Propulsion System.

%
- 1st Stage — SRM → Isp. ☑
- 2nd Stage — LRM → Just modification of propulsion project.
  ↳ Isp.

Step 1 → we should know the total ΔV required to reach
pay load — 50 kg max

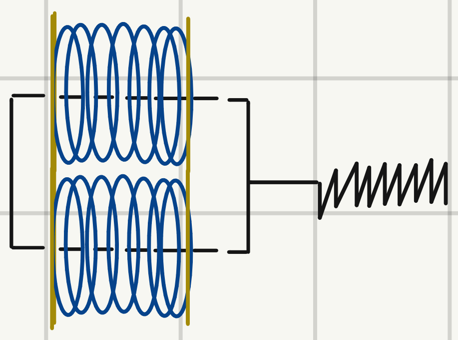
→ we should know the 2nd Stage perfect altitude. → $\boxed{?}$

CEA

→ 1st Stage

- oxidizer — Ammonium Nitrate. NH_4NO_3 ↳ less performing → it's hydroscopicity → keeps attracting water. → which makes it difficult to handle.
  - hydroscopicity → Problem during Storage
- Binder — HTPB. → this is the only composition that we know how to use.
- fuel — Aluminum. → nano sized
  ↳ for better Combustion.

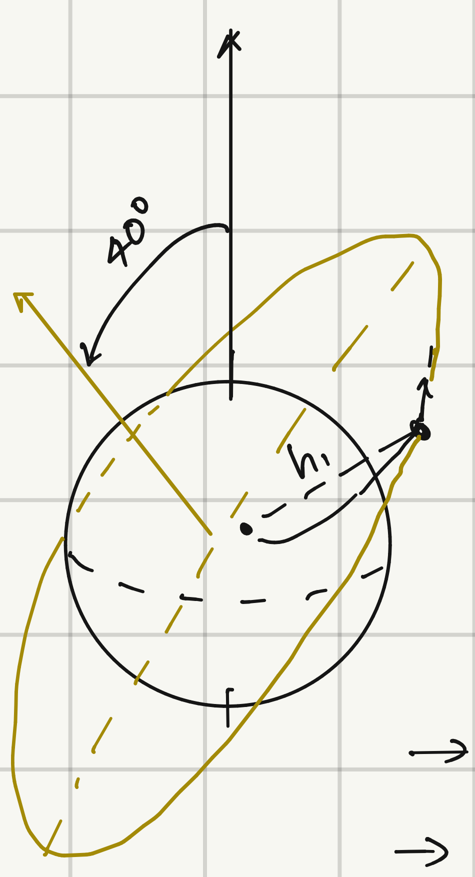
→ Potassium Nitrate → ⓧ not selected. it cheap → but very less performing.
during Combustion → it contains metal particals of Potassium.
↳ unefficient combustion.



from CEA → from the existing model → vega → Rocket mode

↳ Isp ≈ 120.061 sec.
C.C pressure = 70 bar.
} the max that we have obtained.

$C^* = 1788.63$ m/s



for the Stage - 2 → All are Hypergolic.

3 - diff fuel/oxid mixture ?

→ 1. fuel $C_2H_5OH(l)$ 100%; oxidizer $H_2O_2(l)$ 100%

→ 2. fuel $C_2H_8N_2(l)$ - UMHD 50%; $N_2H_4(l)$ 50%, oxidizer $N_2O_4(l)$ 100%

→ 3. fuel: $C_2H_8N_2(l)$ - UMHD 50% & $N_2H_4(l)$ 50%; oxidizer $N_2O_4(l)$ 97% & NO 3%.

Mixture	Corrosivity	C^*
1	No	Unknown
2	yes	Unknown
3	No	Tabulated.

Performace is dependent on the propellent choise.

Hypergolic → redue overall complexity.
lower mass for S/C.

from CEA

↳ Isp ≈ 315.25 sec.
C.C pressure = 15 bar.
$C^* = 1679.48$ m/s

the max that we have obtained.

there is no mager cheng in the values for 16.5 – 20 bar

O/f ratio → 2 → [1, 1.5, 2, 2.5 .... 5.5]
was the best out of

Trial - 1

	LH_2	LO_2
B.P →	−253°C	−183°C
f.P →	−259°C	−219

7/11/2020.

Final Results → for Propullsion.

for LRM.

Option - 1

→ fuel → C_2H_5OH (L) → 1   O/F = 3

Oxidizer → H_2O_2 (L) → 0.85

H_2O (L) → 0.15

P_c = 90 bar

many consider for outside atm. $A_e/A_t \geq 45$

A_e/A_t → Area →	15	25	45
(Bar) Pe →	0.66061	0.337 - 0.334	0.15628
(Sec) Isp	275.93	287.14	310.73	→ Equilibrium
(Sec) Isp	275.93	287.23	310.6	→ frozen

↓ Sea leve (15, 25)   ↓ Vaccum. (45)

Option-2

→ fuel → H_2 (L) → 1.   O/F = 5.552

Oxidizer → O_2 (L) → 1.

P_c = 120 bar

many consider for outside atm $A_e/A_t \geq 75$

A_e/A_t → Area →	25	75	
(Bar) Pe →	0.45375 - 0.41329	0.10515 - 0.09411	
(Sec) Isp	421.44	464.84	→ Equilibrium
(Sec) Isp	414.465	453.84	→ frozen

↓ Sea Level. (25)   ↓ Vaccum. (75)

→ L^* is still unknow. → ?

for SRM

			wt
Oxidiser	—	NH_4NO_3 (IV)	— 68
fuel	—	Al (cr)	— 18
Binder	—	HTPB	— 14

T = 300K

↳ C_4H_6

↳ h = - 51.8 KJ/mol.

$P_c = 70\,bar$

A_e/A_t →	10	15	20	25
P_e (bar) →	0.899	0.522	0.357	0.2666
I_{sp} (sec) →	250.3	260.153	266.3	285.08
	Sea level			Vaccum.