New European Apogee Motor - Advanced Propulsion Technology

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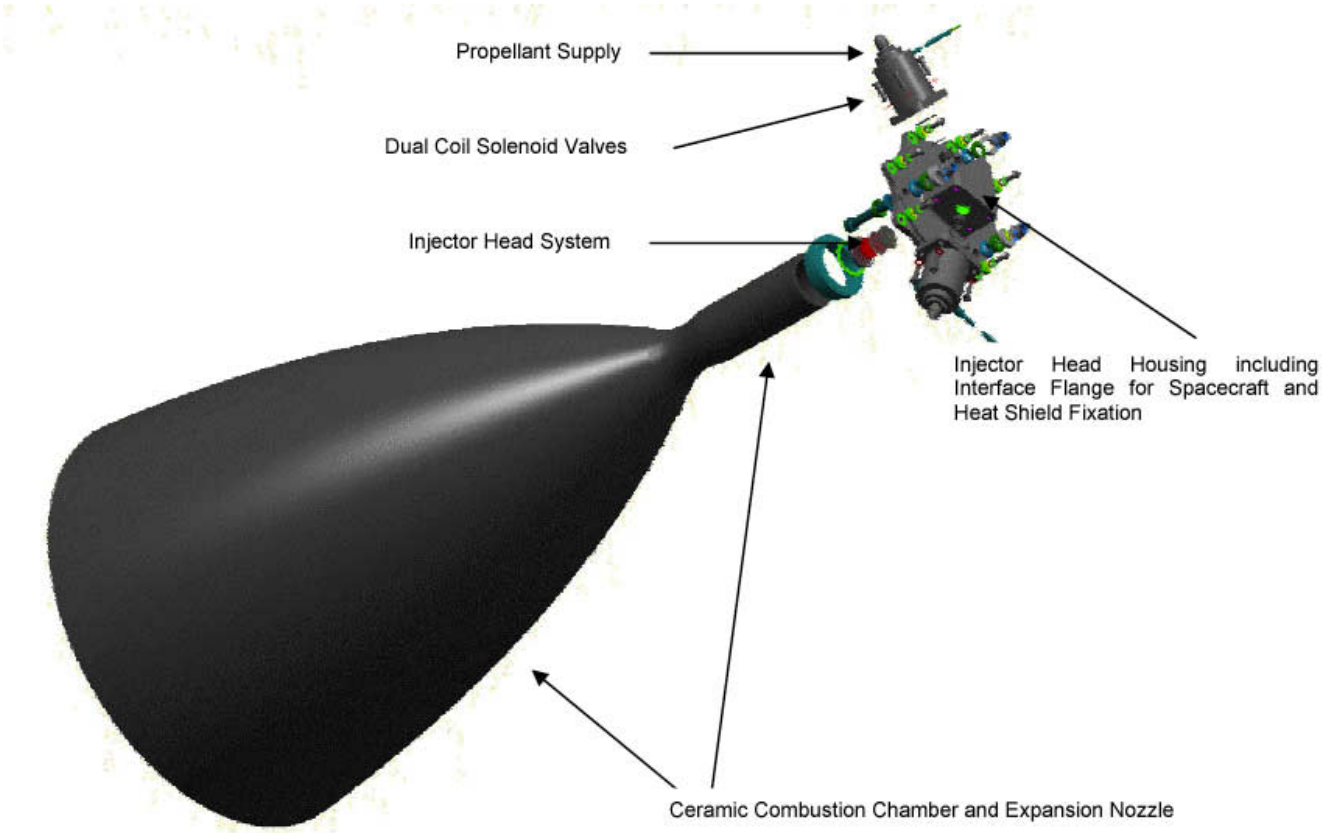
Apogee motors will transfer large geostationary satellites into their final orbit, still within the next decade. 60% of a GEO satellite mass are propellants and 90% of these propellants are consumed by the apogee motor. An increase of motor performance and motor efficiency offers significant mass savings for the satellites. Therefore, an optimum performing apogee motor is still an element of strategic importance for the competitiveness of a large geostationary satellite.

The need for developing a new High Performance Bi-propellant Apogee Motor is driven by the customers' requirements and the demand for higher performance, lower prices, not restricted to the US export licenses and high reliability. The dominating features for the new development are therefore performance, price, non-itar components and reliability. The benefit for the customers will be in the strategic field (independency for Europe) and in the commercial field (mass gain and therefore more payload and competitive price on the world market).



Exploded View of EADS-ST's 500N EAM

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Two essential elements for a high performance motor are the core objective of the work: injector technology and combustion chamber technology. Both components will use the most advanced materials, processes and techniques.

The injector system is the heart of the motor providing the propellants mixed to achieve highest performance. Ignition is obtained by hypergolic reaction of the atomized propellants. The atomization is achieved through a Micro-Showerhead type injector delivering the appropriate droplet size for effective and stable combustion over the large EAM operation box.

The development objectives for the combustion chamber are low specific weight, high specific strength over a large temperature range, low CTE, a good chemical and erosion resistance with hypergolic propellants for an attractive price. The answer to these requests is the application of a ceramic material. Using the fiber-reinforced C/SiC for the combustion chamber an all-in-one chamber and nozzle configuration is feasible to produce the unit without any weld seams. The corresponding manufacturing technologies have to be established to respect the various diameters from chamber, throat to the wide geometry of the nozzle extension by filament winding process. A sophisticated technology is used to combine the ceramic chamber material to the metallic injector head system. This interface technology has to be compatible with the specified vibration loads and thermal conditions during motor life. The combustion chamber must provide sufficient compatibility with respect to the propellants (MMH / N_2O_4) and their derivates, long-term use and tightness and permeability. A high performance coating system is under development to satisfy the complex technical requirements and to respect commercial constraints. Specific Non-Destructive Inspection methods (NDI) have to be developed for C/SiC materials to verify and to validate the manufactured combustion chamber and nozzle expansion.

These specific motor characteristics will make the EAM a highly competitive apogee engine which is very attractive to customers of satellite industry throughout the world.