

## Multiple Satellites Launching by Single Launch Vehicle

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**Abstract**—Now a days satellite launching is unchallenged in the space technology. There are two ways of the launching satellites in space which are single satellite launch and multiple satellites launch. This paper is discussing about the multiple satellite launching. The subject is introduced by the discussion of launching the multiple satellites by single launch vehicle. Twin launch adapters, Multi launch adapter, Space shuttle adapter are the simple and inexpensive launching technique. The main purpose of the paper is to present easy ways of multiple satellite launching. These simple techniques of the launching approach make it appropriate for practical settings of the wide range of launch system.

**Keywords**—Launch vehicle, Satellite, Fuel, Launch adapter, Propellant, Thruster, Boosters.

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### I. INTRODUCTION

In day to day life the technologies are getting modified. As the days are passed the competition gets increasing. This can be also happened in the satellite technology also. The satellite is a synthetic object that has been advisedly placed into orbit. Two types of the satellite launching vehicles are

1. Expandable vehicle
2. Re-usable vehicle

Expandable vehicles are those that can not use more than one time. They're destroyed within the house when inserting the satellites in orbit. Araine and delta square measure are expandable sort of launch vehicles.

Re-usable vehicles are those that can use more than one time. They come back to the world after the placing the satellite in orbit. The samples of the reusable are PSLV and GSLV.

Most of the days multiple satellites launch are controlled by the expandable vehicles. The expandable launch system is developed and operated by the Indian Space & Research Organization (ISRO). It was developed to permit Asian country to launch its Indian Remote Sensing (IRS) satellites into Sun-Synchronous orbits, a service that was, till the arrival of the PSLV.

### II. LITERATURE SURVEY

[4] “Applying Railgun Technology to small Satellite launch” by “S. Hundertmark” in French-German Research Institute of Saint-Louis (ISL) in 2012

The acceleration of a traditional rocket results from the burning of the fuel. Because the rocket carries the specified fuel, the acceleration to the specified rate may be stretched over the complete flight path. So the ensuing acceleration values area unit comparatively modest and also the rate builds up step by step. The biggest a part of a rocket is that the instrumentality for the propellant, leading to a payload to total mass magnitude relation of a p.c. to a couple of p.c.

[5] “On Application of Q-guidance Method for Satellite Launch Systems” by “AidinMohammadi, JafarRoshanian, Mohsen Bahrami, BehrouzEbrahimi” in 2010

In this paper a 3-stage launch vehicle in tabular motion is used. The goal is to launch the payload to a circular orbit with associate degree altitude of five hundred kilometer.

[8] “COSMOS – An Innovation Nodal Architecture for Controlling Large Numbers of Small Satellites and other Diverse Assets” by Trevor Sorensen, Eric Pilger, Miguel NunesInterstel Technologies, USA

In this paper obsessive MOST Engine is used that accepts and processes the mensuration from the node and makes the information offered to any tools operational among COSMOS. Some process is finished domestically at the foremost UI for potency.

### III.DESIGN

The launching vehicle has four stages of satellite launching. The solid rocket boosters, carries 138 tonnes of hydroxylterminatedpolybutadienebound (HTPB) propellant and develops a most thrust of regarding 4800 kN. The 2.8-m diameter motor case is created of managing steel associated has an empty mass of thirty,200kg. Pitch and yaw management throughout 1st stage flight is given by the Secondary Injection Thrust Vector system (SITVC), that injects associate solution of metal salt into the nozzle to provide uneven thrust. It is stored in twocylindricalaluminum tanks strapped to the solid rocket motor and controlled with chemical element. Roll management is provided by two little liquid engines on opposite sides of the stages, the roll management thrusters(RCT).

The acceleration of a traditional rocket results from the burning of the fuel. Because the rocket carries the desired fuel, the acceleration to the desired speed is stretched over the complete flight path. Therefore the ensuing acceleration values square measure comparatively modest and therefore the speed builds up step by step. The most important a part of a rocket is that the instrumentation for the propellant, leading to a payload to total mass magnitude relation of a p.c. to many p.c.

The purpose of this study is to implement and analyze topre-develop. To accomplish that, it's necessary to possess a particular check downside. Here a 3-stage launch vehicle in flattened motion is assumed. The goal is to launch the payload to a circular orbit with associate altitude of five hundred kilometer.

MOST really consists of two package programs, the foremost Engine and therefore the MOST computer program (UI). Formultiple artificial satellites, each is assigned a passionate MOST Engine that accepts and processes the measurement from the node and makes the information obtainable to any tools operative inside COSMOS. Some process is completed domestically at the foremost UI for potency.

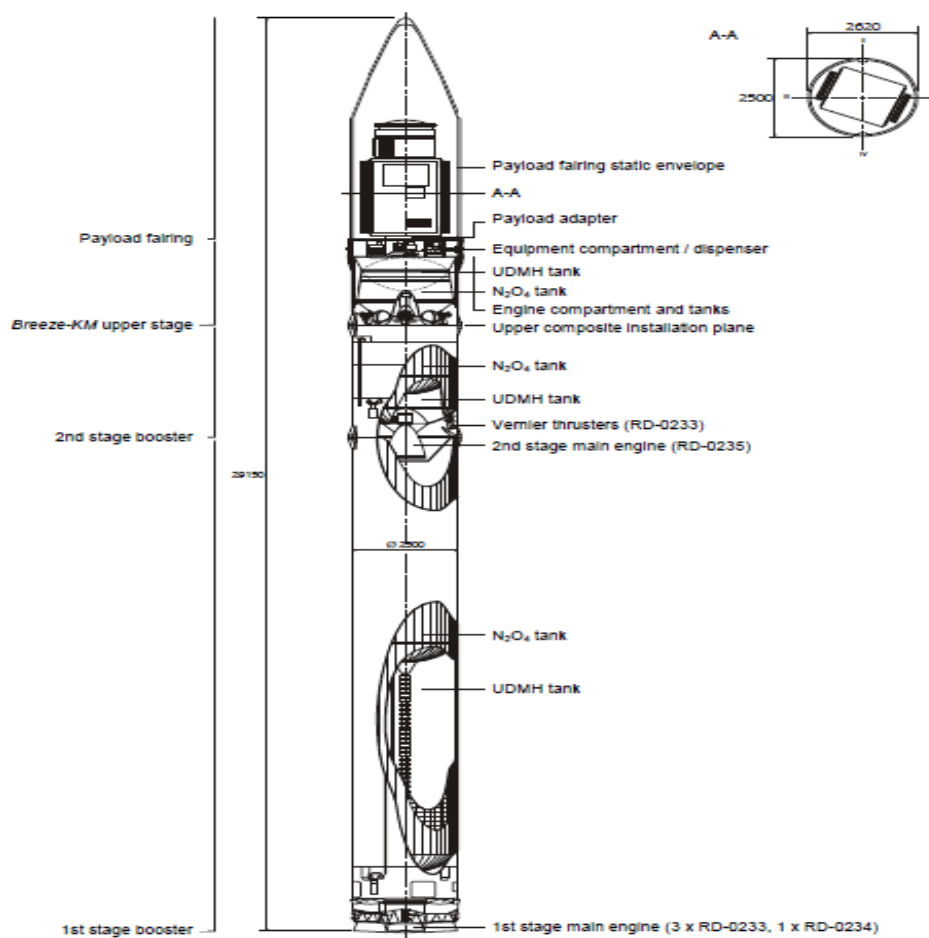


Fig 1. Launch vehicle configuration

#### IV. STAGES OF SATELLITE LAUNCHING

##### A. First Stage

The primary stage of the satellite launching by the distended system is that the Ground LIT STRAPON separation. During this the four booster's area unit separates. That area unit gift with the launched vehicles. Out of the four boosters ground-lit and therefore the remaining to ignite twenty five seconds once the launch. All of them carry the nine tones of propellant and produces 510 kN thrust. It will carry additionally the larger boosters that carry twelve tones of propellant and manufacture 719 kN thrust. Two strap-on boosters area unit equipped with SITVC for added angle management. The components that area unit separated its external diameter is of two.5 meters and a length of seventeen meters. The most body contains N2O4 and UDMH tanks separated by the common partition. Tank pressurization is achieved by suggests that of the new installation.

Main engines 3 x RD-0233, 1 x RD-0234	
Propellant	N2O4 / UDMH
Sea level thrust	1870 kN (each engine 470 kN)
Vacuum thrust	2070 kN (each engine 520 kN)
Sea level specific impulse	285 s
Vacuum specific impulse	310 s
Burn time	121 s

Table 1.Specification of first stage

##### B. Second Stage

The second stage is separated by the system is AIR LIT separation. It carries the 41.5 tonnes of liquid propellant unsymmetrical dimethylhydrazine(UDMH) as fuel and N tetroxide(N2O4) as oxidiser. It generates the almost thrust of the 800 kN. The engine is hydrolically supported to supply the pitch and yaw management, whereas roll management is provided by two hot gas reaction management motors. It's external diameter is of 2.5 meters and length of 3.9 meters. It contains a closed cycle turbopump-fed, fix main engine selected RD-0235 and vernier thrusters selected RD-0236 for directional management. The four vernier thrusters have individual combustion chambers that area unit fed from one turbopump. Every thruster will generate around one axis. The separation of the primary and second stage is perform with the vernier engines kindled simply before the separation, The exhaust gases area unit satisfied by special hatches with within the 1st stage is declawed by retro rockets before the second stage main engine kindled just like the 1st stage it contains the common bulk head and hot gas pressurization system.

Vernier thrusters RD-0236 (One turbopump and four thrusters)	
Fuel	N2O4 / UDMH
Vacuum thrust in total	15.76 kN
Vacuum specific impulse	293 s
Burn time	200 s

Main engine RD-0235	
Propellant	N2O4 / UDMH
Vacuum thrust	240 kN
Vacuum specific impulse	320 s
Burn time	183 s

Table 2..Specification of second stage

##### C.Third Stage

The third stage uses 7 tonnes of HTPB-based solid propellant and produces a most thrust of 240 kN.It's a Kevlar-polyamide fibre case and a submerged nozzle equipped with a flex-bearing- seal supported nozzle thrust vector engine for pitch and yaw management. Roll management is provided by the fourth stage Reaction Management System (RCS).

##### D. Fourth Stage

The fourth stage is battery-powered by twin engines burning monomethylhydrazine (MMH) and mixed oxides of nitrogen(MON).Each engine generates 7.4 kN thrust and is supported to produce pitch, yaw and roll management throughout battery-powered flight. Coast section may be management is provided by RCS. This stage carries a pair of,500 metric weight unit of propellant.

#### V. WORKING

Once the satellite is placed within the parking space(i.e. selected orbit), following activities should to be perform as a part of maintenance. A satellite sits on a launch adapter within a rocket, from that it's ejected within the final section of launch. Typically it's round shape structure wherever bottom attach to rocket and prime attaches to the satellite. The other ways to launch multiple satellites are as follows.

##### A. Twin Launch Adapters

To launch multiple satellites, special launch adapter is used that have numerous shapes. ISRO includes a twin launch adapter wherever one satellite sits insides and one sit on prime. ESA has the twin launch adapter.

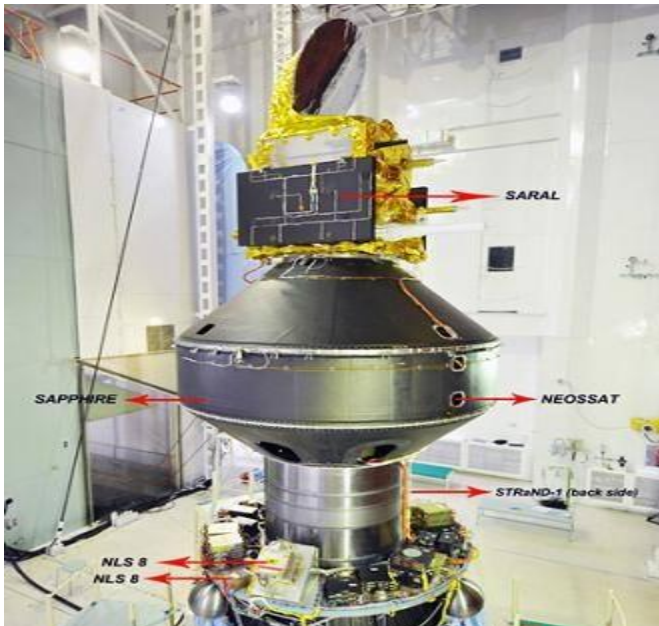


Fig 2. Twin launch adapters

### B. Multi Launch Adapter

ESA's EPSA module converts one launch adapter into multiple launch adapter wherever smaller satellites are hooked up to the facet. Many such adapters and modules are utilized by completely different agencies to launch multiple satellites. ISRO has launched up to ten satellites in one launch victimization similar modules.

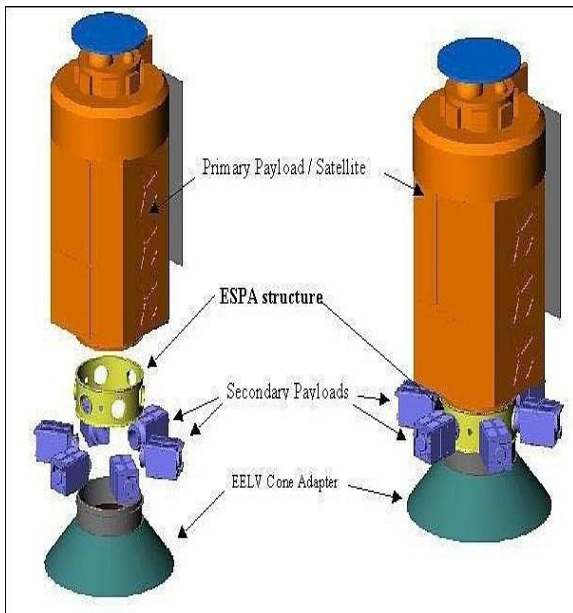


Fig 3. Multi Launch Adapter

### C. Space Shuttle

If rocket like ballistic capsule is used with sufficient area within the orbiters stock bay, it is able to simply match multiple satellites according to the needs. satellites area unit ejected at completely different instants thus on keep afar from one another. Eg.in a

very twin launch adapter(DLA), the highest satellite ejects initial, then half the DLA separates, then the second satellite ejects.

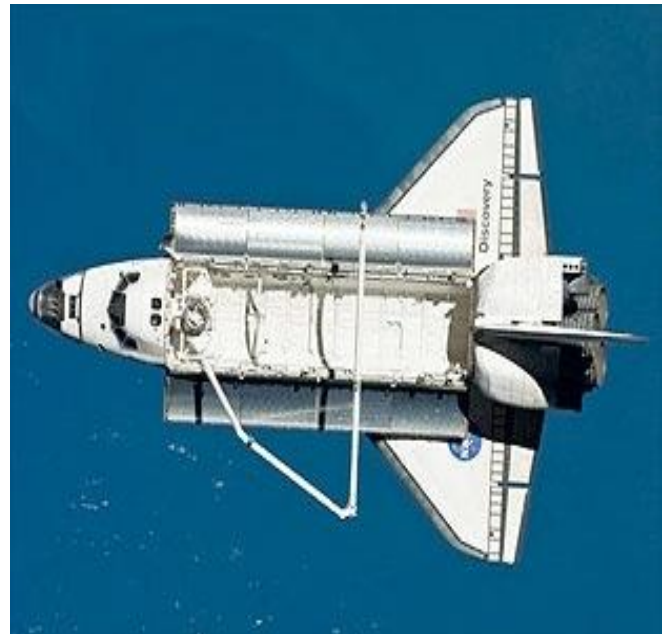


Fig 4. Space Shuttle

Some of these separations are routine in nature whereas some are scheduled as and when required.

## VI. CONCLUSION

Multiple satellites launch by single vehicle is a gorgeous compliment to this rocket launch system. Twin launch adapter, multi launch adapter, space shuttle techniques will offer the reassurance for correct launching of multiple satellites with reduced launching prices. These techniques are the straight forward and obvious samples of sensible feeding systems. Further, such a techniques offers the chance for every of these countries that are tried to perform sensible in space researches.

## VII. FUTURE SCOPE

1. Limits for satellites launching may be extended by single satellite with correct operation.
2. If some part of the satellite after launching is failed then it may be repaired.

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