

# Going Domeless

## Flat panels and beamforming vs stabilized marine antennas

In April, Kymeta Corp. began turning out a new type of satellite antenna for the marine market that the company says performs better than conventional stabilized marine antennas while eliminating the familiar dome housing. The flat-panel antennas accomplish this by harnessing a technology called beamforming to lock on to satellite signals rather than mechanically aiming the stabilized antennas.

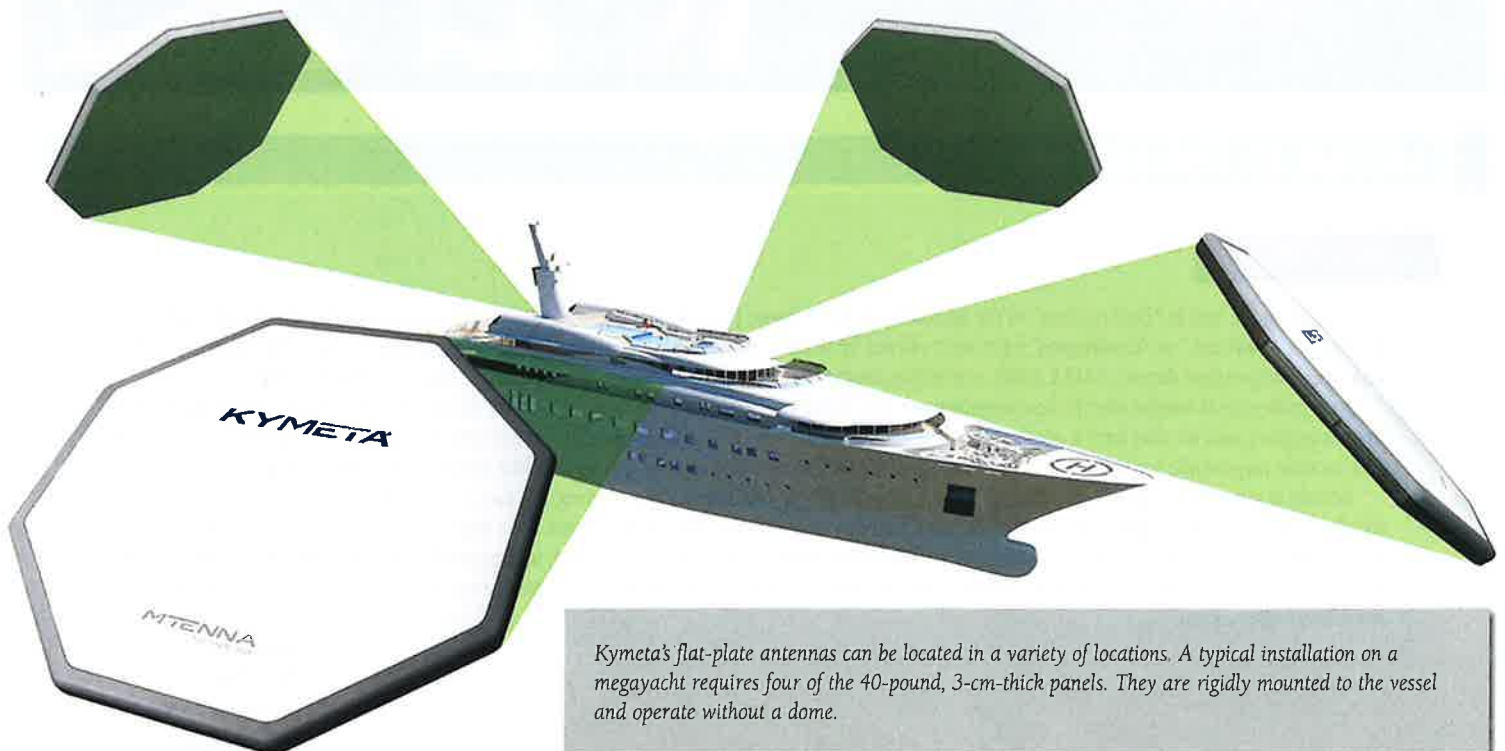
BY JIM FULLILOVE, MEJ EDITOR

**T**here are two approaches currently under development. One involves panels that are rigidly attached to the vessel and all satellite tracking is done via electronic beamforming. The panels do not move and aren't contained within a dome. The second approach combines beamforming and rotation of the flat-panel antenna within a conventional dome—Kymeta calls this a hybrid system.

Kymeta will offer three versions of its flat-panel antennas, ranging from a single panel to several that are combined for increased bandwidth and download speed and finally to the hybrid version that uses both antenna movement and beamforming. A flat panel is eight sided, less than 3 cm thick, weighs 40 pounds and initially costs about \$30,000. A typical installation requires four panels, which can be installed in a variety of locations on the boat.

### Similar to flat-panel TVs

Panels are made from naturally occurring materials that are arranged “in a specific pattern that produces a specific electromagnetic response that is not found in nature,” says Kymeta. The ingredients are said to be similar to a flat-panel TV. In fact, Sharp will produce the panels on a TV production line. As a TV controls three color “dots” behind each pixel, a flat-panel antenna steers the signal through its surface toward the satellite. There



Kymeta's flat-plate antennas can be located in a variety of locations. A typical installation on a megayacht requires four of the 40-pound, 3-cm-thick panels. They are rigidly mounted to the vessel and operate without a dome.

are no moving parts to wear out or break down.

The hybrid version, under development by Intellian, rotates the Kymeta panel mechanically around a vertical post to offset the fact that the Kymeta can't currently beamform the signal below 20 degrees above its horizon. The panel, mounted at a tilt on a vertical post, will rotate to approximately the direction of the satellite and beamforming takes it from there, fine tuning the direction at 20 degrees per second. As the vessel turns, the Intellian version's antenna rotates in response to stay locked on the satellite. Beamforming accommodates the pitch and roll.

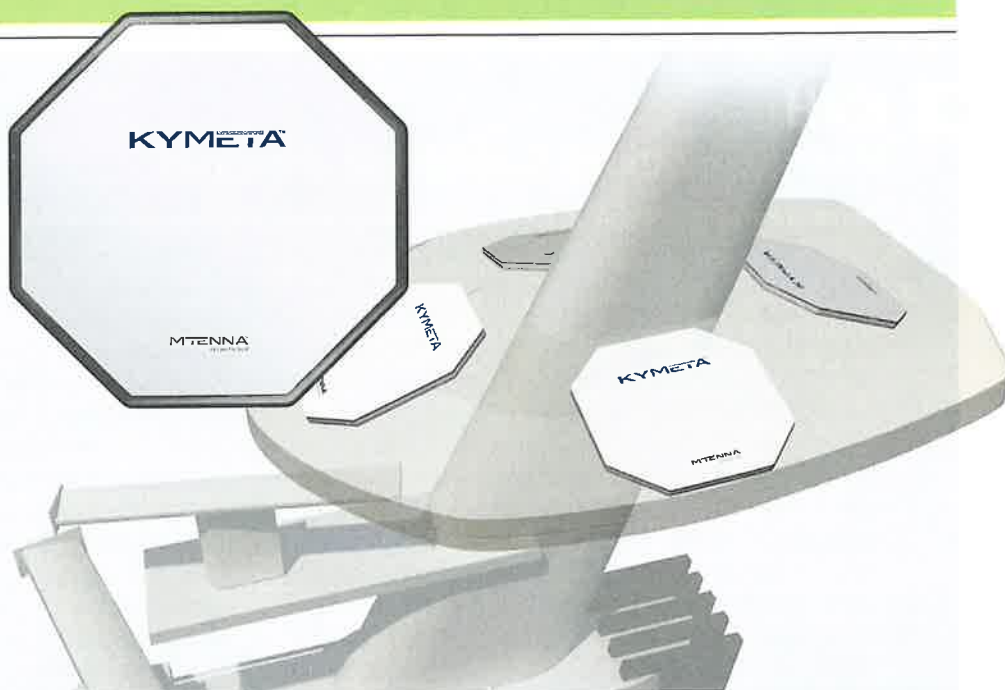
"One panel has about the same gain as a 60 cm stabilized dish antenna," says John Minetola, Sales Manager-Americas for e3 Systems, which will distribute the Kymeta system to the superyacht sector. Panasonic is distributor to the overall marine market. "They can be grouped together to get more gain. One LNB [low noise block converter] per panel, one BUC [block up converter] per group that transmits."

### Higher throughput, lower terminal costs

According to Kymeta, "Leveraging production methods used in LCD televisions, this innovative, software-enabled, metamaterials-based, electronic beamforming antenna is the first designed for mass production to generate volumes never considered before." The company says its antennas are capable of higher throughput than Fleet Broadband and have lower terminal costs than comparable VSAT antennas. Additionally, Kymeta says the panels offer seamless connectivity with any satellite as well as MEO/LEO switching and tracking. Unlike conventional stabilized satellite TV antennas, Kymeta systems do not offer TVRO—live TV. Instead, the flat panels provide a link to the Internet.

"Kymeta is betting that people on boats will watch video over the Internet, just like people at home are cutting off their DirecTV and cable TV," says Minetola. "They watch Netflix and Hulu over the Internet. Also on a yacht and airplane, movies and shows can be downloaded in the background at less expense than live-streaming—to be watched later. Also faster and less expensive satellites are launching in the next couple years."

In a demonstration during the Monaco Boat Show last year, Kymeta says two of its mTennau7 ASMs (antenna subsystem modules) "simultaneously received eight live



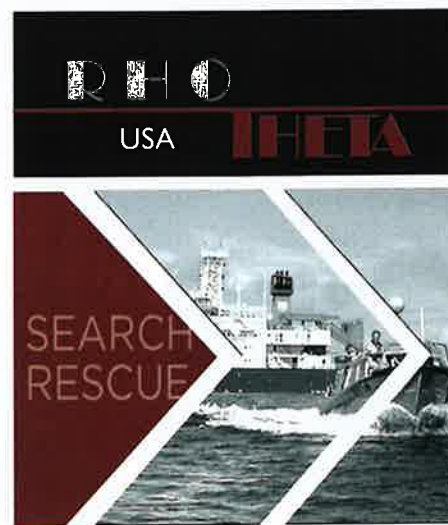
*Unlike conventional stabilized marine antennas, the flat-plate devices track satellites through an electronic process known as beamforming. The system has no moving parts. Currently each panel sells for about \$30,000, but the manufacturer expects costs to come down as volume increases.*

Panasonic multicast eXTV channels, performed multiple live Skype video sessions, multiple HD and Ultra HD Netflix video sessions, and provided WiFi access to an average of 80 users at any one time, during the show. The demonstration also confirmed the low-power consumption of the Kymeta mTenna technology, drawing only 12 watts of power per ASM."

Minetola says the flat panels can be carried aboard by hand and installed in "a matter of hours." He says for commercial vessels the cost of a Kymeta system may be "two to three times higher than conventional [stabilized marine antennas] but is faster and easier to install without tying up the ship."

As for yachts, he says, you need to "consider the whole cost of conventional domes plus the mast and wings, including TVRO and multiple receivers for multiple cabins, multiplied by the number of countries visited. Kymeta replaces this with multiple panels, but subtracts the receivers and service contracts with DirecTV US, DirecTV Latin, Sky Mediterranean, etc."

Minetola says he doesn't think the typical *MEJ* reader will be selling the antenna in the near-term "because of the price/no TVRO/multiple-panel-issue. However, Kymeta and the idea of getting rid of the antenna farm will get a lot of publicity."



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## KVH

### Marine conditions favor dome antennas

We asked KVH to comment on flat-panel antennas. Below is a response from Rick Driscoll, VP Satellite Products & Services.

Most of the press describing use of flat-panel antennas revolves around two-way satellite communications, or VSAT. One reason for this is that generally TVRO services require simultaneous reception of wide bandwidths (typically a GHz or more) and simultaneous dual polarity. This simultaneous reception is difficult to realize in dynamically scanning flat-panel designs.

Kymeta is very interesting technology, and there may be applications that lend themselves to their design approach and constraints. However, we don't feel Kymeta will have universal applicability, particularly in applications with low elevation angles, highly dynamic environments (like maritime) and/or applications where wide bandwidth and simultaneous reception and/or transmission are required. If the "hybrid" approach (mentioned in the article) involves mechanically moving or tilting the flat-panel antenna, then it would defeat much of the purpose of the flat panel.

The biggest difference between flat-panel/phased-array antennas and reflector-based/dome antennas in the maritime market is that flat-panel antennas don't perform as well on a boat that may be pitching, rolling, or cruising in northern latitudes. The reason has more to do with geometry than with the antenna technology itself. With a flat-panel antenna, you will get a weaker signal when the panel isn't

fully perpendicular to the satellite, which can happen quite often at sea depending on boat location and motion.

Having been a pioneer in flat-panel technology when we introduced a phased-array satellite television antenna more than 10 years ago, KVH remains excited about the potential of low-cost, high-performance flat-panel antennas to provide better experiences for our customers in suitable applications. We still make a phased-array satellite television antenna for the automotive market—it's called the TracVision A9. For the maritime market, our engineers have always found that our reflector-based/dome antennas are better suited (TracVision TV-series for satellite television, TracPhone V-IP series for satellite communications) than flat panel as there are many issues created by boats pitching and rolling that make phased-array signals weaker in that application.

With flat-panel antennas, captains and boat owners should be sure they ask about elevation range and how their vessel's location and motion will affect the phased-array antenna's performance, they need to ensure the phased-array antenna will be compatible with the satellite service provider's bandwidth, and they need to really think through the issue of having several phased-array antennas on the boat to do the same work that one dome antenna has proven it can do for years.

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