'FRO' scanning beams.
- ✓ The beam starts the 'TO' sweep at one extremity of its total scan and travels at a uniform speed to the other extremity.
- ✓ It then starts its 'FRO' scan back to its start position. The time interval between the reception of the 'to' and 'fro' pulses is proportional to the angular position of the aircraft in relation to the runway on-course line.

➢ MICROWAVE LANDING SYSTEM

- **AZIMUTH GUIDANCE**

✓ The pilot can choose to fly the runway on-course line (QPM) or an approach path which he selects as a pre-determined number of degrees± the runway direction.

✓ The MLS also incorporates a Back azimuth feature, which provides overshoot and departure guidance ± 20° of runway direction up to 15° in elevation.

✓ A DME system is mostly coupled with the MLS.

✓ The DME range along the MLS course is provided not by markers but by the associated DME system.

✓ For CAT II and III approaches, a precision DME (DME/P) that is accurate to within 100 feet must be available.

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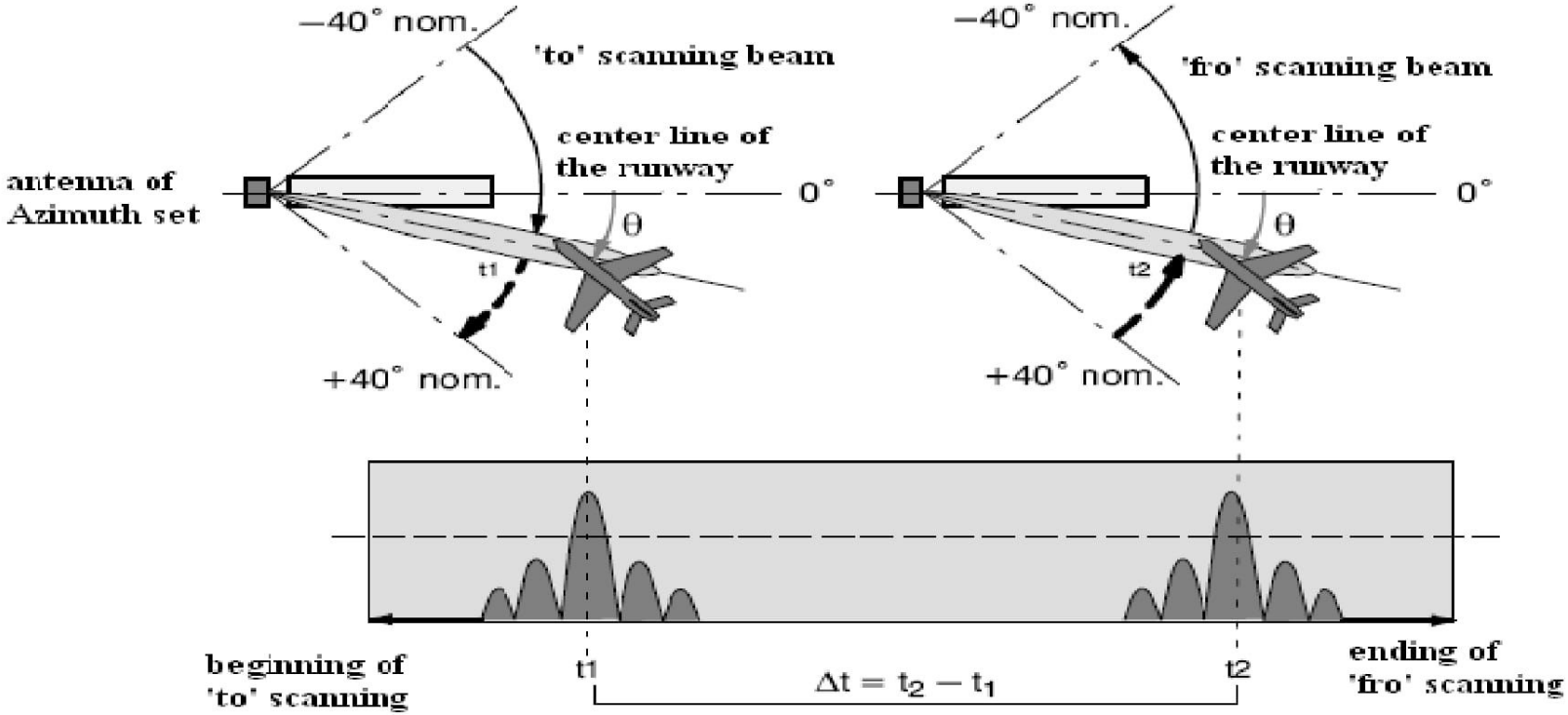

Figure 1 Principle of angle measurement of MLS

The formula of the measurement of the angle is:

$$\theta = (T_0 - \Delta t)\, v/2\,. \qquad (1)$$

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○ GLIDESLOPE GUIDANCE

- ✓ For glideslope guidance, another beam scans up and down at a uniform speed within its elevation limits.
- ✓ The aircraft's position in relation to its selected glideslope angle is thus calculated in the same manner by measuring the time difference between the reception of the pulses from the up and down sweep.
- ✓ The transmissions from the two beams and the transmissions from the other components of the MLS system are transmitted at different intervals i.e. it uses "time multiplexing".

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○ AIRBORNE EQUIPMENT

- ✓ The MLS airborne equipment is designed to continuously display the position of the aircraft in relation to the preselected course and glide path along with distance information during approach as well as during departure.
- ✓ The display consists of two cross bars similar to an ILS display except that the indications are given relative to the selective course.
- ✓ It is possible to program the computer to give segmented approaches and curved approaches for which a DME-P must be installed on the ground.
- ✓ In order to receive ILS, MLS and GPS transmissions, aircraft are equipped with multi-mode receivers and a combined control unit for ease of use by the flight crew.

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- **AIRBORNE EQUIPMEN**