seven times more reliable than magnetrons.

The ASR-30's unique solid-state modulator employs a modular pulse-forming network consisting of five independent solid-state switches. Full power is achieved even if one of these switches fails.

Other transmitter features include a fail-safe system which attempts to restart the transmitter three times in case of shutdown, and a low-speed, oversized liquid cooling system.

These dual klystron amplifiers have an operational life of from three to four years.

Full power can be maintained even if one of these five independent switches in the ASR-30's solid-state modulator should fail.

RECEIVER/PROCESSOR

Each of the ASR-30's two complete receiver/processor channels includes:

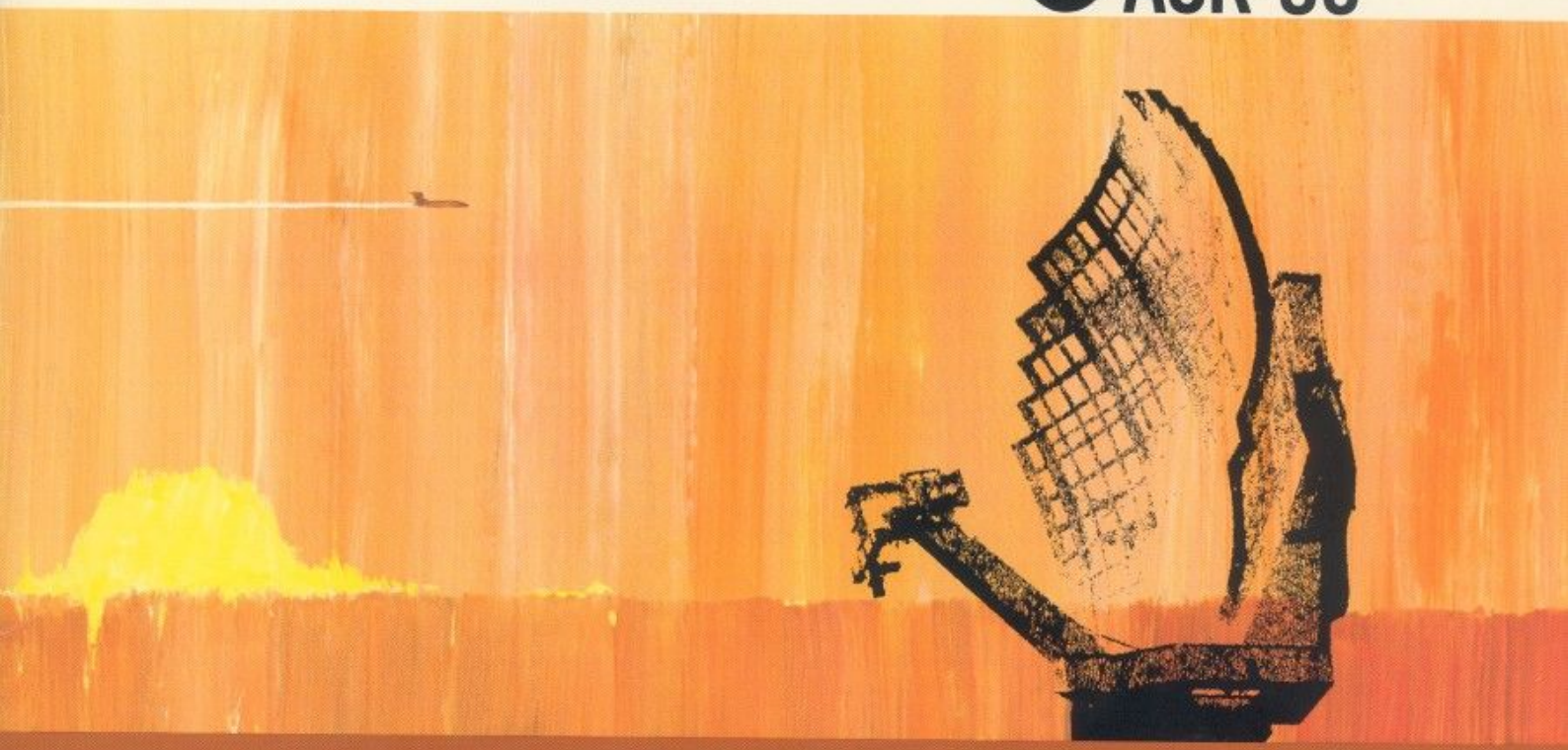
- Built-in STC assembly which provides RF STC (radio frequency sensitivity time control) over the total receiver dynamic range
- Digital MTI with both an In-Phase (I) and a Quadrature (Q) channel
- Log-CFAR (logarithmic constant false alarm rate) receiver.

Switching between MTI and log-CFAR, between RF STC functions, and between the upper and lower beams is accomplished by range-azimuth gates (RAG). The transistor RF amplifier provides a low noise figure in a highly reliable configuration and is protected by a passive T-R limiter.

Three modes of receiver operation are possible: the logarithmic receiver provides a normal mode for superior detection in the absence of weather, the weather receiver displays weather information, and the digital MTI receiver mode enhances target detection capability in the presence of weather and clutter.

The two inside cabinet drawers contain dual receiver/processors which can provide simultaneous display of several different video modes.

ASR-30



"The radar room was in the control tower, one floor down from the glass-surrounded tower cab from which ATC directed aircraft movement on the ground and immediate local flying. The radar section's jurisdiction extended beyond the airport, and radar controllers reached out to bridge the gap between local control and the nearest ATC regional center. The regional centers — usually miles from any airport — controlled main trunk airways and traffic coming on and off them. . . ."

— from the novel *Airport*,
by Arthur Hailey, 1968

AIRPORT

Times change. Today's airports handle a far greater volume of air traffic than the airports of the late 1960's described by Arthur Hailey in *Airport*.

The radars of that era were not built with an eye toward the future and could not handle the rapidly increasing demands placed upon terminal air traffic control (ATC) systems.

The air traffic handled by today's airports continues to increase at a tremendous rate. An airport surveillance radar (ASR) must be built to handle not only today's airport traffic but also the more complex air traffic control requirements of tomorrow's airports.

Westinghouse is building the answer for tomorrow, today: The Westinghouse ASR-30 airport surveillance radar.

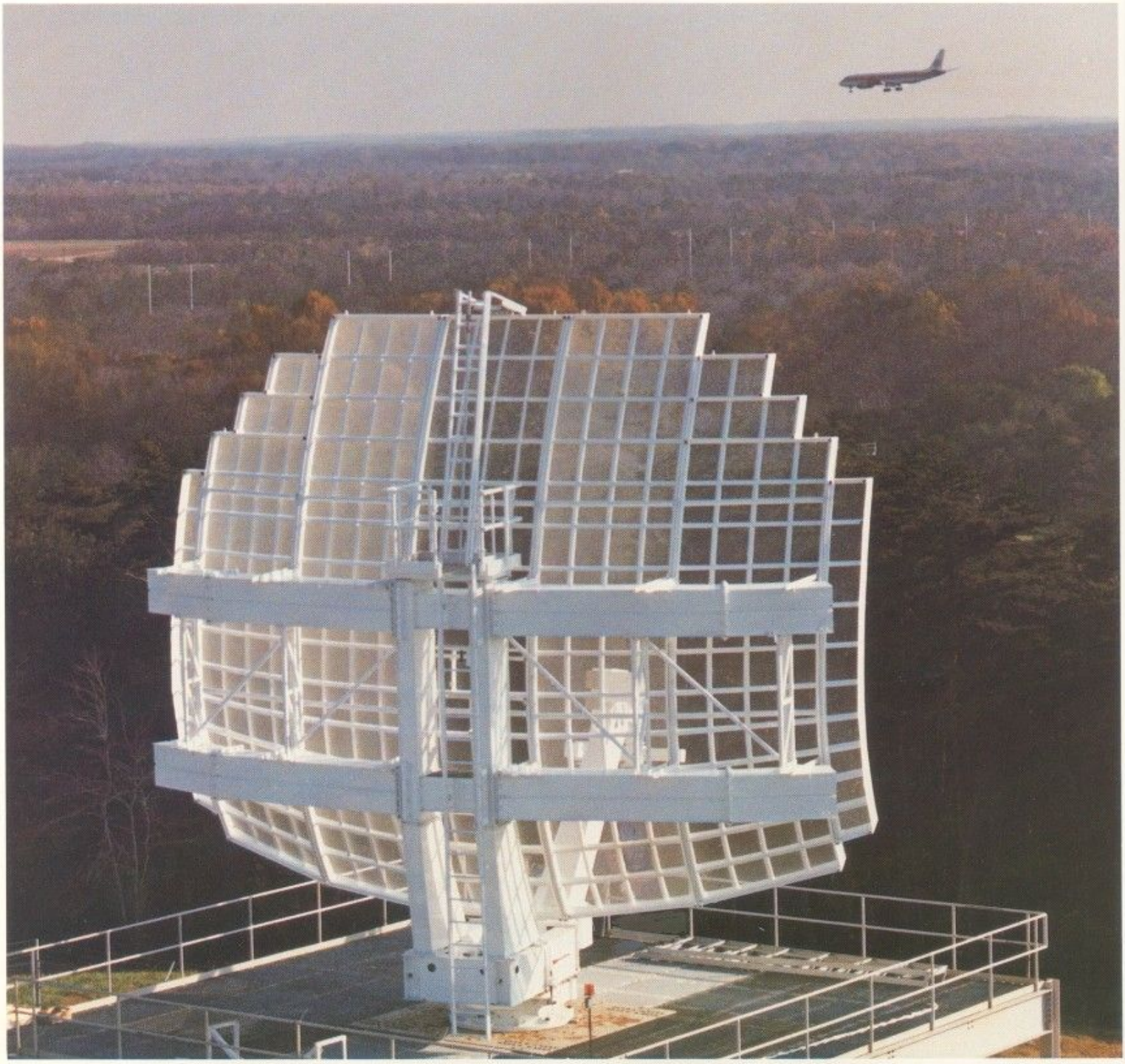
A SYSTEM FOR TODAY ... AND TOMORROW

The Westinghouse ASR-30, the latest system in the Westinghouse family of minimally attended ATC radars, is derived from the FAA's new ARSR-3 enroute radar.

Twenty-three fixed and four mobile Westinghouse ARSR-3's have been delivered to the Federal Aviation Administration to meet their need for a minimally attended air route surveillance radar. Nine additional Westinghouse ATC systems have been purchased by Canada and Switzerland. The ARSR-3 has demonstrated high reliability, easy general maintenance, and the greatest system availability ever achieved for a long-range, high-power radar, while providing complete and accurate radar coverage.

Westinghouse has incorporated these capabilities in the ASR-30 to provide a terminal air traffic control system that meets both FAA and military specifications. The ASR-30 utilizes L-band and improved MTI (moving target indication) capability to detect the smallest of aircraft in the severest of weather and clutter environments far better than any S-band ASR.

The system's dual channel configuration and high reliability allow unattended operation through the use of a remote monitor/control panel. This reduction in manpower gives the ASR-30 the lowest life-cycle cost of any ASR available today.



LONG RANGE RADAR

The ASR-30, a dual-channel, L-band, airport surveillance radar, detects the smallest aircraft (2 m^2) out to 220 km (120 nmi) and beacon/SSR (secondary surveillance radar) equipped aircraft to 370 km (200 nmi).

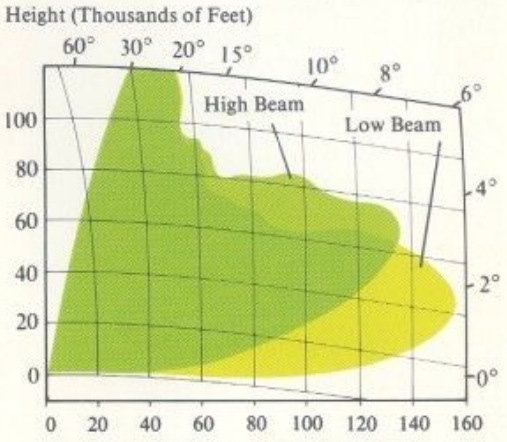
Performance in the presence of heavy ground clutter and weather is outstanding — the radar detects aircraft 100,000 times smaller than clutter or weather noise and rejects weather with over 40 times the efficiency of S-band ASR's.

And when utilizing the system's unique circular polarization mode, the air traffic controller can simultaneously "see in" and monitor the weather to detect targets and to present several contours of weather intensity on the scope, enabling him to provide vectors for aircraft around the weather or through the least hazardous areas.

Superb clutter and electronic interference rejection makes the ASR-30 output ideal for both automatic and manual processing and display systems, and the radar can interface with most processing systems.

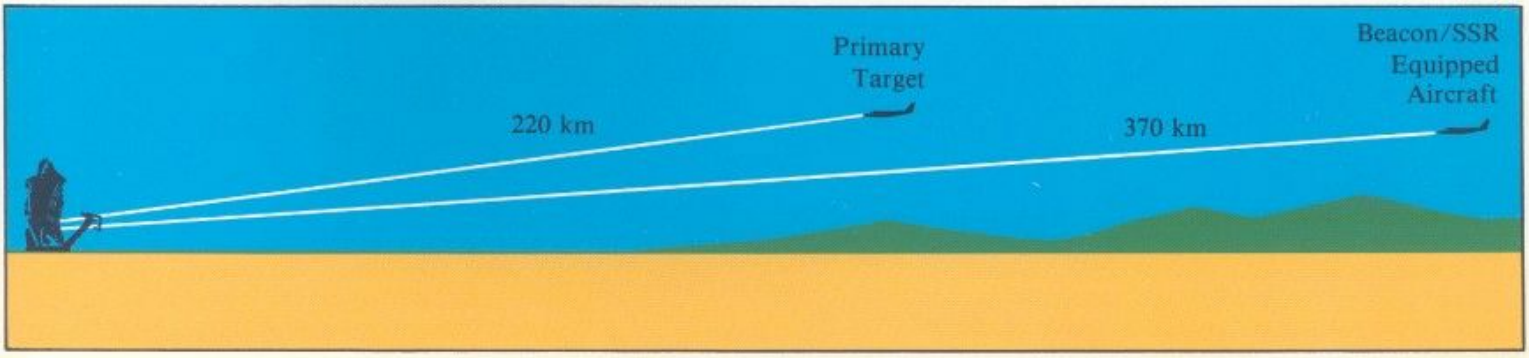
System Feature	Function Performed
L-Band Operating Frequency	Increases clutter-rejection capabilities and invulnerability to weather
Digital MTI	4-pulse cancellation, I&Q processing, and other system stability features result in a 50-dB improvement factor allowing the ASR-30 to see targets 100 times smaller than can be detected with S-band (30-dB MTI) ASR's
Polarization Diversity	Displays targets and weather simultaneously, enabling controller to steer aircraft around weather or see aircraft in it
Diplex Transmitter Operation	Increases detection range, eliminates fades
Dual Beam Antenna	Minimizes lobing, eliminates blind spots in coverage
Radio-Frequency Sensitivity Time Control	Increases detection capability, optimizes performance at site
10-Bit A/D Converters	Improves aircraft detection
Log-CFAR	Prevents system overloads
352 Selectable RAG Gates	Tailors system to specific site, assures optimum target detection
Digital Integrator	Eliminates electronic interference, improves target detectability
Integrated Beacon/SSR Antenna	Eliminates lobing in the SSR pattern

Small Target Detection



ASR-30 Coverage
$P_D = 0.9$ $P_{FA} = 10^{-6}$
Diplex Mode
12 rpm 524 pps
2 m^2 Swerling I Target

Long-Distance Detection



ROUND-THE-CLOCK RADAR

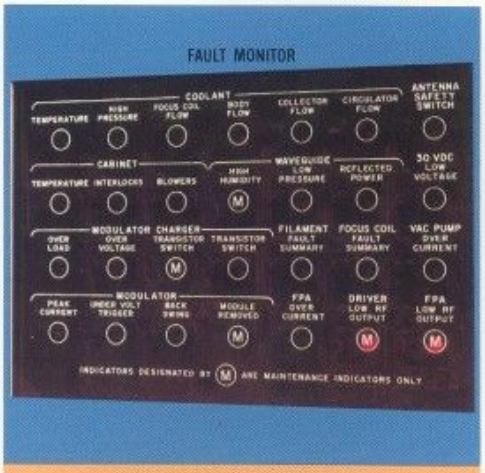
- **Reliability**
- **Maintainability**
- **Availability**

Beneath the antenna, all ASR-30 elements are dualized and include a comprehensive network of built-in-test equipment (BITE) and automatic diagnostics. Should BITE signal a failure, switchover to the redundant component is accomplished automatically if the system is operating in simplex; in diplex operation the system automatically selects the channel that has not failed and switches to that simplex mode of operation.

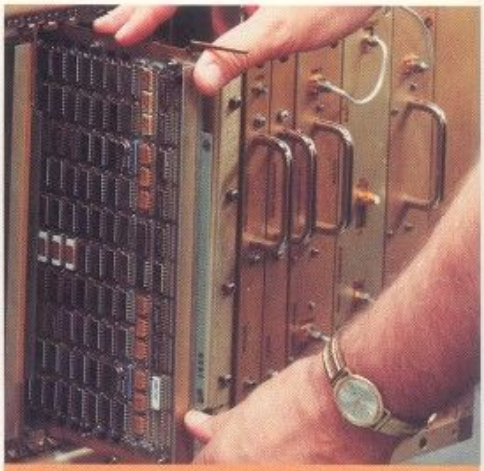
System BITE and fault indicators isolate failures down to an easily replaceable board, while the Westinghouse planar array test system (PATS) further isolates faults to the chip level. These tests, combined with plug-in components, modular design, and easy front access to subunits allow the average fault to be repaired and replaced within 30 minutes without interrupting radar operation.

Westinghouse's ARSR-3, the radar from which the ASR-30 is derived, has demonstrated three months of continuous operation with no failures — an

- Beneath the antenna all elements are dualized. In the diplex mode, both channels operate simultaneously to provide increased detection range.



- A failure occurs and is immediately detected by BITE. An LED (light-emitting diode) on the component lights up to indicate that the unit is faulty...
- ...and the system switches to the channel that has not failed. No system downtime occurs.



- The defective line-replaceable module is pulled out...
- ...and a replacement plugged in.
- The average fault is repaired in 30 minutes without interruption in radar performance.
- The defective unit can be tested with the planar array test system which isolates the fault down to the chip level for easy repair.

BITE provides highest system availability through:

Alignment and Confirmation of System Performance	Maintenance Assistance
Measures • Minimum discernible signal • False alarm rate • MTI cancellation ratio • System data rate Monitors • Radio-frequency transmit power	• Audible alarm • Summary fault and individual fault • System status indicators • Automatic switchover to simplex • Test targets injected every pulse repetiton

MTBF (mean-time-between-failure) of 3000 hours per channel. Audible failure alarms, fail-soft component redundancy, fail-safe system channel redundancy, and the extensive use of reliable mil-spec solid-state circuitry ensure that the ASR-30 will operate round the clock.

To maximize system availability, all elements beneath the antenna are dualized. The complete dual channel receiver/processor and digital target extractor are housed in a four-drawer cabinet assembly which allows easy front access to the radar's replaceable components. The cabinet includes dual frequency generators (located in the upper corners) and a maintenance display console to facilitate rapid maintenance.

Once the ASR-30's automatic BITE alerts maintenance that a board has failed, the mobile planar array test set can further isolate the fault to a specific integrated circuit.

Plug-in, pull-out components make the replacement of a faulty board a simple operation.

The use of electrical rather than mechanical switching provides major improvements in reliability and maintainability. To select a control function the operator merely places a light gun against a specified point on the control panel.

ASR ANTENNA

The latest in the Westinghouse family of computer-contoured reflectors, the ASR-30 antenna contains two microwave feed systems which produce an upper and a lower beam. Optimum short-range detection is accomplished by using the upper beam to avoid ground clutter, while the lower beam provides long-range coverage. The antenna feed also incorporates an integrated beacon/SSR system to provide beacon coverage without degrading the primary radar performance. And this unique antenna allows full weather detection when the system is operating in the circular polarization mode.

For maximum reliability and ease of repair, the pedestal assembly includes two complete drive systems. Should one fail, the other will continue to rotate the antenna. Replacement of the main bearing, a job often requiring several days of downtime and complete antenna disassembly in other radars, takes only two hours in the ASR-30 — *without* antenna disassembly.

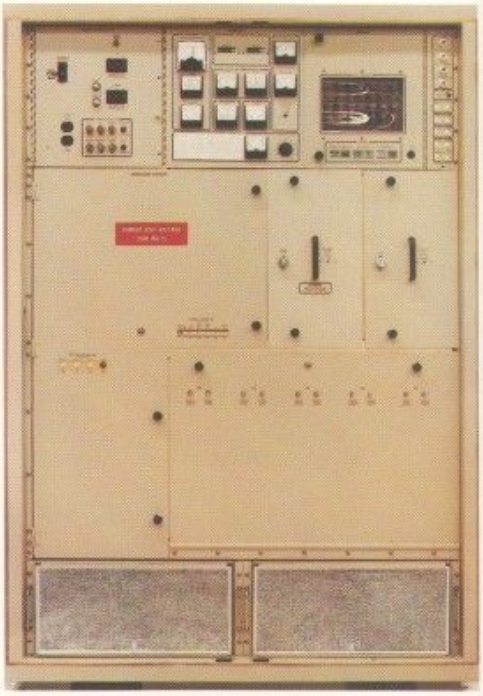
An offset beacon feed is placed to the side of the radar horn to provide the desired beacon pattern without degrading radar performance.

System redundancy extends to twin drive motors, either of which can rotate the antenna. This permits motor replacement without interrupting radar performance.

TRANSMITTER

In the diplex mode both transmitters operate simultaneously but at different frequencies to provide a significant improvement in range performance. The transmit frequency is derived from a single crystal source, resulting in improved system MTI and clutter rejection capabilities.

A klystron amplifier and solid-state construction throughout the rest of the device give the transmitter an MTBF of over 5,000 hours. U.S. Military reliability tests show that the klystron, with an MTBF of 30,000 hours, is some six to



The transmitter has an MTBF of greater than 5,000 hours.

ASR OPTIONS

Solid-State Beacon

By integrating all interrogator-receiver functions into one unit and using an all solid-state design, Westinghouse has designed a beacon-interrogator with an MTBF of 6,500 hours and a mean-time-to-repair (MTTR) of 15 minutes. A dual channel configuration will yield an MTBF of over 50,000 hours. The solid-state beacon meets the requirements of ICAO annex 10.

Radome

For terminal sites faced with constant severe environmental conditions, a rigid space-frame geodesic radome may be used to protect the antenna from the elements. Since the ASR-30 is L-band, radome interference with radar performance is not a problem.

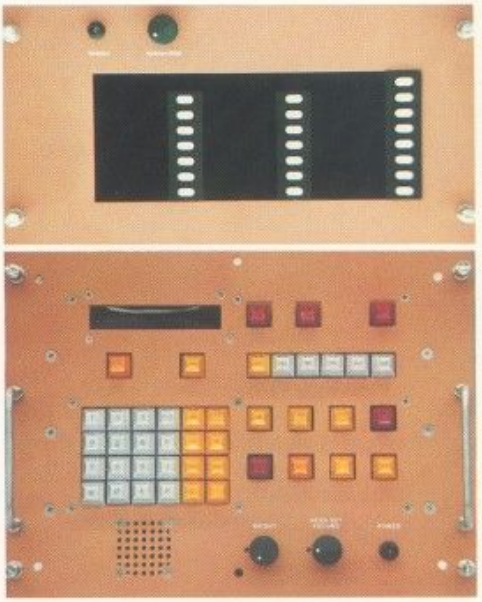
Terminal Communications Control System

The Westinghouse digital Terminal Communications Control System (TCCS) provides a cost-effective link between the controllers on the ground and the pilots in the air.

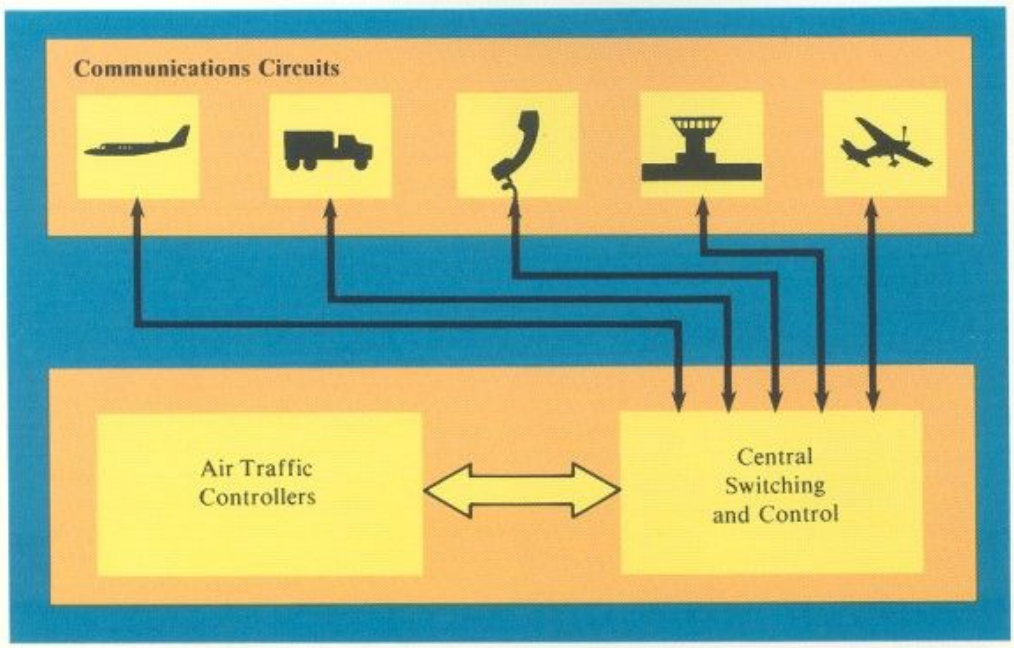
The system utilizes pulse code modulation for high noise immunity. Crosstalk is eliminated and interconnection cabling minimized by the TCCS's use of time division multiplex techniques.

A standard minicomputer controls central switching. The TCCS allows controllers to interface with a wide variety of communication circuits including hotlines, radios, ringdown and dial trunks, dial intercoms, and tape recorder channels.

A radome protects the radar from adverse environmental conditions without impeding radar performance.



The TCCS links controllers with each other and with all communications circuits including air-to-ground radios.



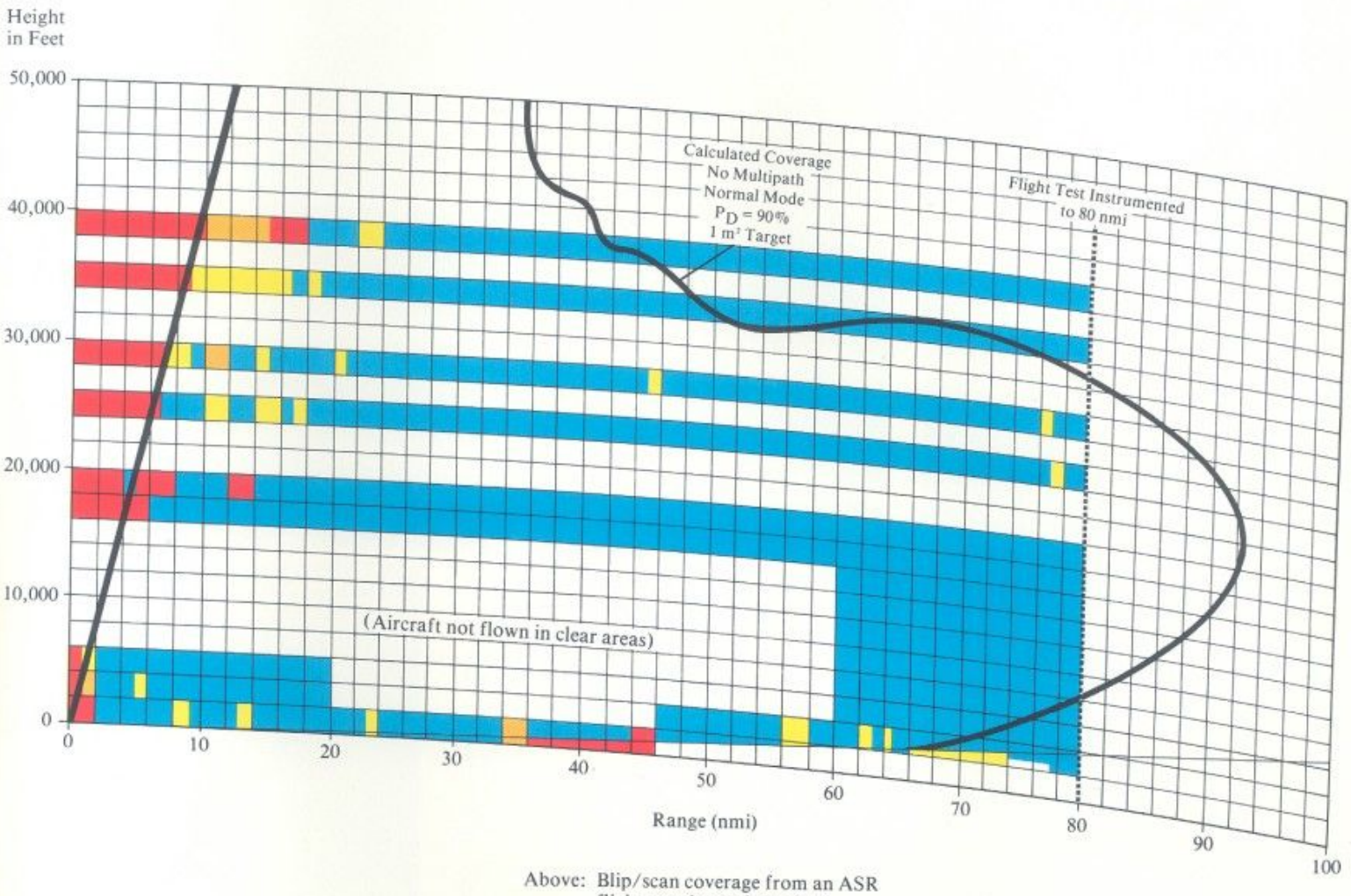
Terminal Communications Control System.

PROVEN PERFORMANCE

The ultimate test of any radar system is its ability to perform as required...to detect aircraft.

In a series of flight tests conducted at Westinghouse radar test facilities, the Westinghouse ASR has demonstrated its ability to provide reliable radar coverage in a terminal air traffic control situation.

The results of one of these flight tests, presented below, show the system's superior low-altitude and vertical close-in coverage, both critical areas of aircraft detection in any airport surveillance situation. The ASR's unique antenna configuration and 50-dB MTI improvement factor provide the ground clutter rejection capability needed to achieve this full-range horizontal coverage.



Above: Blip/scan coverage from an ASR flight test shows the radar's superior low-altitude and close-in coverage.

Station: Jackson Hill, Maryland, USA
Date: December 17, 1979
Radar: Westinghouse ASR-30
(Canadian Variant)

Radar operating mode: Simplex
This test flight instrumented to 80 nmi.
1 m² target (T-33 aircraft)

Key

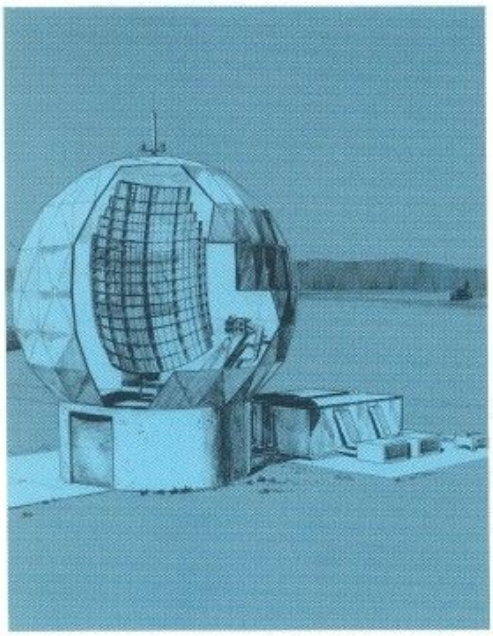
- ASR + SSR
- ASR Only
- SSR Only
- No Hit

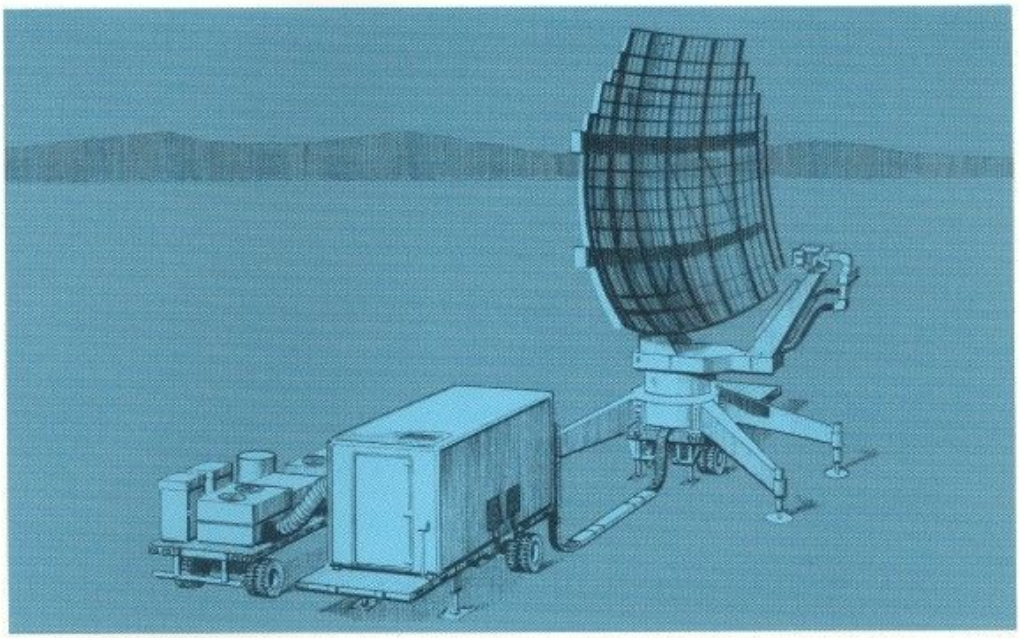
FLEXIBLE FACILITIES

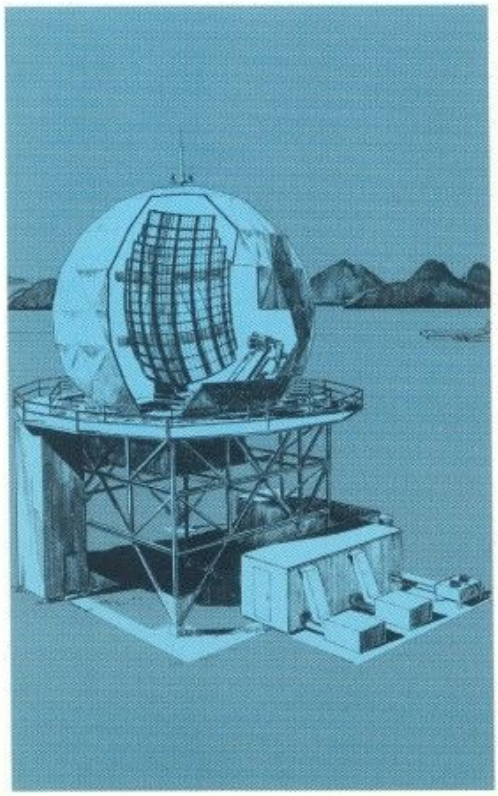
The ASR-30 site can be employed in a variety of fixed and mobile configurations, and requires as little as 23 m^2 (250 ft^2) of floor space. Westinghouse can supply prefabricated metal buildings or self-contained shelters for offices and radar equipment.

The antenna, which requires no special tools for installation, can be emplaced on a roof-top or in a tower. No field alignment is necessary.

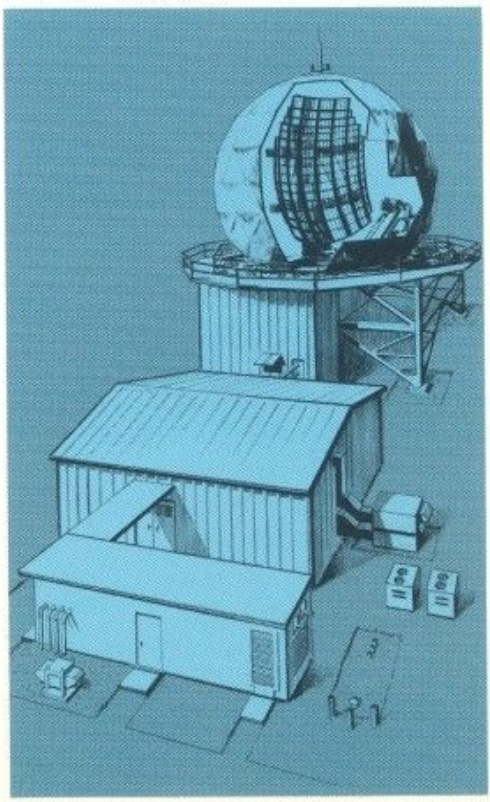
The fixed site need not be on level terrain — the radar's range-azimuth gating generator allows shifting between upper and lower radar beams for avoiding obstructions such as hills and buildings.







The ASR-30 can be employed in mobile (above right) as well as fixed configurations.



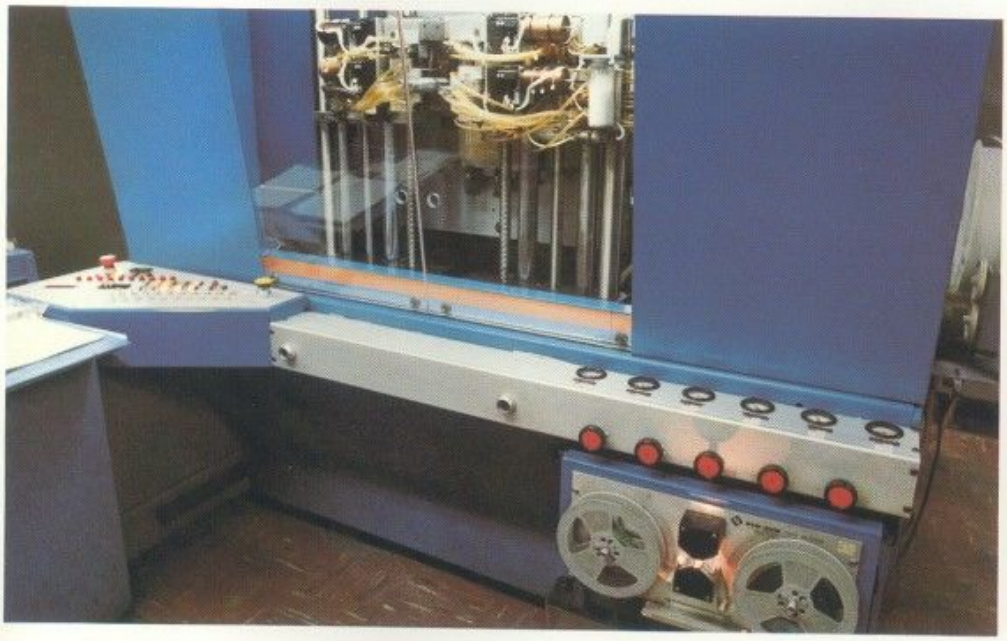
A LIFETIME COMMITMENT

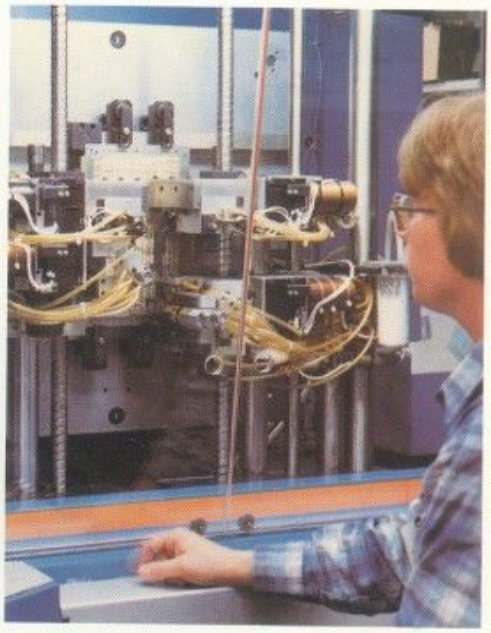
- **Design**
- **Production**
- **Support**

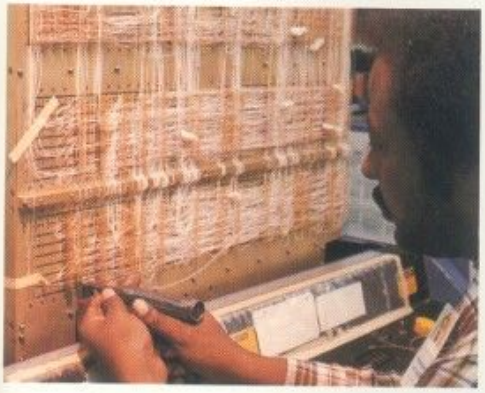
The Westinghouse Defense and Electronic Systems Center employs some 13,500 people including 6,200 engineers and professional employes. These people and more than 207,700 square meters of laboratory, engineering, manufacturing, and office space are devoted to the design, test, and manufacture of Westinghouse systems.

System support begins with design but does not end with delivery. Westinghouse provides a complete and comprehensive support package which can include training, test equipment, spares, manuals, maintenance, management, field operations, provisioning data, field integration services, and support facilities such as complete depots. We are currently supporting ground radars in 17 nations.

Our designers and logistics experts balance high performance and low support cost to give the ASR-30 the lowest design to life-cycle cost of any airport surveillance radar in production today.

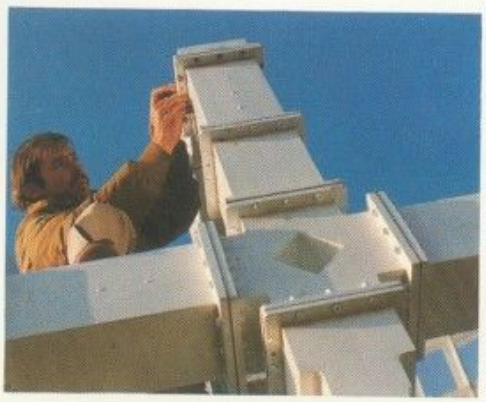


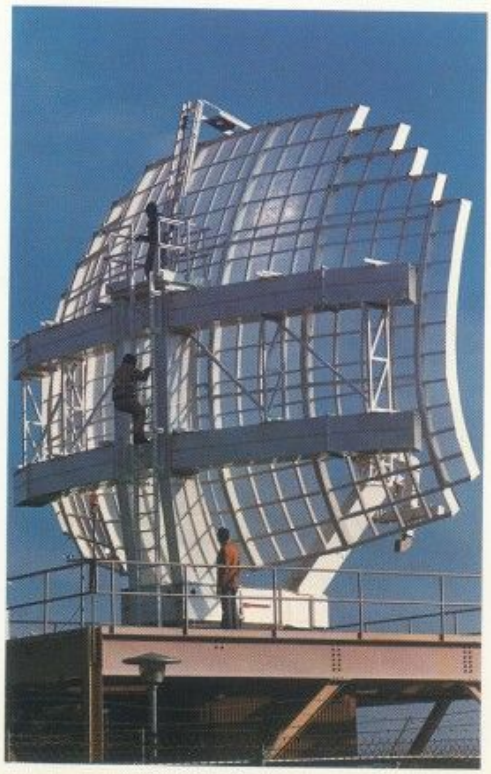




A wire gun (left) is used in conjunction with a semi-automatic pin locator to make solderless wire wrap connections on an ASR-30 planar array board.

A tape-controlled, fully automatic wiring device (above left and right) makes approximately 1000 wire wrap connections per hour. Such automatic devices provide increased reliability and a significant savings in life-cycle cost.





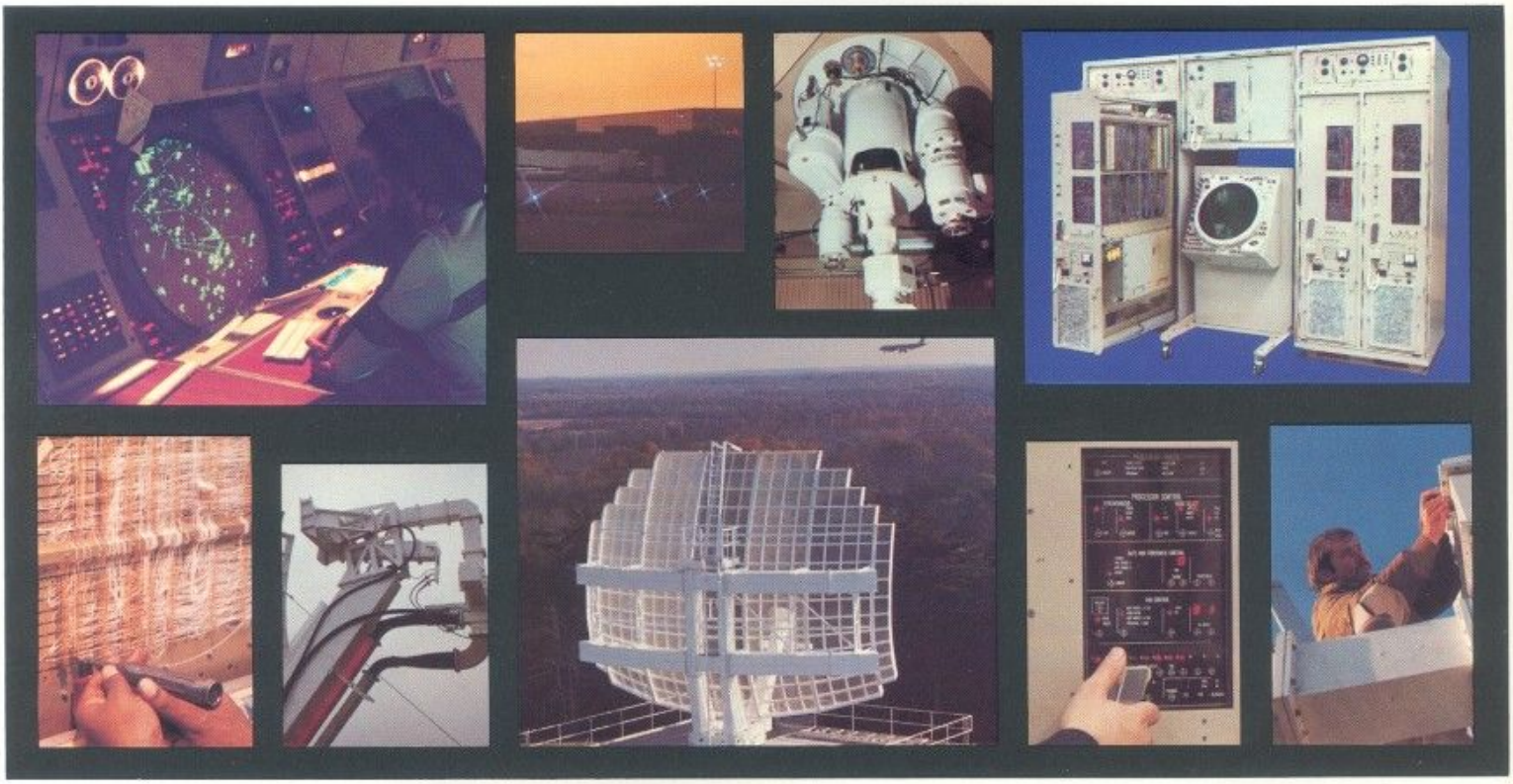
PROVEN PERFORMANCE IN A RELIABLE RADAR

For cost-effective, reliable terminal airspace coverage, the Westinghouse ASR-30 airport surveillance radar provides superior performance in the roughest weather, heaviest air traffic, and severest of environmental conditions. The ASR-30 can be tailored to specific site requirements and function as part of an integrated air traffic control system.

Derived from the Westinghouse ARSR-3, a system with proven long-range detection capability and high availability, the Westinghouse ASR has demonstrated its superior performance.

Redundant design...unmanned operation ...L-band performance...improved MTI...modular construction...circular polarization...mil-spec solid-state circuitry...extensive built-in test...diplex transmitter operation...state-of-the-art technology in an airport surveillance radar designed to handle the ever-increasing air traffic of airports present and future:

The Westinghouse ASR-30.



Westinghouse ASR Characteristics

Frequency Band	1250-1350 megahertz (L-Band)
Peak Power	2.0 megawatts
Average Power	3.65 kilowatts
Pulsewidth	2.0 microseconds
Pulse Repetition Frequency	524 pulses per second (average)
Data Rate	12 revolutions per minute
Noise Figure	2.0 dB, maximum
Integrated Cancellation Ratio	Nominally 21 dB (18 dB minimum)
MTI Improvement Factor	50 dB
Reflector Size	9.4 m high × 10.0 m wide (31 ft high × 33 ft wide)
Azimuth Beamwidth	1.25 to 2.0 degrees at 3-dB points 1.57 degrees used to calculate coverage
Antenna Gain	
High Beam	33.6 dB
Low Beam	34.9 dB
Horizon Ratio	16.75 dB
Prime Power Requirement	50/60 Hz, 65 kVA