Radar Signal Processing Timing Generation Module

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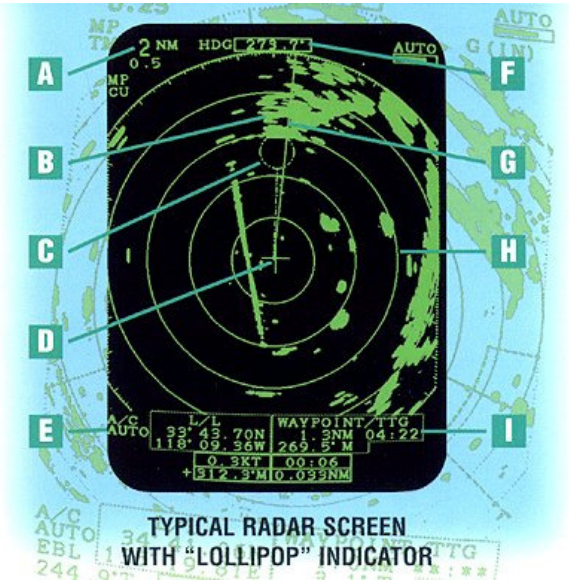
Agenda

- What is radar?
- Types of radar
- Typical modern radar system
- Radar Signal Processor (RSP)
- Timing Generation Module (TGM)
- Advances required for the TGM



TYPICAL RADAR SCREEN
WITH "LOLLIPOP" INDICATOR

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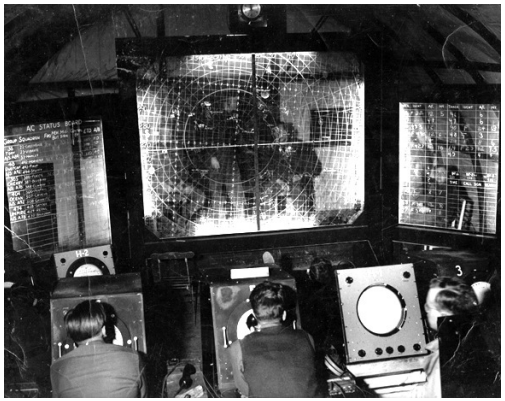
What is radar?

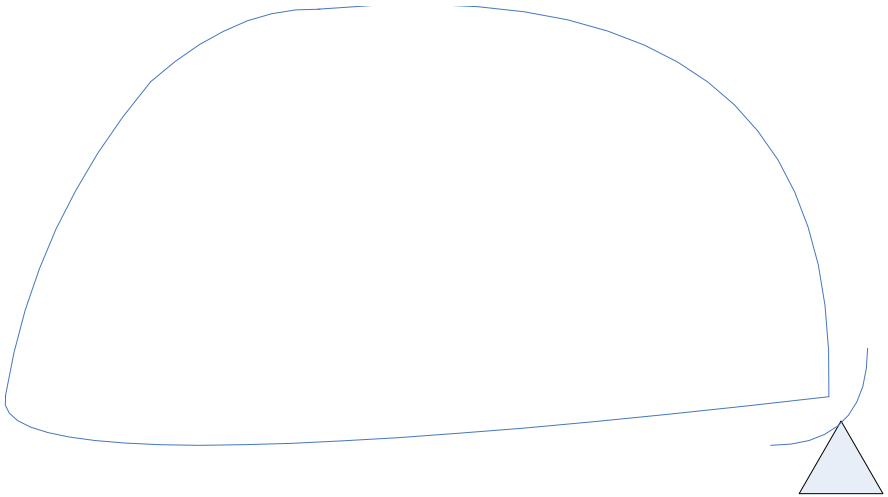
- Discovered prior to WW1 and used extensively during WW2.
- RADAR was coined in 1941 as an acronym for Radio Detection and Ranging.
- System that uses electromagnetic waves to identify the range, altitude, direction, and/or speed of objects.

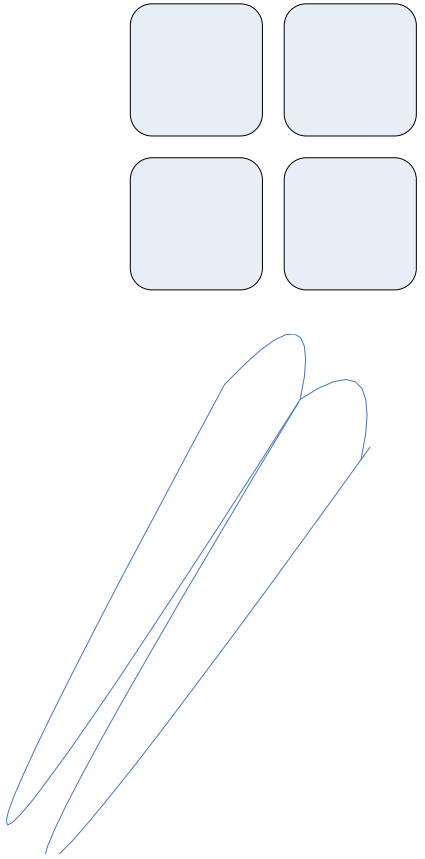


Types of Radars

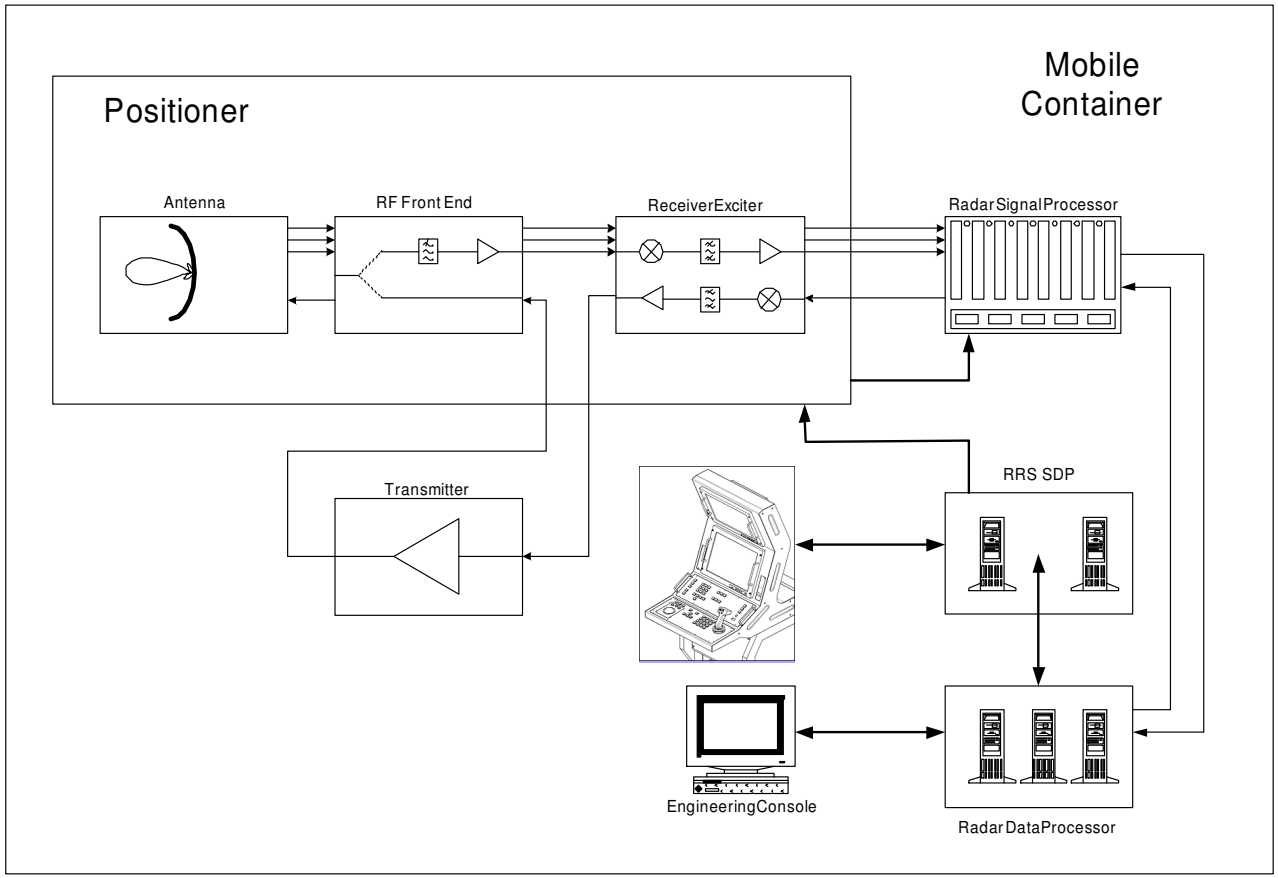
- Search radar, classical well known example. Sweeps surrounding area to find all possible targets.
- Tracking radar, locks onto a single/multiple targets within a narrower beam.
- Phased array radars. Multiple antennas with beams controllable in unison or alone. Can perform the function of both types above.

Radar beams

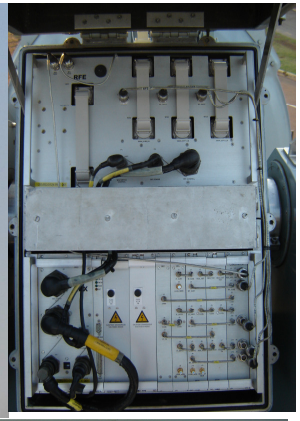


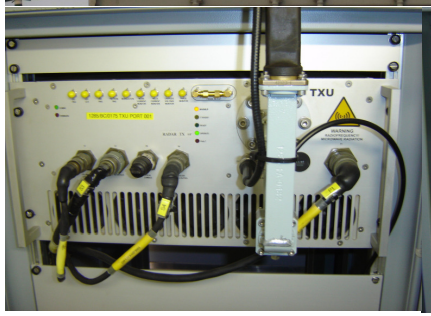


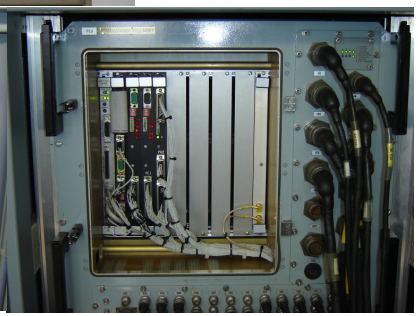
Typical modern radar system

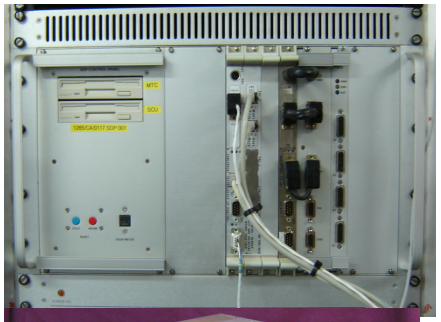


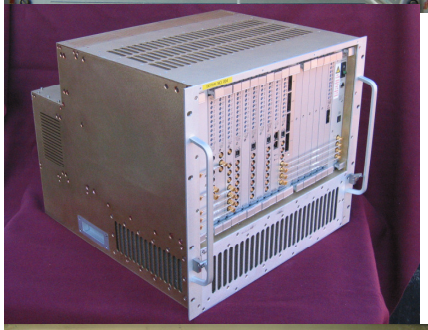
Parts of a radar











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Radar signal processor

- Digital front end: analogue to digital.
- Equalisation and Timing Generation.
- DPC, Digital pulse compression.
- Corner turning memory.
- Doppler processing (type of FFT Fast Fourier transform).
- Constant False-Alarm Rate.
- Detection estimation processor.
- Tracking control filter.
- Radar operator console / Display processor.

Timing Generation Module

- Typically cannot receive during transmission – can blow the receiver!
- Duplexer must be controlled to switch optimally between send and receive.
- Generates the basic timing and control signals that determine the waveform of the radar.
- Waveform tables are used to generate pulses suited to different scenarios.

TGM : Current Technology

- Current technology:
  - Table of patterns. Patterns consist of bursts. Bursts consist of pulses.
  - Pulses have Pulse code (shape), Pulse rate interval, Frequency and Jitter (for ECC).
- Each type of waveform to generate requires setting up patters, bursts and pulses statically.

TGM : New Requirements

- Pulse parameters that can be selected to fit a function for the burst.
- Pulse parameters that depend on the information gained from received pulses.
- Scriptable radar waveforms.
- Overlaying of radar waveforms
- Reconfigurable radar control and timing – allowing connection to different radar roles.

TGM : Achieving results

- Systems engineering process to be followed.
- Project is done using the latest FPGA technology.
- Firmware written in VHDL using HDL author, simulated using Modelsim.
- Verification through simulations and on hardware.

Questions?