

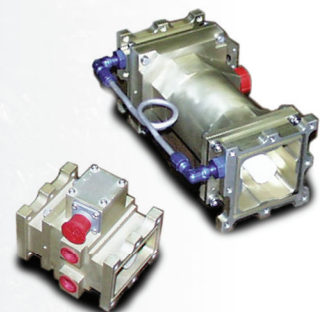
## Background & Products

Microwave Applications Group (MAG) became a California corporation in 1969 with the goal of supporting electronically scanning antenna (ESA) technology and other systems utilizing electronic routing and steering of RF signals, especially at UHF and microwave frequencies. Towards this goal, MAG began developing ferrite-based components and subsystems for many well-known programs, leading to production quantities of phase and beam control devices and waveguide components, many of which are still deployed decades later.

Early growth of the company was made possible by the development at MAG of new “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 Module (PCM) for the B-1B Radar System, based on MAG’s “Dual-Mode” technology, and successfully produced in excess of 130,000 PCMs.

This background has led to program support for defense/military, government, aerospace, laboratory,





and commercial markets at the component and sub-system level with unique solutions—from research and development—to large-scale production—to reverse engineering of existing designs.

MAG products are found on land and sea and in the air, successfully deployed in many different applications. These applications include those for aircraft landing control, air defense, warning and control, surveillance and tracking, fire control, weather observation, high altitude surveillance, threat identification, threat simulation, and laboratory and instrumentation.

Products designed and manufactured include ferrite phase shifters, plus a wide range of components for performing switching, circulator, isolator, variable power divider, and other RF functions. MAG has successfully provided synthetic aperture radar components for over 30 years. A few examples of MAG's products, with each listed with its corresponding application type is shown to the right.

MAG's phase shifters have the advantage of ease of adaptability to any interface, whether free-space, waveguide, coax, or stripline, allowing great flexibility in antenna design. Phase shifter type—dual-mode, rotary-field, or toroid—is determined by the application to give the best performance over the frequency band.

RF switches are products that naturally evolved from MAG's background and desire to broaden its offerings, and are available in both reciprocal and non-reciprocal designs. Electronic scanning antennas (ESAs) have also been designed and manufactured by MAG. In addition, electronic drivers, beam steer-

X-Band High, Low Power Rotary-Field Phase Shifters, Delay Lines  
*Airborne Synthetic Aperture Radar*

C-Band 8-Channel Dual-Mode Phase Control Modules  
*Ground Radar Threat System*

X-Band Dual-Mode Phase Control Modules  
*Airborne Radar System*

Ku-Band Dual-Mode Phase Shifters  
*Airborne Synthetic Aperture Radar*

L-Band Rotary-Field Phase Shifters  
*Ship-Based Air Defense Radar*

S-Band Rotary-Field Phase Shifters  
*Ground Air Defense Radar*

X-Band Simulator Antenna  
*Ground Test Range System*

X-Band Roll Resolvers  
*Airborne Radar System*

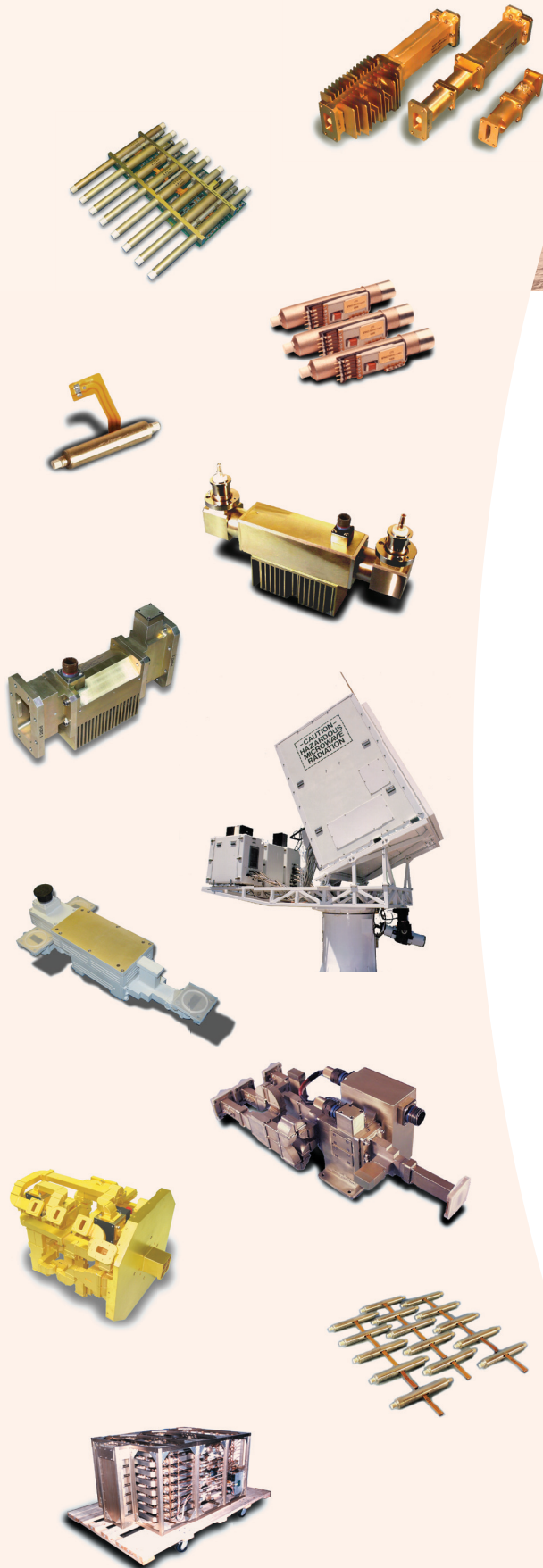
X-Band SP3T Waveguide Switches  
*Ground Air Defense Radar*

X-Band Horn and Feed Network Assembly  
*Ground Radar Simulator*

X-Band Dual-Mode Phase Shifters  
*Ship-Based Surveillance and Tracking Radar*

C-Band RF Phase Control, Splitter, Combiner Networks  
*Ground Fusion Laboratory*

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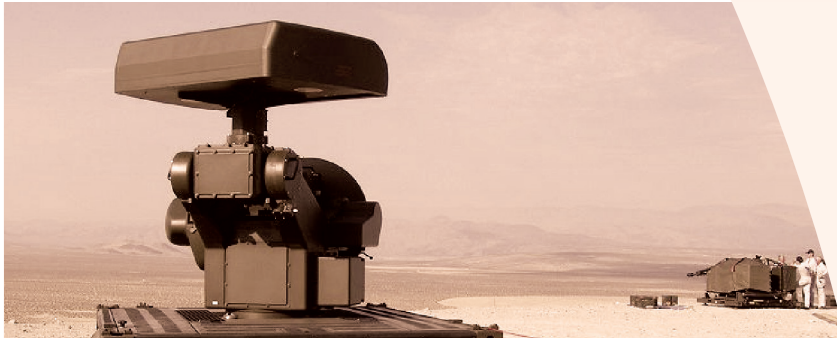
ing controllers, and related electronic test equipment are produced as an offshoot of needs initiated by control of microwave components.

MAG also supports legacy systems, in some cases where the original manufacturer is no longer in business or willing to provide products produced in the past, by fulfilling Diminishing Manufacturing Sources and Material Shortages (DMSMS) requirements. MAG will work from original documentation, or perform reverse-engineering if needed, and has successfully found replacement materials and updated processes due to obsolescence issues. MAG intends to continue its support of DMSMS activities for the RF community as the corporate and regulatory arenas evolve.

MAG's physical plant is an 18,820 square foot facility on a 3 1/2-acre site in the city of Santa Maria, located on California's Central Coast, nearly midway between Los Angeles and San Francisco. MAG's manufacturing capabilities include ceramic grinding, precision machining of waveguide and other parts, assembly, thin film deposition, vacuum impregnation, pressure testing, conversion coating, and mil-spec soldering, each in its own dedicated area. A full complement of laboratory apparatus for electronic and microwave measurements exists at MAG with custom interfaces designed for each specific product tested. Laboratories provide both in-process and final acceptance testing over temperature to ensure specification compliance. Inspection areas are collocated with general and product-specific assembly departments.

In addition to raw materials, MAG's outside vendor (OSV) base provides brazing, prime/finish coating, and environmental testing capabilities to augment in-

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house processes. For services and material provided by its OSVs, MAG requires complete documentation, including batch numbers when applicable. MAG has also built a network of vendors to ensure availability of multiple sources for critical items.

For over 30 years MAG has maintained an approved MIL-I-45208 Quality Assurance System, with current provisions for accommodating MIL-Q-9858A standards as required by customer specification. MAG participated in the California Supplier Improvement Program (CAL SIP) to further refine the concepts of Total Quality Management (TQM), Statistical Process Control (SPC), Teamwork, Leadership and Communication (TLC) and Inventory Management techniques (JIT). Section Q of MAG's Standard Practice Manual defines and establishes uniform practices within MAG for all matters relating to Quality Assurance.

Products delivered by MAG must meet stringent mechanical characteristic and electrical performance requirements. Engineering models and drawings define the product through various stages from raw material through final assembly. Manufacturing process and procedure documents define the detailed steps in the production flow. Acceptance and in-process test procedures define the electrical tests performed to demonstrate compliance with customer and/or MAG specifications. All documentation is reviewed and approved by MAG Engineering prior to release.

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### Sample of programs supported by MAG as OEM:

APQ-164 B-1B ORS • APQ-181 B-2  
APS-143 CP-140 Imaging • APY-1/2 E-3 AWACS  
AR320 3D Air Defense • ARTS-V1 / CLPS  
ARTS-V2 • ASARS-2 Synthetic Aperture  
ARSR-4 FAA Long Range • ASTOR  
DWSR-2501C Doppler Weather  
Global Hawk Synthetic Aperture  
I-15/23 Reflectarray • I-30 Simulator  
MPN-14K Landing Control • PAAS Test Range  
Princeton Plasma Physics Laboratory  
RAC 3D Air Defense • Skyshield 35 Air Defense  
Smart-L 3D Air Defense  
SPN-35C Approach Control  
SPQ-9B Surveillance / Tracking  
TPAAS Test Range • TRS-3D Multimode  
TRS22XX 3D Air Defense  
ZPQ-1 Predator TESAR

### MAG DMSMS program support:

APY-1/2 E-3 AWACS • BMEWS / PAVE PAWS  
HAWK • SPN-35C Approach Control  
MPQ-64 Sentinel SHORAD  
MSQ-T43 MTE System

### Product types provided by MAG:

Dual-Mode Phase Shifters...Ka- to C-Band  
Rotary-Field Phase Shifters...Ku- to L-Band  
Toroid Phase Shifters...X-Band  
Waveguide Switches...Ku- to L-Band  
Pin-Diode Switches...Ku- to UHF  
Circulators...X-Band  
Attenuators...X-Band  
Antennas/Subsystems...Ka- to C-Band  
Waveguide Assemblies...Ka- to L-Band  
Rotary Joints...X-Band  
Waveguide Loads...Ku- to S-Band  
Electronic Drivers • Beam Steering Computers  
Signal, Power, RF Cabling

Contact us for other frequency bands

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