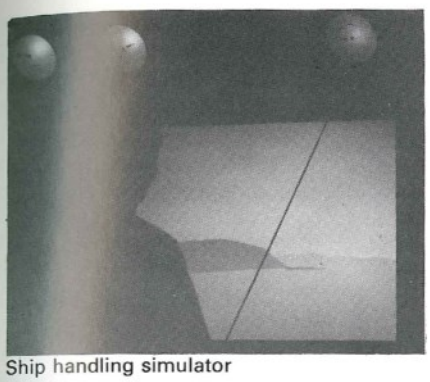
Simulation Equipment

TEPIGEN Television Picture Generator



Ship handling simulator

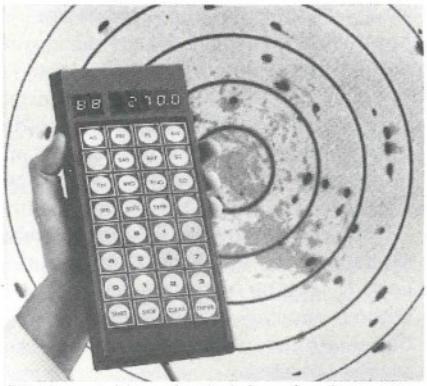
TEPIGEN

In a typical simulation system the performance characteristics of the 'vehicle' (whether land, sea or air) are modelled mathematically in a simulation computer.

In response to the operator's use of the controls the computer continuously updates the heading and position of the vehicle. This information enables the TEPIGEN scenario computer, which contains a mathematical model of the scenery within viewing distance, to calculate what is in the observer's field of view, where it is located and how it is orientated. The picture generator then 'visualizes' the scene in terms of video signals suitable for TV projection, direct viewing, or viewing with infinity optics.

The capacity required in the picture generator and scenario computer depends upon the application. Type H1 TEPIGEN has a 5Hz animation rate and maximum picture content of 500 'faces' suitable for stationary observers, e.g. aimers, or where the movement is slow (e.g. ship handling scenes). Type H2 has a 50Hz animation rate and picture content of 5000 faces, suitable for pilots and vehicle drivers. In both cases the display is 625 line television with 50Hz field rate; the generated picture can be spread across more than one display to give increased field of view, subject to certain constraints in picture composition.

STEG Portable Radar Training Simulator



STEG portable radar training simulator

STEG

(Simulated Timebase and Echo Generator) has been developed to meet the need for a simple, inexpensive and portable radar simulation system. STEG brings the simulator to the operator, whether afloat or ashore. Designed for use in a normal working environment, the complete STEG assembly consists of a main unit to which a hand held keyboard is connected by a flexible lead. The assembly can be coupled to any radar PPI display via an intermediate unit which can be made a permanent part of the display installation. The system thus enables the operator to use his own display as a simulator at any time that it is not in operational use. Interfaced in this way with an existing radar console, STEG will generate or reconstruct critical radar situations which can be varied, stopped or repeated at will. By operation of the keyboard, the simulator will reproduce the radar echoes of aircraft, surface craft, buoys, clutter, thermal noise, wind, tide and blind arc.

The simulator can either superimpose echoes on to a background picture derived from the radar receiver (overlay mode) or can generate a totally simulated picture (autonomous mode). A total of 'own station' plus seven targets can be displayed; if more targets, or secondary radar characteristics, are required, they are available as optional extras. The playing area is a circle, centred on 'own station', of radius 805km (500 miles).

For naval use, STEG will operate with ships' displays in any of their normal modes — ship's head up, north up, true motion, etc. When STEG is operated in conjunction with a coastline generator, it provides a realistic navigational/pilotage facility to which other instrumentation can be added. A dual system can be interconnected to give '2 own ships' configuration.

Data Summary

Electrical

Power requirement (mean):
400W main unit, 100W intermediate unit.
Supply voltage (standard):
The unit can be supplied to operate at 115V, 120V, 220V, 240V, 1ph.
Supply variation tolerated: ±10%
Supply frequency (standard):
48Hz to 63Hz. Units can also be supplied for 400Hz.

Mechanical

Main case dimensions:
550mm x 325mm x 610mm high.
Weight: 40kg
Keyboard dimensions:
230mm x 100mm x 40mm
Intermediate unit dimensions:
dependent on associated radar.
Standard STEG to Intermediate Unit cable length: 5m - max 50m

Environmental

Operating Temperature (main unit cooling by internal fan): 0°C to +40°C.
Operating humidity (no condensation):
10 to 95% RH.
Storage temperature: −20°C to +70°C.

Simulation Equipment

SEEC Simulation Equipment Electronic Countermeasures

Most air defence radar systems are fitted with technically advanced anti-jamming circuitry, but few have the means to effectively test this circuitry on a practical basis. To meet this vital need Marconi Radar have produced SEEC (Simulation Equipment Electronic Countermeasures).

SEEC is intended for integration with air defence surveillance radars and is used to test the operational system without causing external interference. Rapid reversion to normal working is readily achieved.

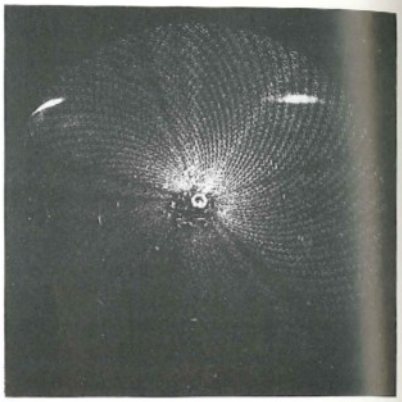
There are two levels of application for SEEC:

1. The means to generate locally at r.f. levels a wide range of ECM effects within a dynamic presentation of airspace activity. By injecting this into the front-end of a radar receiver, various anti-jamming functions can be exercised and a cleaned picture presented at the PPI's. Both active and passive (chaff) jamming may be simulated.

   For full airspace simulation at radar frequency, modules are designed as an add-on to the Marconi digital radar (video) simulator. Integration with other digital simulators is achieved by the provision of interface conversion.
2. The means for objective assessment of radar performance in quiet and jammed conditions by monitoring the receiver and anti-jamming circuitry on a continuous basis. Results are presented on-line.

   SEEC can be employed as a test facility without airspace simulation. With the radar in normal operational use, a number of test pulses at pre-selected amplitudes may be generated and inserted at r.f.:

   (a) In a quiet environment, a count of the number of pulses which survive processing to reach video level will determine the probability of detection.



A typical SEEC presentation of radar display subject to electronic jamming

   (b) In an ECM environment, a comprehensive selection of active jamming effects are produced, enabling improvement factors for the various anti-jamming circuits to be determined. This provides a confidence check on equipment setting up and operation.

Simulation systems combining the most advanced control procedures training facilities at video level with alternative r.f. output for ECCM co-ordination can be supplied for either transportable or static ground radar systems to provide a plug and socket interface with operation equipments.

Simulation Equipment

ATC and Air Defence Radar Simulators

Marconi Radar air traffic control and air defence simulators are based on completely digital techniques. By virtue of modular design they can be assembled into a wide variety of system configurations. A fully configured system comprises:

920 ATC Advanced Technology Computer
Latest in the successful 900 family of computers. An 18-bit general purpose machine, average instruction time 3μs, with either 32K or 48K words of core store cycle time 1μs.

Simulator Peripheral Equipment
Computer Interface Unit (CIU)
This interfaces the computer peripheral data, address and control highways with the various simulator peripheral units.
Radar Signal Generator
This comprises three functional modules – store and control, primary video generator and secondary radar video generator.

The store and control module holds data (range, azimuth, video address and category) for 60 targets, or clutter or ECM defining points. Data for each target is output to the video generators a number of times in successive p.r.f. periods to generate the number of strikes per target paint appropriate to the simulated antenna beamwidth. The store also receives an azimuth word which determines when further target information is required from the computer. Thus there is no limit to the number of targets that can be accommodated in any sector of the radar cover, provided that no more than 60 of them actually overlap within the antenna beamwidth, a special feature of the Marconi Radar simulator.

The primary video generator module accepts digital data which defines target strength and azimuth deviation from plot centre, to generate a target echo pulse of appropriate amplitude, making use of preset radar parameter data. A pseudo-random number generator feeds a digital probability distribution network, normally set to generate Rayleigh-distributed noise although other probability distributions may be specified. Fixed clutter is produced by specifying in software form areas of trace-to-trace correlated noise of varying intensity.

The secondary radar video generator module produces data in serial or parallel form as from an interrogator/responser, compatible with the requirements of STANAG 5017 and ICAO annexe 10, including interleaved code trains and mode interlaced responses.
Aircraft Control Unit (ACU)
A desk console containing an electronic data display (EDD), a keyboard and a communications control unit, by which an operator pilot communicates with the simulation system (by digital data) and with the trainee controllers (by voice).

The EDD is a standard 625 line 11in. television monitor displaying 30 lines of 80 characters in high ambient lighting.

The keyboard uses extremely reliable reed switches with a light, positive touch. Modular buildup provides a maximum of 70 keys in 5 rows of 14 columns. Multi-key rollover is incorporated.

The communications control unit provides one simulated R/T transmit/receive circuit, for communication with the trainee controller, and one intercom circuit for communication with the supervisor.
Target Track Intervention Keyboard
This optional 25-way keyboard and four digit readout provides the means to divert any background track from its pre-specified flight plan, to obtain its current height, heading or speed and to fade a track on either a temporary or permanent basis.


A typical simulator control room

	Limits	Increments
Aircraft parameters		
Heading	0–359°	1°
Speed	0–900kn or Mach 0.6–5.0	10kn or Mach 0.01
Altitude	0–100,000ft	100ft
Vertical speed	100–45,000ft/min	100ft/min
Acceleration	10–1,000kn/min or 0.01–2g	10kn/min or 0.01g
Turn rate	½–5	½
Bank angle	5–75°	5°
Fuel load	100–50,000 } selectable units	100
Fuel consumption	10–1,000 }	10
Radar parameters		
P.R.F.	200–1500 p.p.s.	fully variable
Pulse length	25μs (max)	fully variable
Rotation rate	2–20 rev/min	fully variable
Beamwidth – hor/vert	0.088 min −5° to +90°	0.088° fully variable
Display range – max	250 (500 optional) nm	
Video outputs	Log, linear, MTI, target only	
General parameters		
Airspace vertical	100,000ft	
horizontal	500 (1000 optional) sq. nm	
accuracy	0.025% vertical/ 0.0125% horizontal	
Wind structure	5 layers (fine or coarse)	
direction	0–350°	10°
speed	0–200kn	5kn
Geographical locations	50 max	
Airfield data	3 standard	
Runway data	6 standard	
Radar sites	1 standard (2 optional)	

Note: nm denotes nautical mile(s)