source of six fuel capsules maintained in a segmented graphite heat-accumulator block. The main body of the sealed generator was a cylindrical magnesium-thorium shell containing six heat-dissipating magnesium fins and 36 threaded holes; 70 pairs of series-connected PbTe 2N/2P thermoelectric couples were assembled in 35 modules of two couples each. Hot-junction temperature was calculated at about 790 K at beginning of life. Some waste heat from the RTG was used to maintain electronic instruments in the satellite at a temperature near 293 K.

SNAP-19. This technology-improvement program built on the SNAP-9A developments. The SNAP-19B power system was designed specifically for NASA's Nimbus weather satellites—a first demonstration of RTG technology aboard NASA spacecraft. Modifications to SNAP-19B were required to power the Pioneer and Viking missions.

Nimbus/SNAP-19. Specifications required 50 W(e) deliverable after one year in orbit. Two SNAP-19B's, with higher fuel loadings than those of SNAP-9A, were used on Nimbus III. To meet safety requirements, the Pu-238 fuel was changed from a metal form to oxide microspheres. Thermoelectric elements were made of cold-pressed and sintered PbTe. Each RTG thermopile consisted of 90 PbTe 3P/2N couples distributed in six modules of three parallel rows of five couples each. Modules were connected in series and enclosed in a magnesium-thorium housing. Hot-junction temperature was 800K. The two RTG's produced 56 W(e) — 49.4 W(e) usable — at launch and 47 W(e) one year later. Unlike the sealed capsules used in SNAP-3B and SNAP-9As, the SNAP-19B fuel capsule was vented into the generator. Possible sources of power degradation were identified as: rate of argon leakage; replacement of argon with helium in fuel decay; oxygen released from the PuO fuel attacking the thermoelectric elements and bonds. Design of subsequent RTGs was changed to reduce these sources of degradation.

Pioneer/Snap-19. Improvements for powering the Jupiter fly-by were made in the 19B converter, heat source, and structural configuration. A TAGS-SnTe/2N* thermocouple was designed with modified electrical circuitry to limit the magnetic field from the RTG to very low levels. Fill gas was a 75:25 helium-argon mixture, with a zirconium getter added to eliminate oxygen in the RTG. End covers were bolted and seam-welded to the cylindrical housing to further reduce gas leakage. Mission requirement called for four RTGs to produce 120 W(e) total at the Jupiter fly-by. Power output at Jupiter encounter was 144 W(e) for Pioneer 10 and 142.6 W(e) for Pioneer 11. Estimated minimum power requirements for a Saturn fly-by were 90 W(e) and the RTG's on Pioneer 11 actually provided 119.3 W(e) at Saturn.

*TAGS: a solid solution of silver antimony telluride in germanium telluride.