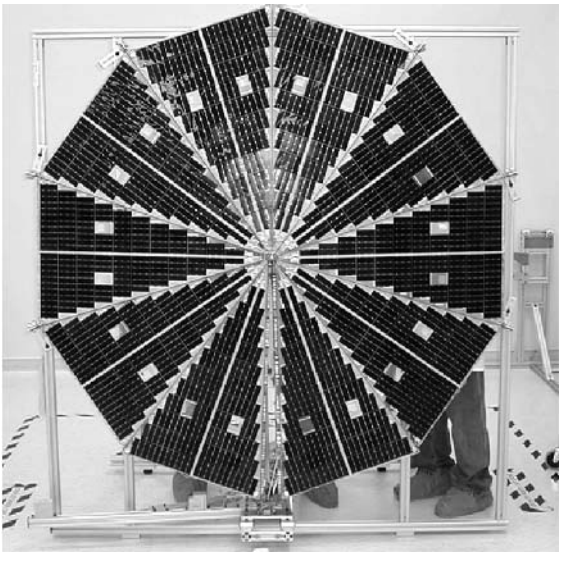

Figure 10.13 Flexible round panel array with circular deployment. (Picture courtesy of AEC-ABLE)

TRW, Inc., developed a flexible flat panel/rectangular array in the late 1980s, known as the Advanced Photovoltaic Solar Array (APSA), under a contract with NASA/JPL [50]. A similar array development was performed with DOD support. These arrays were based on the same fundamental concept of using polyimide panels stretched between lightweight hinges that could be deployed by an extendible mast. Silicon cells with an average AM0 efficiency of 14% were used for the arrays. The structure (mast, release motor, containment box) accounted for ~51% of the array mass with the panel assembly (polyimide substrate, solar cells, cover glass, and interconnect tabs, hinges, wiring harness) making up the balance.

The original APSA design was for 130 W/kg at 5.3 kW BOL in GEO. However, the specific power of this type of array does not scale linearly. The low-power arrays of this design had a specific power on the order of 40 to 60 W/kg. Projected BOL and EOL specific power of the APSA array for both Si and GaAs cells available in the early 1990s are given in Figure 10.14.

The Terra satellite uses an APSA-type array. The specific power of this array is only ~40 W/kg. This was due to the necessity of reinforcing the stowage box because the box could not be stiffened by the spacecraft structure as APSA had assumed. Also, a stronger and heavier substrate than that APSA had assumed would be possible was used. The ISS Array also had a BOL specific energy of 40 W/kg owing to additional maneuverability and safety and reliability requirements put on the arrays [13].

10.5.4 Thin-film or Flexible Roll-out Arrays

The flexible roll-out array is similar to the accordion-folded array mentioned earlier, except the fact that the semiflexible or flexible substrate is rolled onto cylinder for launch.