

*Continuing to support systems, as we have since 1969
...on land, on the sea, and in the air*





Company historical highlights

1960s

Incorporation
Chatsworth 1969
Santa Maria 1981



1970s

E-3 AWACS
Rotary-Field
Phase Shifter



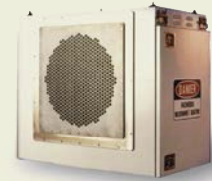
1980s

APQ-164 B-1B
Dual-Mode
Phase Shifter



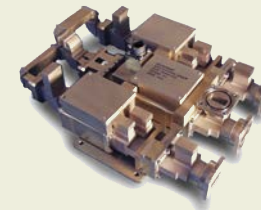
1990s

TPAAS and I-30
Electronically
Scanning Antennas



2000s

RF Switches
X-Band, C-Band
SPDT, SP3T, DPDT



2010s

DMSMS
Filling Legacy
System Needs





Sample of accomplishments

Design, Prototype, Production Fabricate, Test

130,000+ B-1B Phase Control Modules

E-3 AWACS phase shifter suite including Beam Steering Phase Shifter, Beam Offset Phase Shifter, Septum Polarizer, Orthomode Junction, and Loads

ASARS-2, Global Hawk, and ASTOR phase shifters

SPQ-9B phase shifters

Design, Fabricate, Test

PAAS/TPAAS family of target antennas in Ku-, X-, and C-Band versions, with first antenna delivered in 16 months ARO

I-30 threat simulator delivered 18 months ARO

Diminishing Manufacturing Sources and Material Shortages (DMSMS)

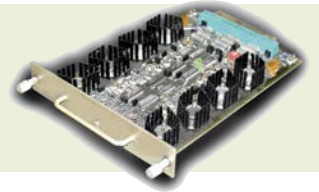
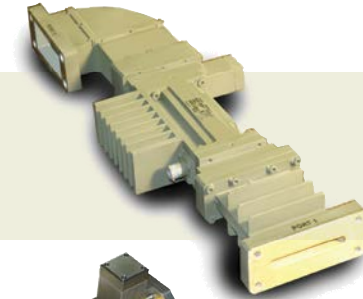
MAG has developed alternate parts for the government on numerous programs



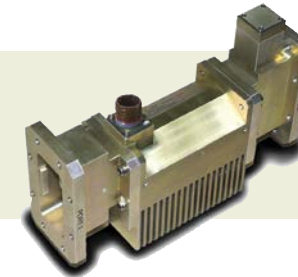
Major program highlights ...on land



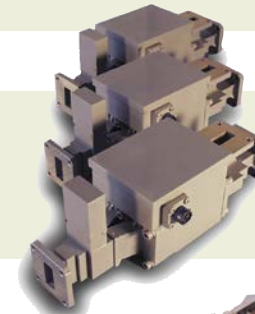
AR-320 S-Band



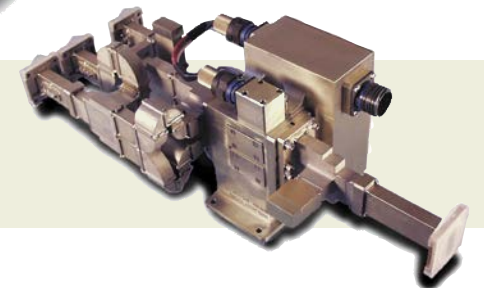
TRS-22XX 3D S-Band



MPN-14K X-Band



Skyshield 35 X-Band





Major programs ...on land

Rotary-Field Phase Shifter
Dual-Mode Phase Shifter
Switch/Resolver/Other
Antenna/Subsystem

- AR-320 S-Band
- TRS-22XX 3D S-Band
- RAC-3D C-Band
- KALKAN 3D X-Band Latching
- AKASH C-Band
- I-15 X-Band Element
- C-Band Phase Module
- MPN-14K X-Band Switch
- DWSR-2501 C-Band Switch
- I-15 X-Band W/G Network
- Skyshield 35 X-Band Switch
- HAWK X-Band Rotator
- 8-Element Ku-Band Array
- Ka-Band Antenna
- PAAS X-Band Antenna
- TPAAS X-Band Antenna
- TPAAS Ku-Band Antenna
- TPAAS C-Band Antenna
- I-30 X-Band Antenna

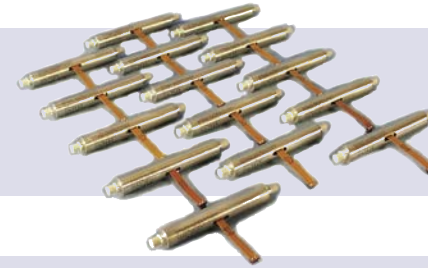
	1970s	1980s	1990s	2000s	2010s
AR-320 S-Band		•			
TRS-22XX 3D S-Band		•			
RAC-3D C-Band		•			
KALKAN 3D X-Band Latching				•	
AKASH C-Band		•			
I-15 X-Band Element		•	•		
C-Band Phase Module					•
MPN-14K X-Band Switch			•	•	•
DWSR-2501 C-Band Switch			•	•	•
I-15 X-Band W/G Network				•	
Skyshield 35 X-Band Switch				•	
HAWK X-Band Rotator					•
8-Element Ku-Band Array		•			
Ka-Band Antenna		•			
PAAS X-Band Antenna		•			
TPAAS X-Band Antenna			•		
TPAAS Ku-Band Antenna			•		
TPAAS C-Band Antenna			•		
I-30 X-Band Antenna			•		



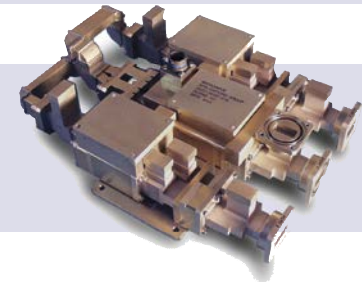
Major program highlights ...on the sea



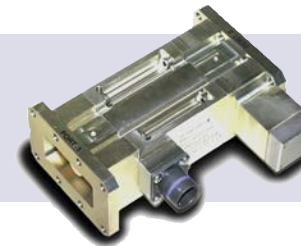
SPQ-9B X-Band



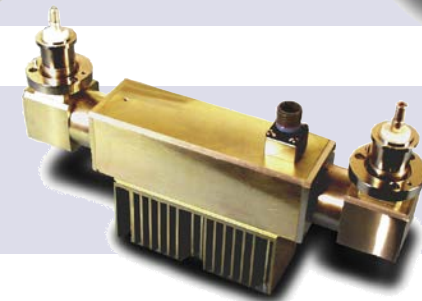
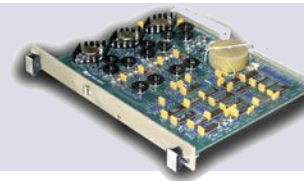
SPN-35C X-Band



TRS-3D C-Band



Smart-L L-Band

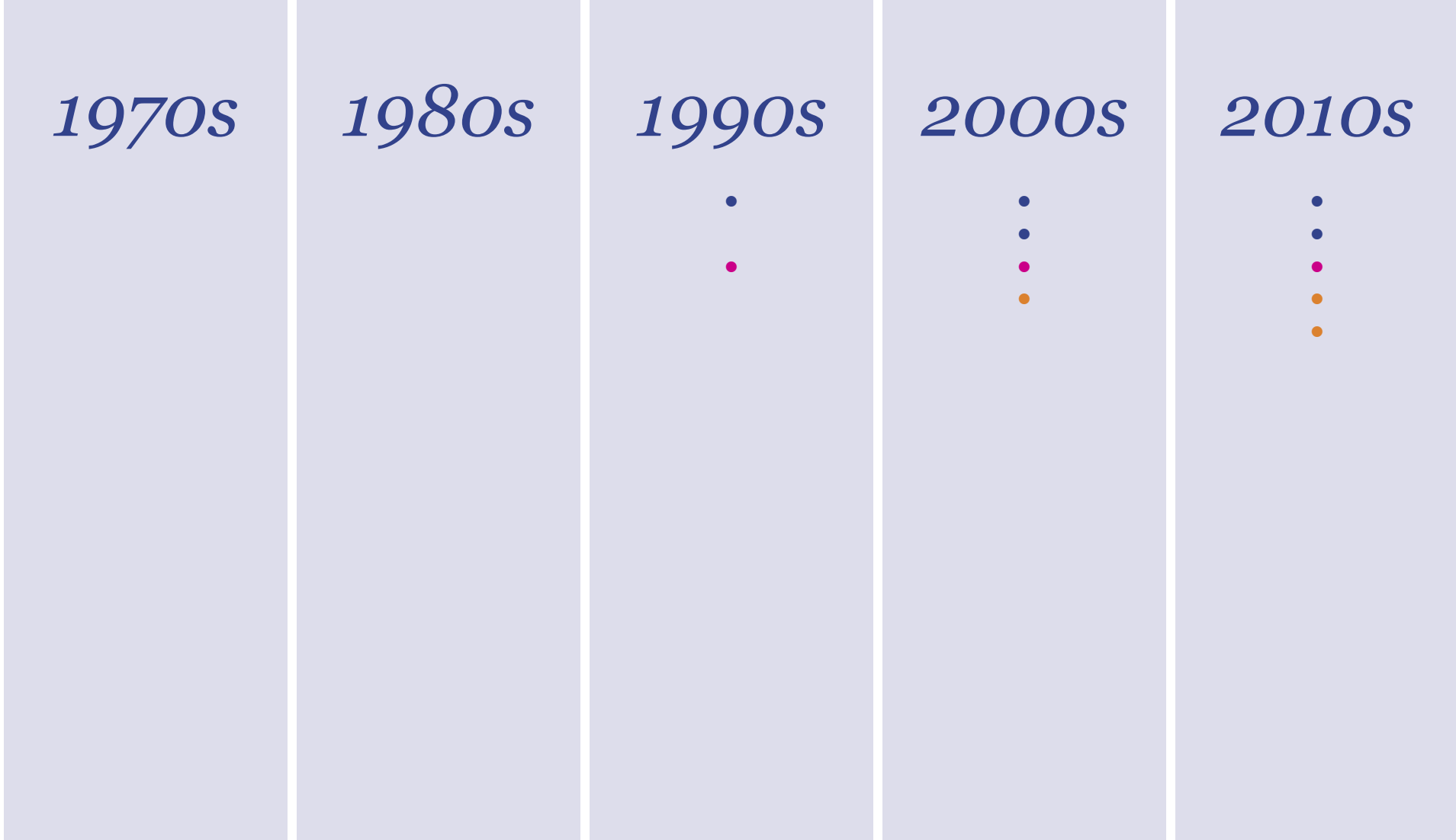




Major programs ...on the sea

Rotary-Field Phase Shifter
 Dual-Mode Phase Shifter
 Switch/Resolver/Other
 Antenna/Subsystem

SMART-L 3D L-Band
 TRS-3D C-Band
 SPQ-9B X-Band
 SPN-35C X-Band Switch
 SPN-35C X-Band Rotary Jt.

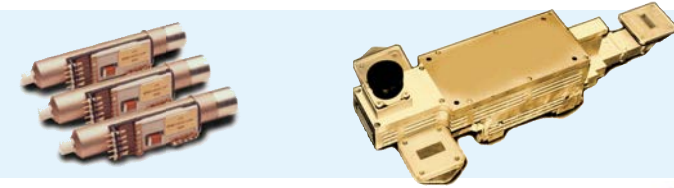




*Major program highlights
...in the air*



APQ-164 B-1B X-Band



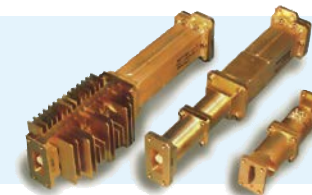
APY-1/2 E-3 AWACS S-Band



APQ-181 B-2 Ku-Band



ASARS-2 X-Band





Major programs ...in the air

Rotary-Field Phase Shifter
Dual-Mode Phase Shifter
Switch/Resolver/Other
Antenna/Subsystem

	1970s	1980s	1990s	2000s	2010s
APY-1/2 E-3 AWACS S-Band	•	•	•	•	•
APQ-181 B-2 Ku-Band		•	•		
ASARS-2 X-Band		•	•		
ASTOR X-Band				•	
RQ-4 Global Hawk X-Band				•	
APQ-164 B-1B X-Band PCM		•	•	•	
Project 212 XL-Band		•			
ZPQ-1 TESAR Ku-Band				•	
Commercial Aircraft X-Band				•	
APY-1/2 E-3 AWACS W/G	•	•	•	•	•
APQ-164 B-1B X-Band Res.		•	•	•	•
APQ-181 B-2 Ku-Band Res.		•	•	•	•
CP-140 X-Band Switch				•	
Project 212 XL-Band Res.		•			•
Missile Guidance Ku-Band			•		

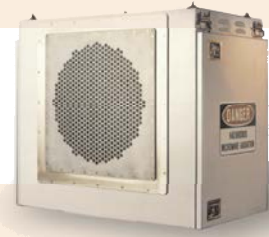


*Major program highlights
...range, instrumentation, special test equipment*

I-30 X-Band



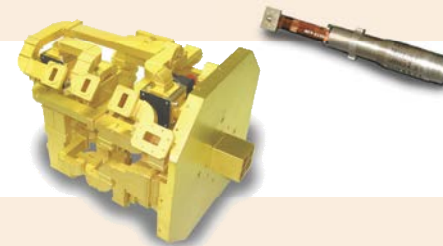
TPAAS Ku-, X-, C-Band



Ka-Band



I-15 X-Band



Ku-Band



Princeton PPPL C-Band





Ferrite-based device experts

One of the U.S. companies that pioneered and fostered use of ferrite phase shifters

Continues to design and fabricate ferrite-based components

Last remaining U.S. company actively designing and building these devices



Ferrite phase shifter characteristics

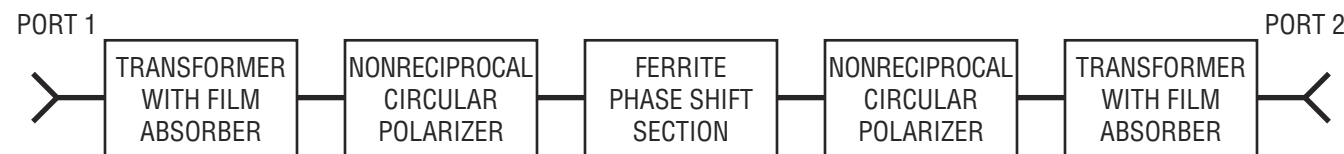
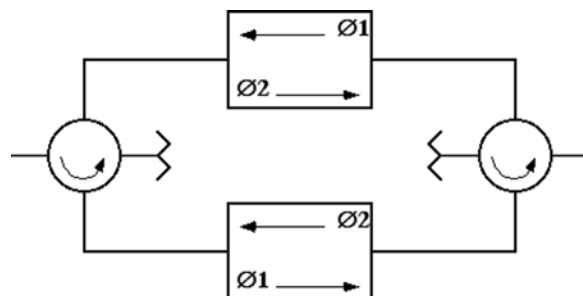
	<i>Dual-Mode</i>	<i>Rotary-Field</i>	<i>Toroidal</i>
Phase Shift	Time delay	True phase shift	Time delay
Insertion Phase Determined by	Magnitude of DC bias field and hysteresis effects	Angle of DC bias field and hysteresis effects	Magnitude of DC bias field and hysteresis effects
Frequency	4 to 90 GHz	1.2 to 39 GHz	3 to 28 GHz
Insertion Loss	0.8 to 2 dB	0.5 to 0.75 dB	0.4 to 1.2 dB
Amplitude Modulation	0.4 dB	0.2 dB	0.4 dB
Latching	Yes	Either	Yes
Reciprocal	Yes	Yes	No
Advantage	Economical	Continuously variable phase capability allows real-time slewing of antenna beam	Fastest switching



Ferrite phase shifter characteristics

...Dual-Mode

Concept



Block diagram

Physical realization



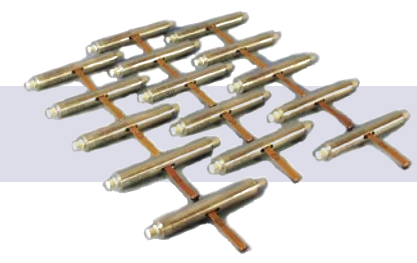


Dual-Mode Phase Shifters

APQ-164 B-1B X-Band



SPQ-9B X-Band



ZPQ-1 TESAR Ku-Band

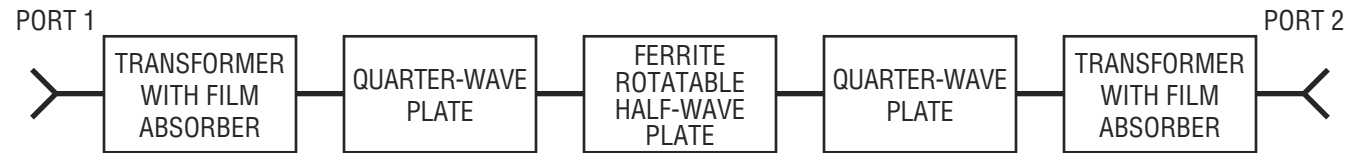




Ferrite phase shifter characteristics

...Rotary-Field

Block diagram

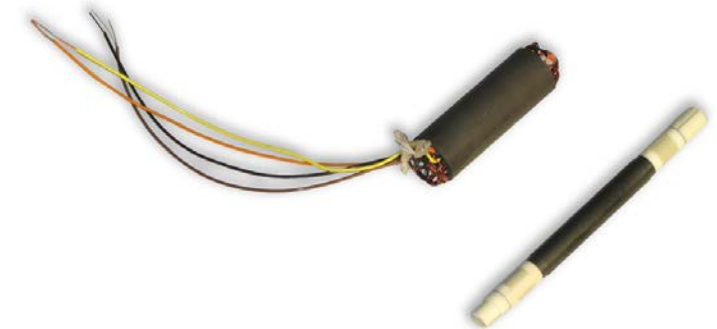


Physical realization

Non-Latching



Latching





Rotary-Field Phase Shifters

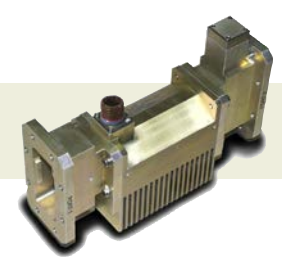
APY-1/2 E-3 AWACS S-Band



TRS-3D C-Band



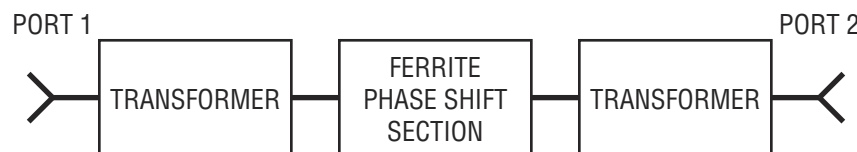
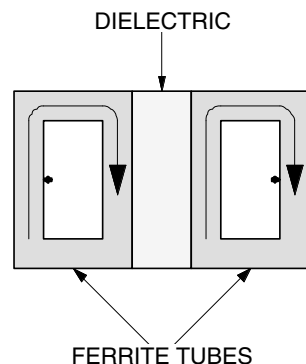
TRS-22XX S-Band





Ferrite phase shifter characteristics ...Toroidal

Concept



Block diagram

Physical realization

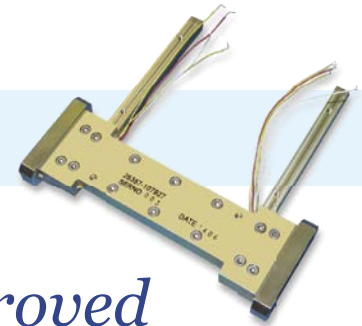




MAG recent and current activities ...Toroidal

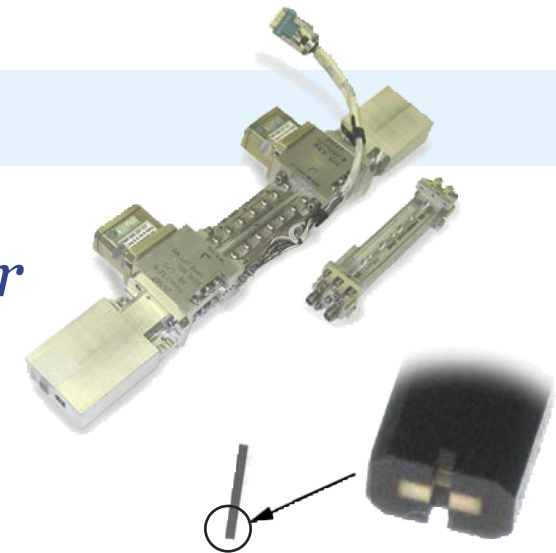
X-Band Volt-Time Twin-Toroid Phase Shifter

Production quantity built by MAG for domestic customer with approved export license for foreign end-user



AN/ALQ-172 Components

MAG is currently under contract to provide replacements for portions of this countermeasures system



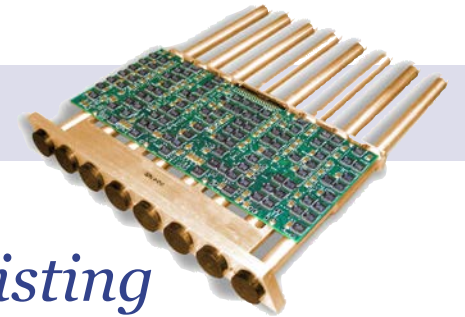
DUAL TOROID



MAG recent and current activities ...Dual-Mode

C-Band Phase Control Module

Large production order being delivered by MAG, each module consisting of eight Dual-Mode phase shifters packaged with a multi-channel driver controlling each phase shifter individually



ARTS-V2

MAG's Project 212 phase shifter design fulfills ARTS-V2 program requirements



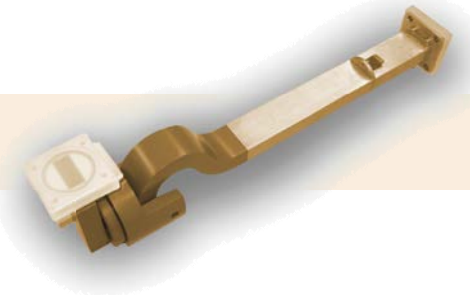


*MAG recent and current activities
...Diminishing Mfg Sources and Matl Shortages (DMSMS)*

S-Band APY-1/2 E-3 AWACS Load



X-Band SPN-35C Rotary Joint



X-Band Hawk Rotator

