AIR TRAFFIC CONTROL SYSTEMS

Marconi
Radar Systems

ASTRID DISPLAYS

The Marconi ASTRID is a versatile microprocessor-controlled radar display and data handling system which is available in a number of configurations for ATC including approach, departure, terminal area and en-route control.

Embodying the latest technology ASTRID has been designed for high reliability, availability and ease of maintenance made possible by the use of quality components, flexible system design, firmware control, modular construction and built-in test equipment.

Features

- Flexible, general purpose low cost design

- Choice of autonomous or central processor configurations

- Distributed processing configuration for larger control centres

- Accepts radar video plus extracted radar and SSR plots

- Choice of 16-inch (40cm) and 22-inch (56cm) display screen sizes

- Bright, high resolution displayed picture

- Wide range of standard radar data processing (RDP) facilities

- User-programmable digital maps

- Optional tracking with groundspeed in track label, high ground warning and multi-radar inputs.


1 "The independently produced and processed raw video and synthetic data are displayed together."
2 "Preselected aircraft are converted automatically from SSR code to callsign."
3 "An electronic range and bearing marker gives relative co-ordinates between any two points on the display."
4 "Digital vector maps can provide any required contours and reference points."
5 Tabular data area 1
6 Tabular data area 2
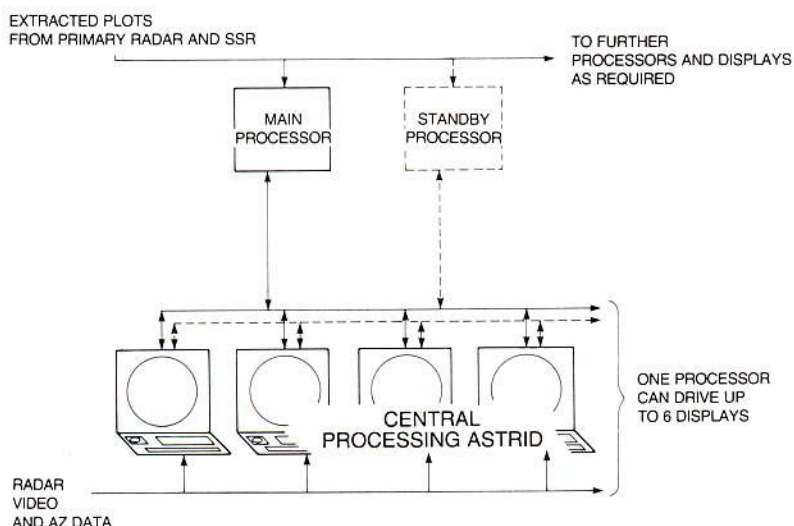
Configurations

The basic elements of the ASTRID system are the Display Unit, the Control Desk and Processor. Each Display Unit has its own Control Desk which contains a control panel and two keyboards.

The system concept is particularly flexible and allows the system configuration to be closely matched to a wide range of operational and functional requirements. The Processor can drive up to six Display Units so that in the case of approach and terminal area control centres, the
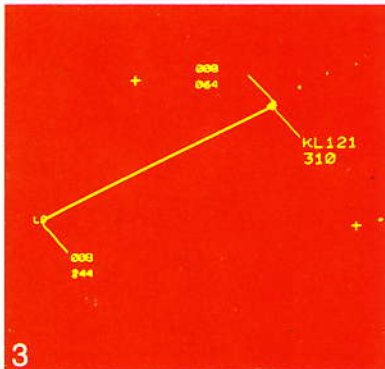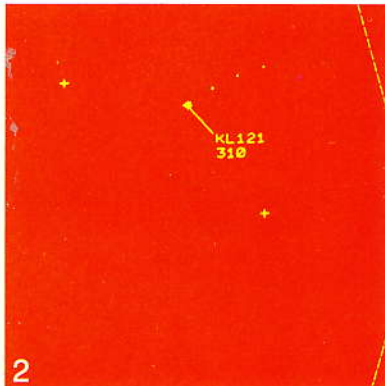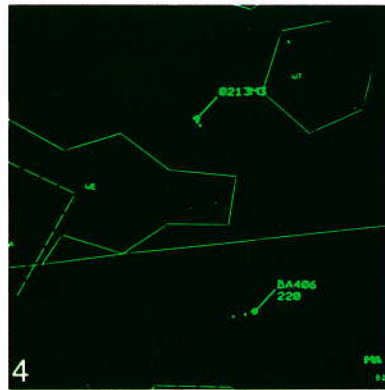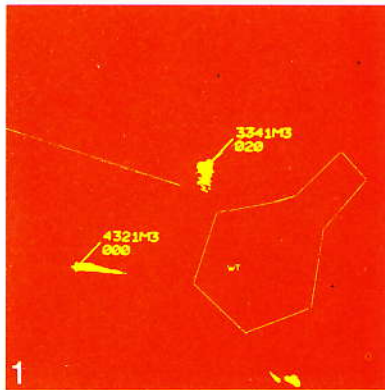
Operational Facilities

The flexibility of the ASTRID system allows a wide range of ATC requirements to be met from the most basic to the most complex. The standard package for approach control, and terminal area applications has the following features:

- Display of raw or plot extracted primary radar
- Display of extracted SSR plots
- Aircraft positional symbols with labels containing: SSR code or callsign, flight level or altitude, cleared flight level, climb/descent arrow and groundspeed
- Up to five history plots per aircraft symbol
- Selectable character size and brightness
- Optional SSR and combined plot tracking
- Coasting on missed SSR plots for track continuity
- Aircraft filtering with "quick-look" override
- Code/callsign correlation and callsign display
- Automatic flight level to altitude conversion
- Vector maps (held in non-volatile store)
- Tabulated data areas, positioned by rolling ball
- Electronic range and bearing indication, calculation and readout
- ADF interface and presentation
- Rolling ball cursor
- Interconsole marking and "silent" handover
- Interconsole message transfer
- Optional high ground warning system
- Extended runway lines
- Temporary map facility
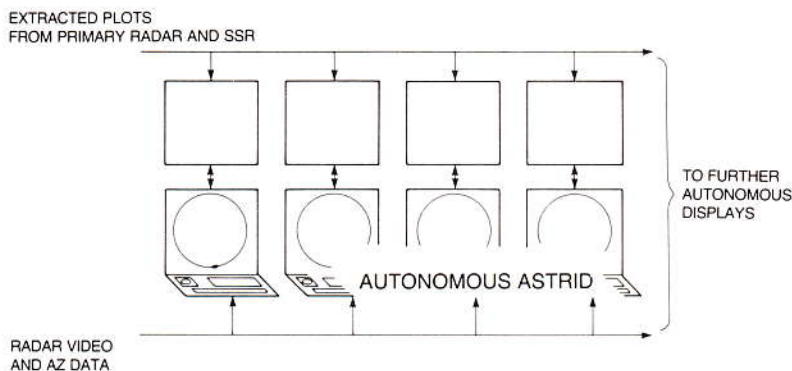
most reliable and economic configuration is to have a main and a standby central processor. An extra Processor can be added if up to twelve Display Units are needed. Alternatively, if autonomous display operation is preferred a separate Processor can be used with each Display Unit.

In areas of high traffic density where an area control centre is dealing with a large number of tracks derived from several primary radar and SSR sources, reliability and economy become

EXTRACTED PLOTS
FROM PRIMARY RADAR AND SSR

TO FURTHER AUTONOMOUS DISPLAYS

AUTONOMOUS ASTRID

RADAR VIDEO AND AZ DATA

The Display Units

Two Display Units are available in the ASTRID system. One has a screen diameter of 16-inches (40cm) and the other of 22-inches (56cm). Both displays are electrically identical and only differ mechanically to accommodate the different tube sizes.

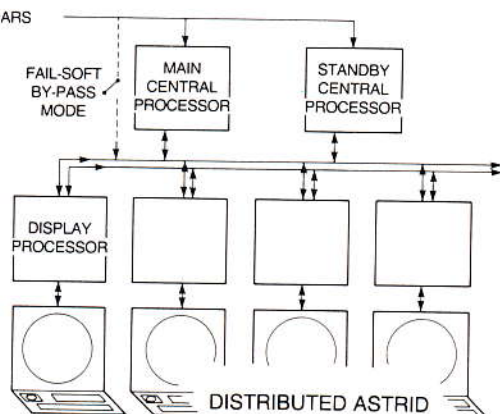Each unit is available with a choice of phosphors to suit the particular application, whether raw radar, mixed raw/synthetic data or synthetic data only. The resulting picture is bright and well defined due to the small spot size, and the use of dynamic focusing maintains sharpness right to the edge of the screen.
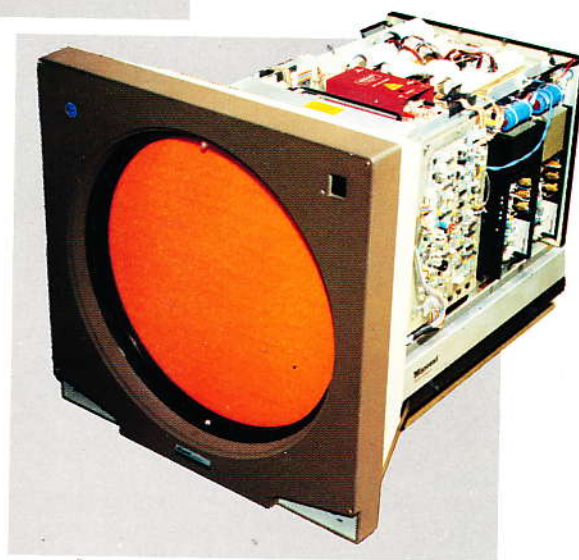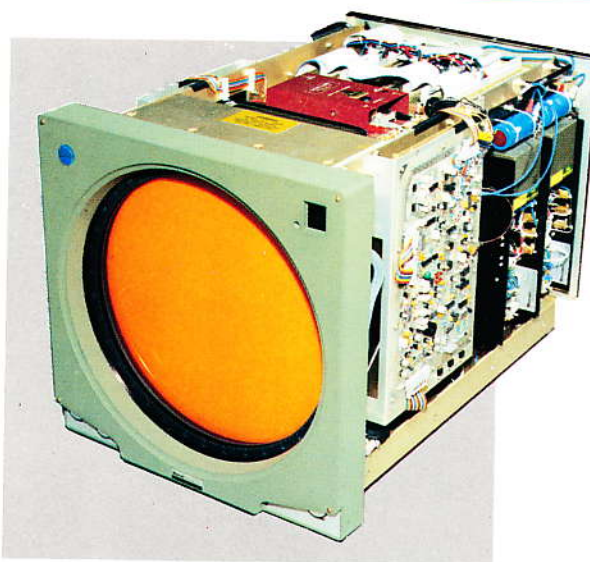
When a raw/synthetic radar picture is required, video signals are fed directly to the display where they are time-compressed in order to allow ample time for all alphanumeric data to be displayed. Range marks and deflection waveforms are generated within each display unit so that it may be used as a raw radar monitor without the need for an alphanumeric processor.

Both Display Units are particularly compact so that they can be installed in any type of ATC control console or on a simple "table top" mount.

PRIMARY RADAR
AND SSR PLOTS
FROM REMOTE RADARS

FAIL-SOFT
BY-PASS
MODE

MAIN
CENTRAL
PROCESSOR

STANDBY
CENTRAL
PROCESSOR

DATA BUS
TO OTHER
DISPLAYS

DISPLAY
PROCESSOR

DISTRIBUTED ASTRID

supremely important. The optimum arrangement is then to centralise the functions which are common to all the display positions and to distribute the processing which is individual to each display.

With each configuration a VDU terminal can be provided entering code/callsign pairs and for amending QNH at predetermined time intervals. Code/callsign pairs may also be entered at each display position.

The Control Desk

The standard control desk contains video gain and mixing controls for use with raw radar video, a function keyboard for the selection of various facilities provided by the Processor, a QWERTY keyboard for entering code/callsign correllations, setting up height filters and other actions requiring communication with the Processor. A rolling ball is included for "pointing" the cursor when positioning the off-centering, the range/bearing line, the tabular areas or for addressing individual aircraft tracks. The Control Desk includes a microprocessor which scans the keyboards and reports entries to the Display Unit and Processor.

The units in the Control Desk are modular and can be individually fitted in an existing ATC control console, to suit particular operational and ergonomic requirements.
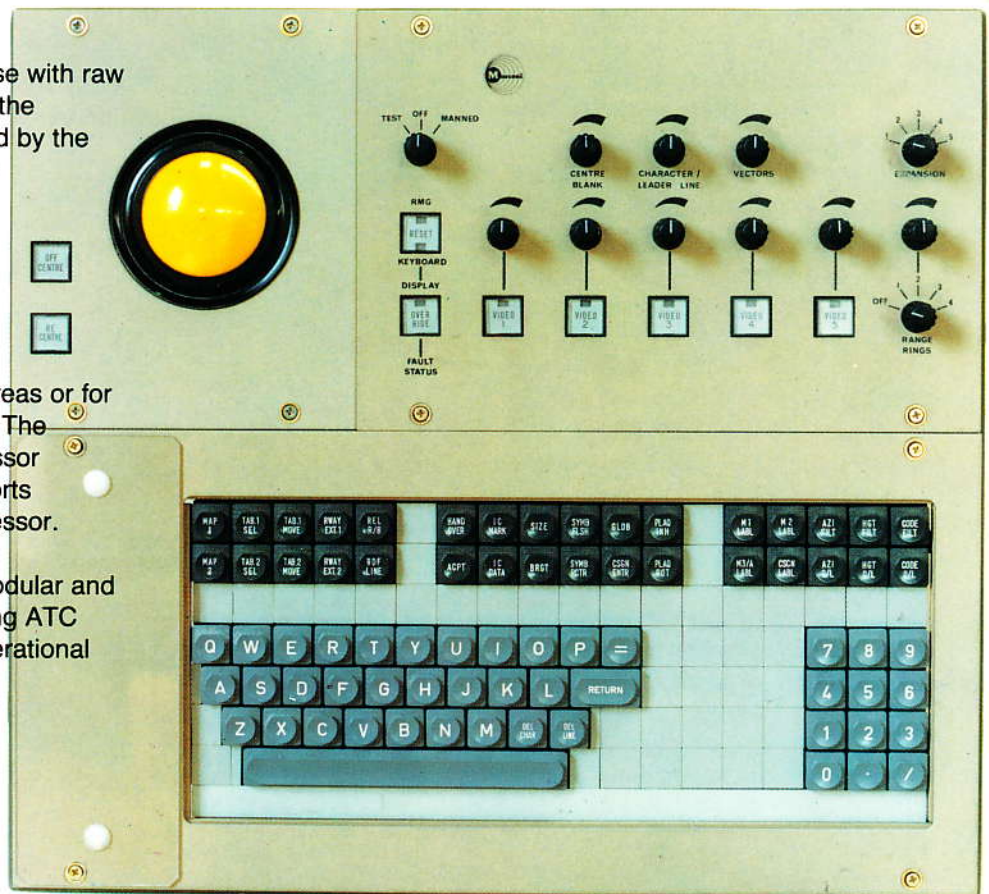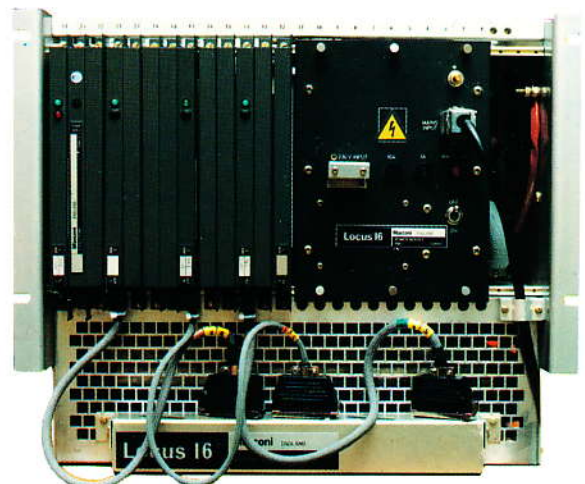
The Processor

The Processor accepts plot extracted data from the primary and/or secondary radar sensors, either co-located or separate. Slant range correction is provided for track correlations from separate sites. The data is processed and passed to up to six display units over a high speed serial data link. The processing includes slant range correction, the formation of data blocks, plot coasting, aircraft filtering, silent handover between displays, tabular data generation, code/callsign conversion and QNH conversion. Optional enhancements include tracking, high ground warning and the presentation of multiple radar responses.

The Processor uses the well proven and highly flexible LOCUS technique. This comprises a card frame and multilayer printed circuit, high speed bus into which are inserted processor, store and interface cards. A continuously upgraded library of over 200 standard LOCUS cards, incorporating the latest high performance integrated circuits, is available to the equipment designer. This simplifies the development task, shortens the timescales and reduces the cost of the end-product.

The standard ASTRID Processor uses six cards in a single frame which includes the power supply. Additional space is available for optional enhancements and the whole unit is designed for 19-inch rack mounting.

Where the requirement is to handle a large number of tracks at an area control centre an alternative Processor with a greater capacity is used.

DATA SUMMARY

Processor

Plot extracted inputs	3 (primary radar and/or SSR)
Input plot format	FAA. Other to order
Correlation	Slant range correction of SSR plots included
Code/Callsign associations	50 per Processor
Vector maps	4 (max) from 400 vectors plus 200 symbols, typically
Temporary map	By Rolling Ball input at each display

Display Units

Analogue inputs:

Input video channels	5 per display
Azimuth data	4096-bit incremental with North bit
Radar sync	3-40 volts
Expansion ranges	5
Expansion ratio	20:1 max, e.g. 120 nm, 90 nm, 60 nm, 30 nm, 15 nm.
Off-centre	To max display range
Range marks	Four sets, typically: 1 nm with every 5th brightened 2/10, 5/20, and 10/50
Centre blanking	Adjustable to 20% max range
ADF line	QDM, QTE, QDR, or QUJ

Processed Data on Displays

No. of plots	250 maximum
No. of plaques	50 maximum (included in above)
Refresh rate	60 Hz (synthetic data only) 25 Hz (labelled raw radar)
Trail dots	1 to 5 per track (selectable)
Track filters	Mode, code, height and azimuth
Tabular areas	2
Character sizes	3
Brightness levels	3 Independently selectable for each type of data
Track label rotation	Individual rotation NE/SE/SW/NW

Marconi
Radar Systems

Since the inception of radar into ATC, air traffic controllers have been condemned to work in restricted light conditions at least, if not in total darkness.

Marconi Radar's new BRIGHT ASTRID display changes all this by providing a radar picture which can be used in almost any type of ambient light. The controller's working environment can now be one of his own choosing whether it is broad daylight with fresh air or bright artificial light with air conditioning.

A particular feature of the new display is that it retains in full the high resolution of the modern cursive radar display. BRIGHT ASTRID can, therefore, be used for all ATC applications from local control in the tower cab to en-route monitoring in an area control centre.

Features

- Full daylight viewing capability

- Excellent cursive display resolution

- Ideal for all ATC applications from control tower cab to area control centres

- Autonomous operation or shared central processor

- Full ASTRID facilities with plot extracted inputs

- 16-inch (40cm) screen with anti-reflection coating

- Over 90% component commonality with standard ASTRID

- Simple, low cost conversion kit, changes standard 16-inch ASTRID to daylight viewing version.

The Display Unit

BRIGHT ASTRID has a screen diameter of 16-inches (40cm) and the display unit is physically identical to the standard 16-inch Astrid. A special cathode ray tube is used having a high brightness green phosphor and a matched filter which is welded to the CRT face plate. An effective anti-reflection coating is used on the front of the filter to allow the display to operate in high ambient light levels where reflections can be particularly troublesome.

The picture is much brighter than a conventional TV or raster scan display and brighter even than standard cursive displays using a P31 phosphor. The high brightness, together with the filter, provides a contrast ratio of better than 5:1 in an ambient light level of 10,000 lux.

The very high resolution of the standard ASTRID display is fully retained in the bright version. Alpha numeric characters as small as 1.25mm in height are clearly readable. This allows three different character sizes to be used simultaneously without the largest size obscuring other wanted data.

Earlier bright displays using storage tubes or raster scan systems have provided a bright picture at the expense of resolution. BRIGHT ASTRID has both and is therefore not just limited to use in the control tower cab but can be employed in any other ATC radar application without restrictions on the room lighting.

Because BRIGHT ASTRID is a conventional cursive display it retains the flexibility and independent operation which have been a feature of this type of display. This allows each controller to set his display exactly as he wishes. All ASTRID displays have a maximum range expansion of 20:1 which allows almost any operational requirement to be accommodated.

BRIGHT ASTRID provides a synthetic PPI picture derived from plot extracted primary radar and SSR signals together with track labels, tabular lists, digital maps and other alpha-numeric data.

The use of plot extracted signals is already universal in the case of SSR and is becoming widespread for primary radar. The resulting "synthetic" PPI picture is increasingly being accepted for approach control purposes where its clear, easily interpreted picture reduces workload.

The picture consists of aircraft plot position symbols with trail dots providing past track history.

Labels associated with each track contain call-signs, mode C height, cleared height, climb/descend arrow and groundspeed as an option. Reporting points, digital maps, ADF lines, tabular lists and extended runway centrelines are also included.

System Configurations

BRIGHT ASTRID shares the same LOCUS ATC processor which is described in the main ASTRID brochure reference RS3 Issue 2.

Each processor can drive up to six ASTRID Display Units which may be standard or bright versions or a mixture of the two. Alternatively a processor can be dedicated to a single BRIGHT ASTRID to form an autonomous assembly. This configuration is particularly convenient when BRIGHT ASTRID is used with display systems of other than Marconi manufacture. In this case additional interfacing equipment may be required.

The BRIGHT ASTRID display unit is supplied with a modular control desk from which the individual panels may be removed for independent mounting if required. The desk is identical to that provided with the standard ASTRID display but excludes the analogue video controls.

The processor accepts both primary radar and SSR signals in a combined plot message form from either a local or remote radar site via normal telephone circuits. In cases where local primary radar information is only available as analogue video signals a Marconi S7204 primary radar plot extractor can be provided. The S7204 is a modular, universal extraction system which includes facilities for providing and combining SSR and primary plots, for weather extraction and for reducing primary false alarms. Suitable modems can be supplied for plot data transmission over telephone circuits. Only one single primary extractor is needed to provide plots for an almost unlimited number of BRIGHT ASTRID displays, via ASTRID processors.

Conversion kit

A simple, easily fitted and low cost conversion kit is available which enables standard ASTRID display units to be changed into the BRIGHT ASTRID version.

DATA SUMMARY

BRIGHT ASTRID Display Unit

Display screen diam	16-inches (40 cm)
Contrast ratio	5:1 in 10,000 lux ambient
Resolution	1.25 mm characters clearly resolved
Displayed picture	Plot-extracted, synthetic
Expansion ranges	5
Expansion ratios	20:1 max. Typically 120, 90, 60, 30, 15 naut. miles
Off-centre	To max display range
No of labelled tracks per display	Typically 150 plus maps and data
Refresh rate	60 Hz
Trail dots	1 to 5 per track (selectable)
Tabular areas	2
Character sizes	3
Brightness levels	3 simultaneously

Photograph shows BRIGHT ASTRID in Tower Cab at Southend Airport.

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