Company and Products

Microwave Applications Group (MAG) has a proven record of creativity and innovation in microwave component and subsystem design for government, military, and commercial applications. MAG has been at the forefront of electronically-steered radar technology, especially in the area of ferrite-based devices. Programs utilizing MAG designed and produced products over the last 40 years are well-known and continue to operate successfully. These programs include:

E-3 Airborne Warning and Control System (AWACS) Radar;

B-1B APQ-164 Offensive Radar System;

B-2 Antenna System;

ASARS Surveillance Radar;

Global Hawk Antenna;

Predator Antenna;

AR320 3D Air Defense Radar;

TRS22XX 3D Air Defense Radar;

RAC 3D Air Defense Radar;

DWSR-2501C Doppler Weather Radar;

Smart-L 3D Air Defense Radar;

AN/SPQ-9B Surface Surveillance and Tracking Radar;

AN/MPN-14K Landing Control Center;

AN/SPN-35C Precision Approach Radar;

Skyshield 35 Air Defense Radar.

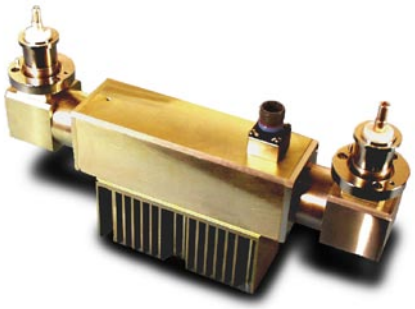
MAG was founded as a California corporation in 1969 to serve the government/aerospace/commercial market with high-technology microwave component and system activities from applied research through volume production.

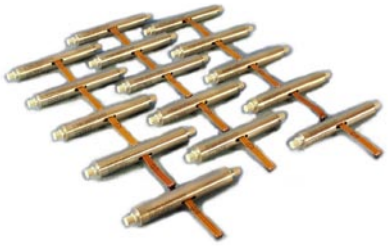
Early growth of the company was made possible by the development at MAG of “Dual-Mode” and “Rotary-Field” ferrite phase control elements, the latter of which was subsequently used in electronic steering of the antenna for the USAF/Westinghouse E-3 Airborne Warning and Control System (AWACS) radar. MAG provided engineering services and hardware items throughout the feasibility study and engineering model phases of the AWACS program and continues as a supplier of hardware for production phase AWACS antennas. MAG also developed and supplied items for the Electronically Agile Radar (EAR), a USAF-sponsored program which served as a prototype for the B-1B APQ-164 Offensive Radar System. MAG subsequently received the contract to support the production of the Phase Control Modules (PCM’s) for the B-1B Radar System and successfully produced in excess of 130,000 PCM’s.

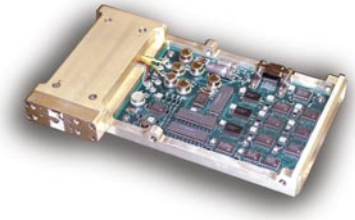
Company and Products

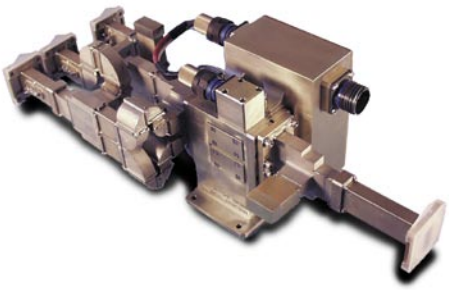
Examples of products developed and supplied by MAG are:

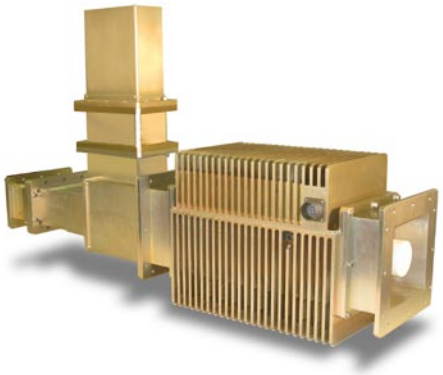
- Precise analog Rotary-Field ferrite phase shifters for use at high peak and average power levels;
- Reciprocal, latching, Dual-Mode ferrite phase shifters with weight and size parameters compatible for use in phased array antennas;
- Reciprocal, latching, Rotary-Field ferrite phase shifters combining the best of traditional Rotary-Field and Dual-Mode phase shifter characteristics;
- High performance waveguide isolators, variable power dividers, and polarization controllers;
- Ferrite switches that achieve a unique combination of high isolation, wide temperature range, and reciprocal operation at high power levels;
- Electronic drivers, function generators and interface equipment for real-time computer control of processes;
- Planar phased array antennas and linear array modules, complete with phase shifters, drivers, antenna controller, radiating elements and feed assembly;
- MAG continues to develop new products using proven ferrite technology, and looks forward to advancing the state of the art of microwave components and subsystems.











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Over 40 years of service to the microwave community...

providing ferrite-based waveguide components and subsystems

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supporting systems since 1969

Dual-Mode Phase Shifters

Latching reciprocal dual-mode phase shifters provide 360+ degrees of phase shift for phased arrays at a low cost. Listed here are some of the dual-mode phase shifters developed by MAG.

X-Band Airborne	APQ-164 B-1B Offensive Radar	
Ku-Band Airborne	ZPQ-1 Predator TESAR Radar	
C-Band Ground-based	Akash Rajendra 3D Air Defense Radar	
X-Band Ship-based	SPQ-9B Surveillance and Tracking Radar	
X-Band Ground-based	I-15 Range Radar Simulator	

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APQ-164 B-1B Offensive Radar
Dual-Mode Phase Shifters

MAG provides X-Band phase control modules (PCM's), the heart of which are MAG's dual-mode latching ferrite phase shifters in conjunction with a polarization diversity capability, for the B-1B offensive radar system. Over 130,000 PCM's have been produced and delivered by MAG.

X-Band Airborne

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ZPQ-1 Predator TESAR Radar
Dual-Mode Phase Shifters

MAG provided these lightweight Ku-Band dual-mode latching ferrite phase shifters for this synthetic aperture radar.

Ku-Band Airborne

Akash Rajendra 3D Air Defense Radar
Dual-Mode Phase Shifters

MAG designed and built phase control modules for this radar. The phase shifter portion is a dual-mode phase shifter operating at C-Band.

C-Band
Ground-based

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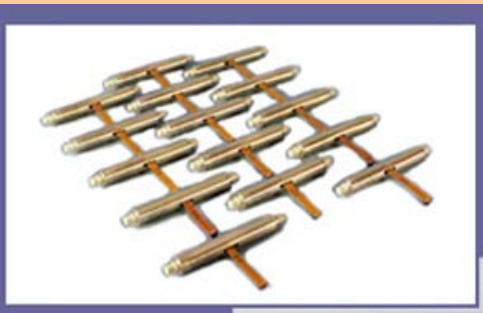
SPQ-9B Surveillance and Tracking Radar
Dual-Mode Phase Shifters



MAG provides these X-Band dual-mode phase shifters for use on this widely deployed system. The units were qualified at shock levels in excess of 60 g.

X-Band
Ship-based

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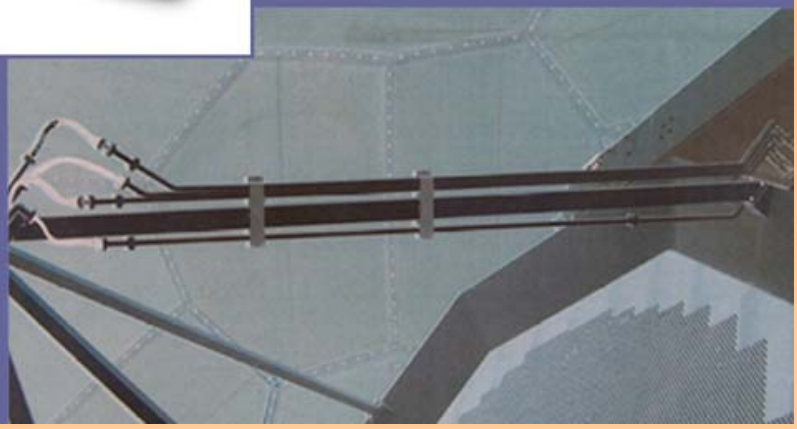
I-15 Range Radar Simulator
Dual-Mode Phase Shifters

MAG designed in excess of 19,000 polarization diverse X-Band reflectarray elements for this radar simulator.



X-Band Ground-based

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Rotary-Field Phase Shifters

Rotary-field phase shifters provide modulo-360 degree phase shift with high power capability and low phase error. Listed here are some of the rotary-field phase shifters developed by MAG.

S-Band Airborne	APY-1/2 E-3 AWACS Radar	
X-Band Airborne	ASARS-2 Radar	
Ku-Band Airborne	APQ-181 B-2 Radar	
X-Band Airborne	ASTOR Radar	
X-Band Airborne	Global Hawk Radar	

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Rotary-Field Phase Shifters

Rotary-field phase shifters provide modulo-360 degree phase shift with high power capability and low phase error. Listed here are some of the rotary-field phase shifters developed by MAG.

S-Band Ground-based	AR320 3D Air Defense Radar	
S-Band Ground-based	TRS22XX 3D Air Defense Radar	
L-Band Ship-based	Smart-L 3D Air Defense Radar	
C-Band Ground-based	RAC 3D Air Defense Radar	
C-Band Ship-based	TRS-3D Multimode Radar	

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APY-1/2 E-3 AWACS Radar
Rotary-Field Phase Shifters

MAG is the design authority and OEM for the S-Band beam steering and beam offset phase shifters, as well as septum polarizer and orthomode junction waveguide components for the AWACS antenna.

S-Band Airborne

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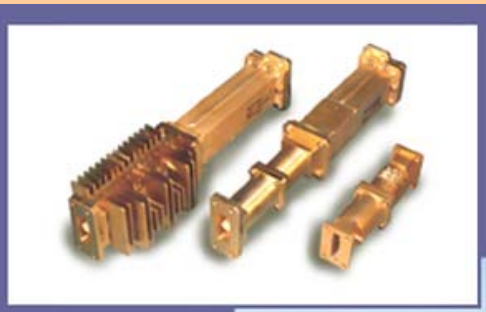
ASARS-2 Radar
Rotary-Field Phase Shifters



MAG provides X-Band high and low power rotary-field phase shifters and high power delay lines for this synthetic aperture radar. During a recent refurbishment all of the phase shifters were found to meet the original requirements over 20 years after delivery.

X-Band Airborne

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APQ-181 B-2 Radar
Rotary-Field Phase Shifters

MAG provided Ku-Band rotary-field phase shifters for the AN/APQ-181 radar, and was part of the team winning the Collier Trophy in 1991.

Ku-Band Airborne

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ASTOR Radar
Rotary-Field Phase Shifters

MAG provided X-Band rotary-field phase shifters for use in the synthetic aperture/ground mapping U.K. Airborne Stand-Off Reconnaissance (ASTOR) Radar, also known as the Sentinel Project.

X-Band Airborne

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Global Hawk Radar
Rotary-Field Phase Shifters

MAG provided X-Band high power phase shifters and delay lines for power distribution as well as low power phase shifters for this synthetic aperture radar on a U.A.V. platform.

X-Band Airborne

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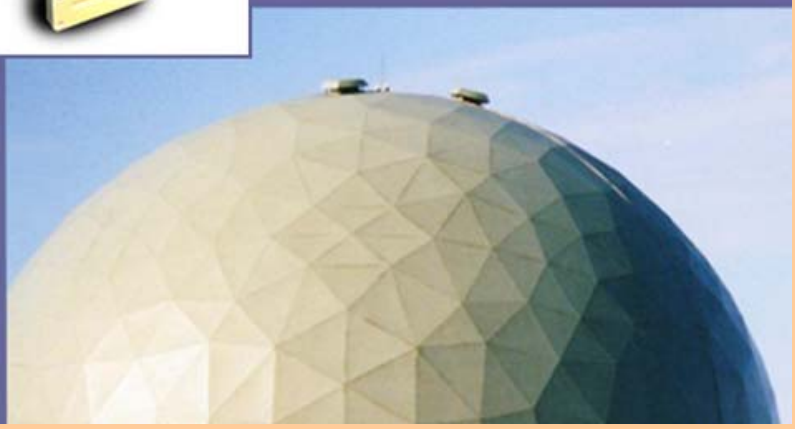
AR320 3D Air Defense Radar
Rotary-Field Phase Shifters

MAG provided S-Band rotary-field phase shifters for this ground-based radar.



S-Band
Ground-based

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TRS22XX 3D Air Defense Radar
Rotary-Field Phase Shifters

MAG provides S-Band rotary-field phase shifters for use in this radar, deployed in NATO and Allied countries.

S-Band
Ground-based

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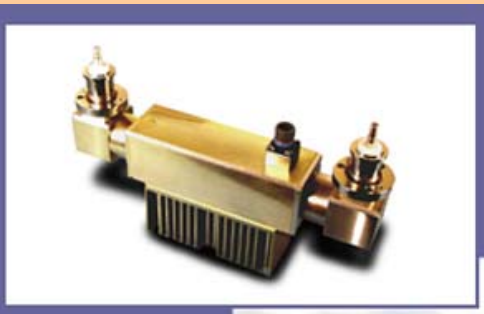
Smart-L 3D Air Defense Radar
Rotary-Field Phase Shifters



MAG provides high performance reduced cross-section L-Band rotary-field phase shifters to fulfill the stringent packaging requirements in this ship-based radar.

L-Band
Ship-based

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RAC 3D Air Defense Radar
Rotary-Field Phase Shifters

MAG provides C-Band rotary-field phase shifters for use in this radar, deployed in NATO and Allied countries.

C-Band
Ground-based

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TRS-3D Multimode Radar
Rotary-Field Phase Shifters

MAG provides C-Band rotary-field phase shifters for use in this ship-based radar.

C-Band Ship-based

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Phase Shifter Drivers

Driver boards are available for both rotary-field and dual-mode phase shifters, in either commercial or MIL versions. ASIC/Hybrid drivers are also available that mount directly on phase shifters. Listed here are some of the drivers developed by MAG.

S-Band Ground-based	AR320 3D Air Defense Radar	
C-Band Ground-based	Akash Rajendra 3D Air Defense Radar	
S-Band Ground-based	TRS22XX 3D Air Defense Radar	
C-Band Ship-based	TRS-3D Multimode Radar	
L-Band Ship-based	Smart-L 3D Air Defense Radar	

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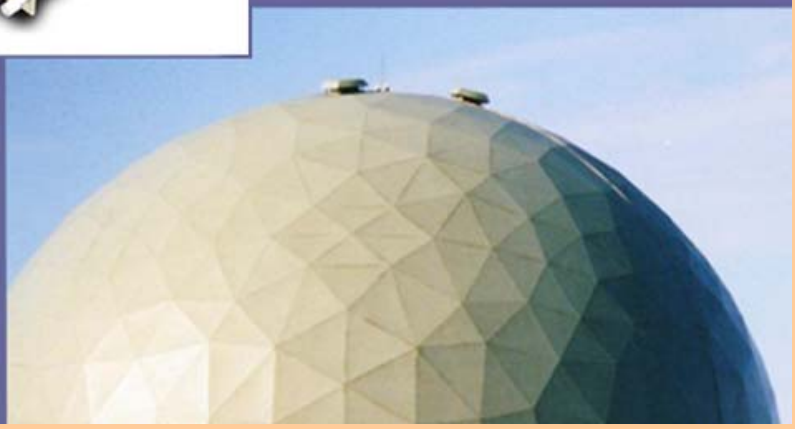
AR320 3D Air Defense Radar
Phase Shifter Drivers

MAG provided drivers for this ground-based radar.



S-Band Ground-based

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Akash Rajendra 3D Air Defense Radar
Phase Shifter Drivers

MAG designed and built phase control modules for this radar, which include a hybrid microelectronic driver mounted to each module.

C-Band Ground-based

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TRS22XX 3D Air Defense Radar
Phase Shifter Drivers

MAG supports customer requirements by designing and fabricating drivers as exemplified by those used on this widely deployed antenna.

S-Band
Ground-based

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TRS-3D Multimode Radar
Phase Shifter Drivers

MAG's drivers are designed to meet customer power and interface necessities.

C-Band
Ship-based

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Smart-L 3D Air Defense Radar
Phase Shifter Drivers

MAG's single power supply drivers are provided for this ship-based radar.

L-Band Ship-based

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RF Waveguide Switches

Ferrite based waveguide switches provide fast switching, moderate peak and average power capabilities, and good isolation with low loss. Listed here are some of the switches developed by MAG.

X-Band Ground-based	MPN-14K Landing Control Radar	
X-Band Ground-based	Skyshield 35 Air Defense Radar	
C-Band Ground-based	DWSR-2501C Doppler Weather Radar	
X-Band Ship-based	SPN-35C Approach Control Radar	
X-Band Airborne	APS-143 CP-140 Imaging Radar	
L-Band Ground-based	ARSR-4 FAA Long Range Radar	

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MPN-14K Landing Control Radar
RF Waveguide Switches

MAG provided high power single pole double throw waveguide switches for this precision approach radar.

X-Band Ground-based

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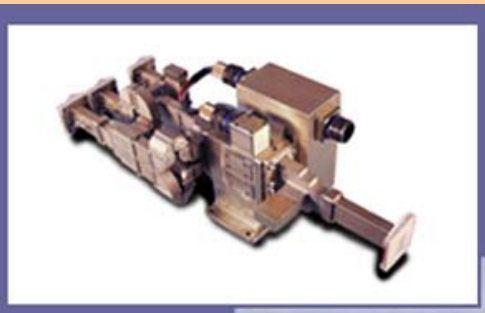
Skyshield 35 Air Defense Radar
RF Waveguide Switches



MAG's single pole triple throw high power X-Band switch provided for this radar features power level monitoring and feedback.

X-Band Ground-based

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DWSR-2501C Doppler Weather Radar
RF Waveguide Switches

MAG designed and built C-Band waveguide switches for use in this weather radar.

C-Band Ground-based

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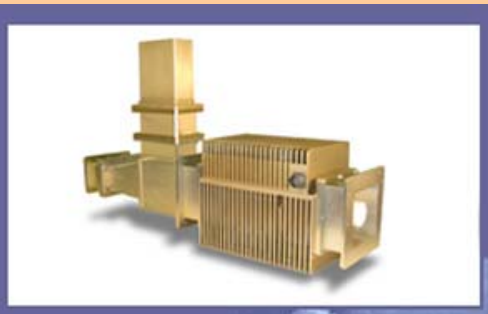
supporting systems since 1969

APS-143 CP-140 Imaging Radar
RF Waveguide Switches

MAG provides X-Band high power waveguide switches for this airborne radar.

X-Band Airborne

ARSR-4 FAA Long Range Radar
RF Waveguide Switches



MAG designed and built an L-Band high power air-cooled polarization rotator for the FAA Long Range Radar, capable of switching between vertical linear and right-hand circular polarization.

L-Band Ground-based

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Resolvers

Airborne roll resolvers transform data from aircraft to other coordinates, whether looking down at the earth or maintaining satellite contact. Also used for variable multiplexing. Listed here are some of the resolvers developed by MAG.

X-Band Airborne	APQ-164 B-1B Offensive Radar	
Ku-Band Airborne	APQ-181 B-2 Radar	

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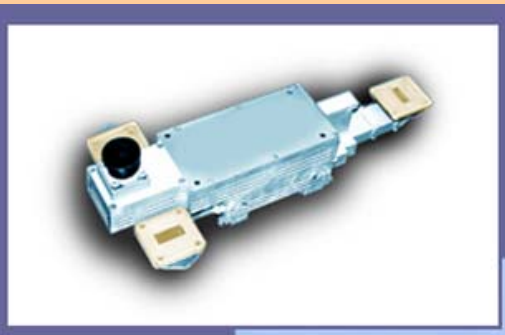
APQ-164 B-1B Offensive Radar
Resolvers



MAG provides X-Band Roll Resolvers for the B-1B Offensive Radar System.

X-Band Airborne

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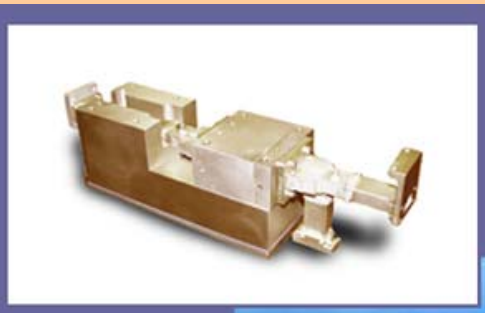
APQ-181 B-2 Radar
Resolvers



MAG provides Ku-Band Roll Resolvers for the B-2 radar system.

Ku-Band Airborne

Antennas/Subsystems

Complete antenna systems include RF feed network and phase shift beam steering, beam steering computer, and power distribution. Listed here are some of the antennas and other systems developed by MAG.

C-, X-, and Ku-Band Ground-based	PAAS/TPAAS Range Instrumentation Family	
X-Band Ground-based	I-30 Range Instrumentation Antenna	
Ka-Band Ground-based	Millimeter-Wave Tracking Radar Antenna	
Ku-Band Airborne	Ku-Band Terminal Guidance Antenna	
C-Band Ground-based	Princeton Plasma Physics Lab Combiner	

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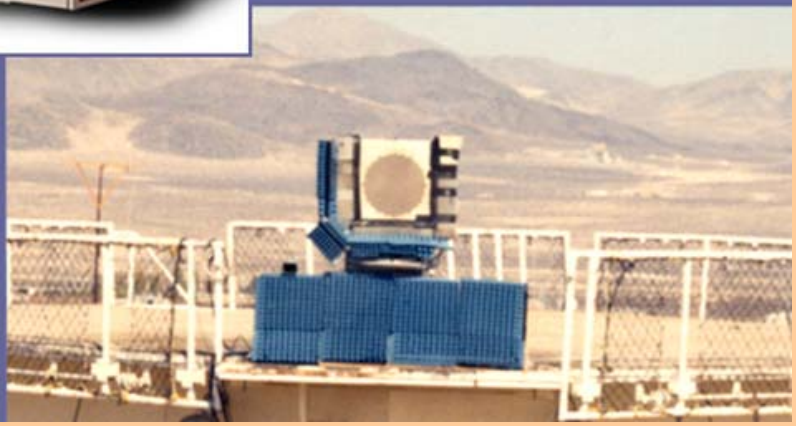
Transportable Phased Array Antenna System (TPAAS)
Antennas/Subsystems

MAG designed, built, and delivered this family of test range antennas in Ku-, X-, and C-Band versions.

C, X, Ku-Band Ground-based



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I-30 Range Instrumentation Antenna
Antennas/Subsystems

MAG designed, built, and delivered this 2,101 element electronically steerable phased array antenna for test instrumentation within 18 months from contract award.

X-Band Ground-based

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Millimeter-Wave Tracking Radar Antenna
Antennas/Subsystems

MAG designed and built this ESA which utilizes a resonant waveguide feed to achieve 1D pencil beam and 1D fan beam for fire control applications.

Ka-Band Ground-based

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Ku-Band Terminal Guidance Antenna
Antennas/Subsystems

MAG designed, built, and delivered this ESA, which utilizes an unusual waveguide feed to achieve 500 MHz instantaneous bandwidth.

Ku-Band Airborne

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Princeton Plasma Physics Lab RF Combiner
Antennas/Subsystems

MAG designed and built RF assemblies that split, phase controlled, and recombined 2 MW of RF power for plasma excitation and control in a tokamak pressure vessel for fusion research.

C-Band Ground-based

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New Products in Development

These devices are currently being tested and optimized for the best possible performance.

High-Isolation Waveguide Switch

X-Band

L-Band

Coaxial Tee

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