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Virtual Distinguished Lectures During COVID-19

The IEEE Antennas and Propagation Society (AP-S) may be pleased to know that, considering the severe travel restrictions resulting from the COVID-19 pandemic, some AP-S Distinguished Lecturers (DLs) have started giving virtual presentations online, and, in my recent communications, others have been encouraged to do so. The process to request a virtual Distinguished Lecture is the same as that for a standard lecture, and it is described on the DL Program website at https://www.ieeeaps.org/education/distinguished-lecturer-program.

In this column, I take the opportunity to highlight a new Distinguished Lecture that is available starting this year. It is "Recent Developments in Small Satellite Antenna Technology," given by Dr. Richard E. Hodges (Figure 1), Jet Propulsion Laboratory, California Institute of Technology, and available as a virtual Distinguished Lecture. For information about other Distinguished Lectures, please visit the DL Program website.

"RECENT DEVELOPMENTS IN SMALL SATELLITE ANTENNA TECHNOLOGY"

Antennas are one of the key technologies enabling the rapid growth of small satellite (SmallSat) missions. SmallSats are rapidly transforming the space industry by providing new imaging, remote sensing, and science capabilities. SmallSat missions that are being planned will perform remote measurements that previously would have required large, expensive satellites. To make this happen, antenna engineers are developing unique new designs that can accommodate the limited stowage and low mass required by SmallSat launch and operational constraints. The greatest challenges are imposed by high-gain antennas (HGAs) and low-frequency antennas, both of which are physically large and must be stowed for launch and deployed in orbit. HGA designs and deployment mechanisms that have already been developed and demonstrated in space include novel deployable mesh reflectors, flat-folded panel reflectarrays, and membrane antennas. Recent experiments have also been performed with low-frequency antennas in the high-frequency band.

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FIGURE 1. Dr. Richard E. Hodges, AP-S DL, 2020–2022.

This Distinguished Lecture presents an overview of recent developments and future trends in SmallSat antenna technology. Examples of recent HGA technologies, such as novel deployable mesh reflectors and flat-folded panel reflectarrays, are discussed, including lessons learned from flight technology demonstrations. The talk also reviews research-level technologies, with an eye toward risks and the potential for flight implementation. Examples of novel reflector antenna concepts, such as origami-folded (Figure 2), membrane, and inflatable reflector antennas, are described, and

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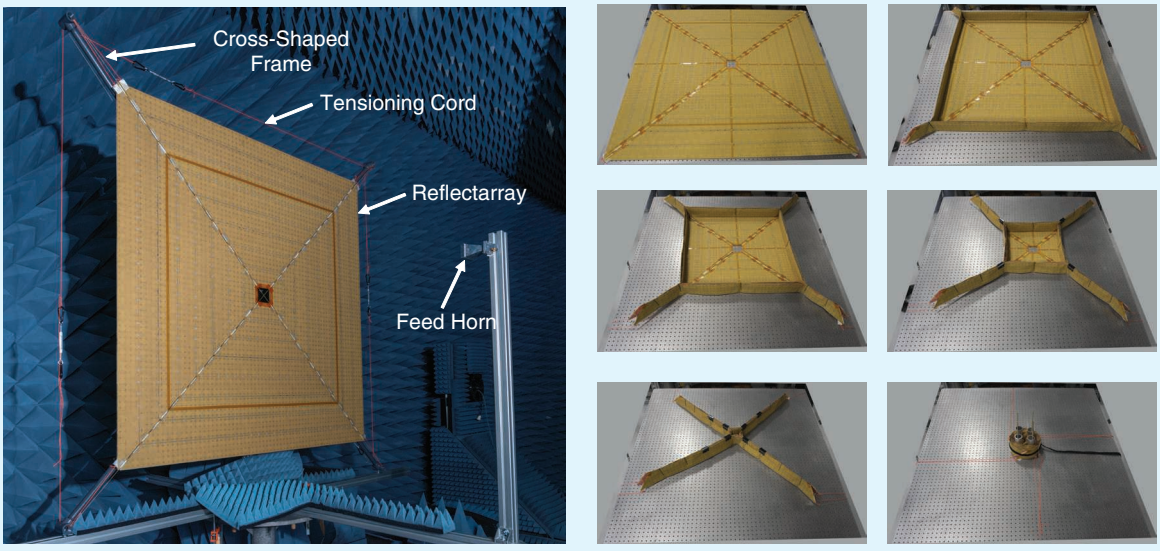

FIGURE 2. Large aperture deployable reflectarray based on origami folding concept. (a) A deployed antenna in near-field range test. (b) The deployment sequence in which the antenna folds and rolls into a cylinder. (Source: NASA.)

the relative advantages, drawbacks, and current technology readiness level of each are presented. Next-generation antenna architectures, including formation-flying distributed aperture antennas, robotic assembly in space, manufacturing, and autonomous assembly in space, are also discussed.