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## DARPA's giant Legos in space

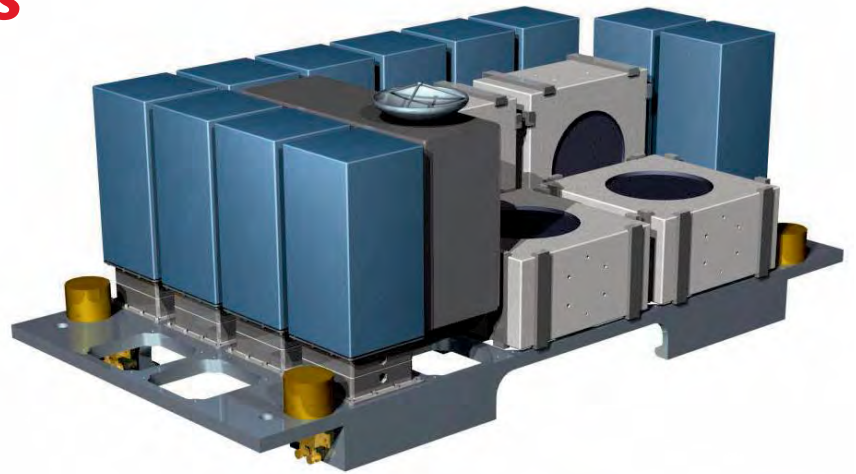
**Launching satellites today** is like reinventing the wheel. In the factory, each set of cameras or communications antennas must be fitted to a satellite bus that provides power and navigation. DARPA has a better idea: Instead of expending mass on a satellite bus for each mission, why not position permanent satellite support platforms in geosynchronous orbit, and then simply send the payloads to them?

This is the concept behind DARPA's Persistent Platform in Geosynchronous Earth Orbit project. The goal is ambitious: create orbital platforms in geosynchronous orbit that could eventually be larger than the International Space Station. Small payloads would be lofted into GEO and then robotically added to the sustaining structure.

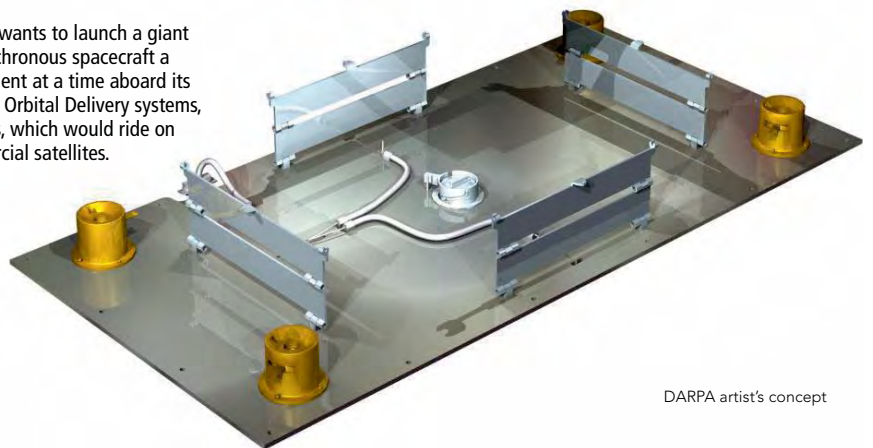
Each of these platforms would be "designed to last decades, perhaps even longer than the ISS. Systems that permit a large number of secondary payloads would ferry these payloads to GEO on a regular basis," says Jeremy Palmer, a program manager in DARPA's Tactical Technology office. "Robotic systems on this platform would have the ability to swap out the new arrivals for the old ones."

The impetus for the project is sheer economics. GEO satellites are elaborate, long-term projects. By the time the payload is inserted into orbit, the electronics might already be obsolete. A platform could include supporting infrastructure, which ages more gracefully, while upgraded payloads and their high-value electronics could be attached as technology improves.

Palmer says construction of small GEO platforms could be accomplished within the next 10 to 15 years, though larger, kilometers-wide structures might take far longer. For now, DARPA's goals are more modest. The industry is competing to be included in the first phase of a Small Business Innovative Research project that could begin in September. DARPA has specified



DARPA wants to launch a giant geosynchronous spacecraft a component at a time aboard its Payload Orbital Delivery systems, or PODs, which would ride on commercial satellites.



DARPA artist's concept

that the individual units comprising the platform must each fit within DARPA's Payload Orbital Delivery launch system, which is scheduled for a test launch in 2017. POD aims to cheaply loft payloads into orbit by piggybacking them aboard commercial satellite launches. However, POD payloads must be only 90 to 130 kilograms and less than a cubic meter in volume.

While the concept of on-orbit assembly isn't new, Palmer sees DARPA as spurring commercial use of GEO by creating what could be described as essentially a satellite office park in space. "The platform operator would be akin to a building manager that is leasing apartment space."

The technology to build a GEO platform is almost ready, Palmer says. There will need to be advances in assembling structures and fabricating structural members in space. Also,

the platform will require cellular components that can be assembled into whatever support nodes, such as communications, are needed.

"Instead of exquisite and unique bus components launched to this platform, imagine instead a collection of Lego bricks," Palmer says.

Commercial firms must also be willing to invest the necessary capital. And therein lies the thorniest problem of a GEO platform: If the platform is international and services everyone's satellites, who owns the platform?

"There are a lot of regulatory and policy issues that have to be addressed with the presence of robotic — especially robotic servicing technology — in GEO," Palmer notes. "The law has to catch up with the technology first."

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