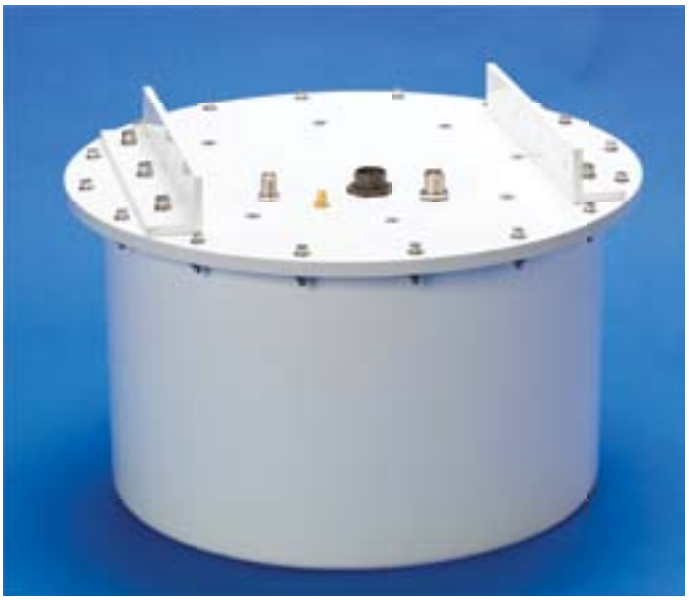
PA16 Electronically Steerable Array Antennas



-Auto-tracking / 16 high gain beams

-Seamless solid-state switching

-No moving parts

-Integrated control system

The PA16 antenna is an electronically switched array that produces a single, high gain 14 dBi beam in one of sixteen directions in azimuth.

An integrated internal control system allows auto-tracking, keeping the beam pointing toward a chosen target site as the helicopter changes its position and heading.

PA16 antenna systems are now in use all over the world, providing TV stations, broadcast video providers, and emergency services with long range, airborne SD and HD digital video transmissions.

The following feedback, after Hi-Def DVB-SH testing in Dallas, TX, is from Ken Pyatt of SKY helicopters.

"We completed HD range testing using the R44 NewsCopter, a DVB-SH modulator, 8W 2 GHz transmitter and the Peak PA16. We tested by flying away from WFAA Cowboy receive site, a fairly broad 20 dBi dish mounted 600 AGL. At 120 NM we completed several orbits with fine HD pictures. We stopped making pictures at 130 NM with no visible RF haystack. We could roll 20-25 deg and pitch 10-15 deg without losing pictures."

Photo courtesy of SKY Helicopters

PEAK ANTENNAS

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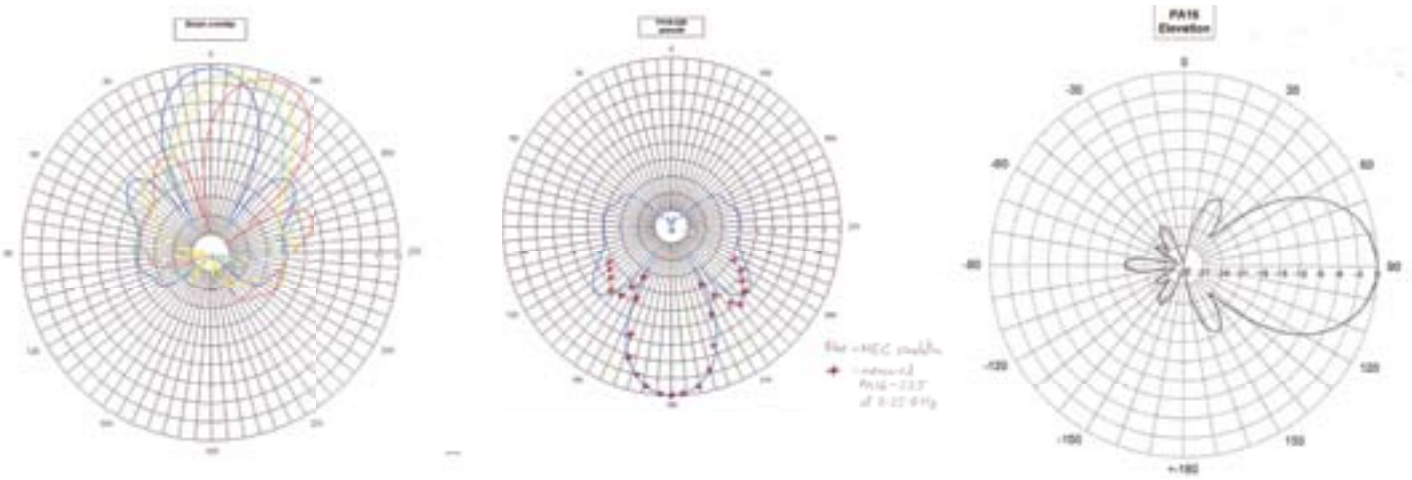
Antenna System Description:

The PA16 array has a ring of 16 antenna panels, each comprising two tiers of vertical dipoles, driven through PIN diode switching and phasing circuits.

Each of the **16** overlapping **azimuth beams** is formed by switching in, and phasing up, 4 adjacent panels. This configuration creates a well optimised pattern to cover a 22.5 degree sector. Each beam shares 3 panels with neighboring beams, which makes for a **compact design,** and ensures **smooth transitions** with minimal RF amplitude and phase changes as the beams track round. A new feature fills in the amplitude ripple, and mitigates the effect of compass response latency during rapid manoeuvres, whereby as the target direction approaches the cross-over angle, the current beam squints-in toward that direction and then hands off to the next beam also squinting-in. The beam then reverts to its normal shape.

The **elevation beamwidth** is 35 degrees, which allows adequately for most in-flight manoeuvres.

An **integrated** circularly polarised downlook antenna allows the system to be used as a relay in a ground to air to ground link.



From left to right: Beam overlap, showing enhanced hand-off with squint-in feature; azimuth beam, measurements and simulation; elevation radiation pattern

Installation under Robinson R44

An external GPS antenna with inbuilt 20 dB gain LNA is provided with the system. The LNA is powered from a DC voltage on the inner of the GPS cable connector.

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PA16 Electronically Steerable Array Antennas

Control System Description:

The internal control system comprises a GPS receiver, electronic compass, microprocessor with embedded system software, I/O comms and diode drivers.

Hand-held Terminals:
User interface is provided by an externally connected handheld keyboard / display terminal. This is used to select the mode of operation, input the lat / long coordinates of target sites and provides various real-time information on the screen. The control system software supports two different terminals. The Trans-Tech Pro-Term is standard, but the Oyster OT-40 is available on request. The pods can also interface with a PC running terminal emulation software.

Custom Pro-Term installation in R44

Control Functions:
A total of 15 target sites can be entered and edited, and this data is held permanently in memory. When **Directional or auto-tracking** mode is selected, the control system uses the current GPS position and compass heading information to keep the beam pointed toward the selected target site, as the helicopter changes its position and heading. Other operational modes are **Manual,** where the user can select which of the 16 beams is energised, **Omni**, where all the array panels are energised creating a low gain omnidirectional antenna and **Nearest**, where the beam will automatically be pointed toward the nearest target site in the memory. When the helicopter is closer than 1.5 km from the selected target site in Directional mode, the system automatically changes to Omni mode in order not to risk overloading the receive site.

GPS Receiver:
The integrated GPS receiver provides the current location of the helicopter to the processor (for use in the pointing calculation). It also has a look-up library of the magnetic declination values worldwide, and so also provides the local declination value (again for use in the pointing calculation). Additionally it provides NMEA data sentences, available at the control connector in RS232 format at 4800 baud or 1200 baud (with an option for an FSK, Bell modem also). This can be added to the transmission to provide positon data to a tracking receive site. The lat/long is displayed on the terminal screen.

Electronic Compass:
A high performance compass module is mounted inside the pod. It features enhanced accuracy and stability, with liquid-filled bubble pitch/roll sensors backed up by mems rate gyros, separate filtering of pitch/roll sensors and magnetometers for output stability in vibrating environments and a sophisticated and proven calibration routine to remove errors caused by permanent magnetic fields generated by the airframe and associated hardware.

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PA16 Electronically Steerable Array Antennas

Specifications:

Designation:	PA16-225	PA16-250
Frequency:	1.98-2.50 GHz	2.3-2.7 GHz
No. of beams:	16	
Gain:	14 dBi	
Beamwidth:	25 degrees azimuth	
	35 degrees elevation	
Polarization:	Vertical	
Return loss:	14 dB	
Downlook Antenna:	5 dBi gain, 90 deg B/W, RHCP	
Size:	< 355 mm (14 inches) radome diameter	
	> 225 mm (9 inches) height	
Weight:	6.8 kg (15 lbs)	
Voltage Supply:	7-28 V DC (unregulated)	
Current Draw:	1.0A at 20V	
Connectors:	Array	N type socket
	GPS (ext. ant.)	TNC socket
	Downlook	SMA socket
	Control	19 pin circular (KPT07A14-19P
Hand Terminal:	Trans-Tech Pro-Term (or Oyster OT-40)	

Pro-Term (left) and Oyster (right) hand-held terminals

Top plate connectors

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