Background
In the last decade, segmented and curved final approaches were made possible with the emergence of high performance navigation, onboard flight management and guidances systems.

Objective:
To examine Non-Precision Approach (NPA) and Precision Approach (PA) and their deficiencies with respect to ground infrastructures, signal interference, airspace capacity and noise impact to ground.

What is NPA and PA?
A NPA is an instrument approach and landing that utilises only horizontal guidance, while a PA is an instrument approach and landing with both horizontal and vertical guidances.

Instruments in NPA
1. Non-directional Beacon (NDB):
   A ground based radio transmitter used for an instrument approach at airports and offshore platforms.

2. VHF Omnidirectional Range (VOR):
   A system which provides each aircraft with a receiver to determine its position while staying on course through the reception of radio signals transmitted by a group of ground-based radio beacons.

3. Distance Measuring Equipment (DME):
   A system which is restricted to line-of-sight transmission. Aircraft use DME to determine the diagonal range distance by timing the propagation delay to a ground station.

Instruments in PA
1. Instrument Landing System (ILS):
   Consists of four ground sub-systems: a localiser transmitter, glideslope transmitter, marker beacons and approach lighting. An aircraft with ILS is equipped with 2 sub-systems that include a localiser and a glideslope receiver which provide horizontal and vertical guidance respectively.

2. Microwave Landing System (MLS):
   A system with better precision designed to replace ILS. Positional Information and data determined by azimuth, elevation and range measurement are provided over a large sector.

3. Ground Based Augmentation System (GBAS):
   A system which is restricted to line-of-sight transmission. Aircraft use DME to measure diagonal range distance by timing the propagation delay to a ground station.

Conclusion
As commercial air transport grows, older terrestrial systems like the ILS are losing ground to newer and more accurate satellite based systems like the GBAS. With that being said however, it is still necessary to have both terrestrial and satellite based systems available, to cater for redundancy.