



Working Principle of Cryogenic Engine for Space Travel

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DESCRIPTION

Cryogenic Technology which mainly operates with temperatures below -150°C is the main working principle behind the cryogenic engines. When elements cooled at these temperatures they change their properties. Same is the case with one used in rocket engines when oxygen is cooled below -183° centigrade it modifications its state to liquid & its properties, similarly when hydrogen is cooled below -253° centigrade. During these temperatures while these liquid are clashed against in a controlled condition in a combustion chamber it gives a big accept which has a specific impulse of near about 450. No other engine can. Generate this amount of energy in negligible about of fuel. Since its invention in USA is utilized in all space mission through every country because of its reliability. Cooling used for trust chamber during combustion is likewise provided by liquid fuel which saves a lot of energy used for cooling.

This Rocket Technology has an excellent History regarding many large countries including USA, Russia, Japan, France etc. A close competition was lead in later half of twentieth Century for this technology since its invention by USA. When USA successfully launched its 1st Atlas V rocket in 1963 boosted up the cold war among Russia and USA which performed a great role in rapid development in this technology in such less period of time. Indian Space Research Organisation was also trying its hand on this technology in 20th Century. ISRO's then Chairman U.R.Rao in 1993 introduced that its cryogenic engine will have a launch in just 4 years. But it took more than 20 years to Ignite its cryogenic engine so we joined the competition lately in 21st century because of its frequent failure and no technological support from other developed countries.

But now ISRO is operating good with successful launch of Mangalyaan in its first attempt, being the first country of this kind. In this setup a rapid pump is used to provide a high velocity to the fines droplets of fuel in combustion chamber. A gas generator is used to drive the turbo pump. Gas generator uses the energy from fuel to generate energy for turbo pump. The gas generator is used in order to drive the turbo by a gas flow. The gas generated produces this energy by pre burning some amount of liquid fuel. Use of Gas generator aligned with Turbo pump increases the efficiency of this engine to a great Extent. The working of this engine is very easy to understand as it does not contain any complex cycles or any reciprocating mechanism. The fuel from tanks is firstly passed through the turbo pumps which rotates at a speed of approximately 14000 rpm through which the mass flow rate of fuel increases to about 2.4 tons before attaining the combustion chamber.

CONCLUSION

Injector performs the most crucial role in the rocket engine it is like heart of the engine that pumps out the appropriate amount of fuel from the turbo pump to the combustion chamber as per requirement. Injector ensures the stability of the combustion chamber therefore deigning of injector is the most challenging part of the designs department of cryogenic engine even today. The frequency of the combustion chamber is to be maintained between 100-500 cycles per second. If this rate is affected even slightly shifted above or below leads to the failure of engine which has been seen in tragedy of 'Discovery Spacecraft'. But if injector is so designed so as to increase the specific impulse more than 700 space crafts can travel much long distances in the universe.

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