

TechSat 21: Space Missions Using Distributed Satellite Systems

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A new way to perform space missions utilizes the concept of clusters of satellites that operate cooperatively to perform the function of a larger, single satellite. Each smaller satellite communicates with the others and shares the processing, communications, and payload or mission functions. The required functionality is thus spread across the satellites in the cluster, the aggregate forming a "virtual satellite". An important application of these clusters is to synthesize a large aperture. Since the satellites are not connected by structures, they can be separated over very large baselines that could not be considered for monolithic apertures. This system architecture is also appealing for its adaptability. Since neither the geometry of the cluster or the number of satellites in the cluster is fixed, the cluster configuration can be changed to suit a mission need. It is also expected that this concept reduces the cost of space missions through economies of mass production since many smaller satellites are needed, by allowing a tailored and more optimal phased deployment, by permitting multiple missions to be accomplished with the same constellation, and by its unprecedented large effective aperture.

The Air Force Research Laboratory has initiated a program - called TechSat 21 - to explore the basic technologies required to enable distributed satellite systems. Several interesting applications of these concepts are described. The research and technology challenges are also described. These research and technology areas are being studied in a coordinated effort between several directorates within AFRL and the AF Office of Scientific Research. The TechSat 21 program plan is briefly outlined.