

The background is a deep blue gradient with a subtle pattern of white stars. Overlaid on the left side are several white geometric and celestial diagrams. These include concentric circles, arcs, and dashed lines, some with arrows indicating direction. A prominent circular scale with degree markings from 140 to 260 is visible. Other smaller circular elements with arrows are scattered across the left half of the image.

SPACE MISSION

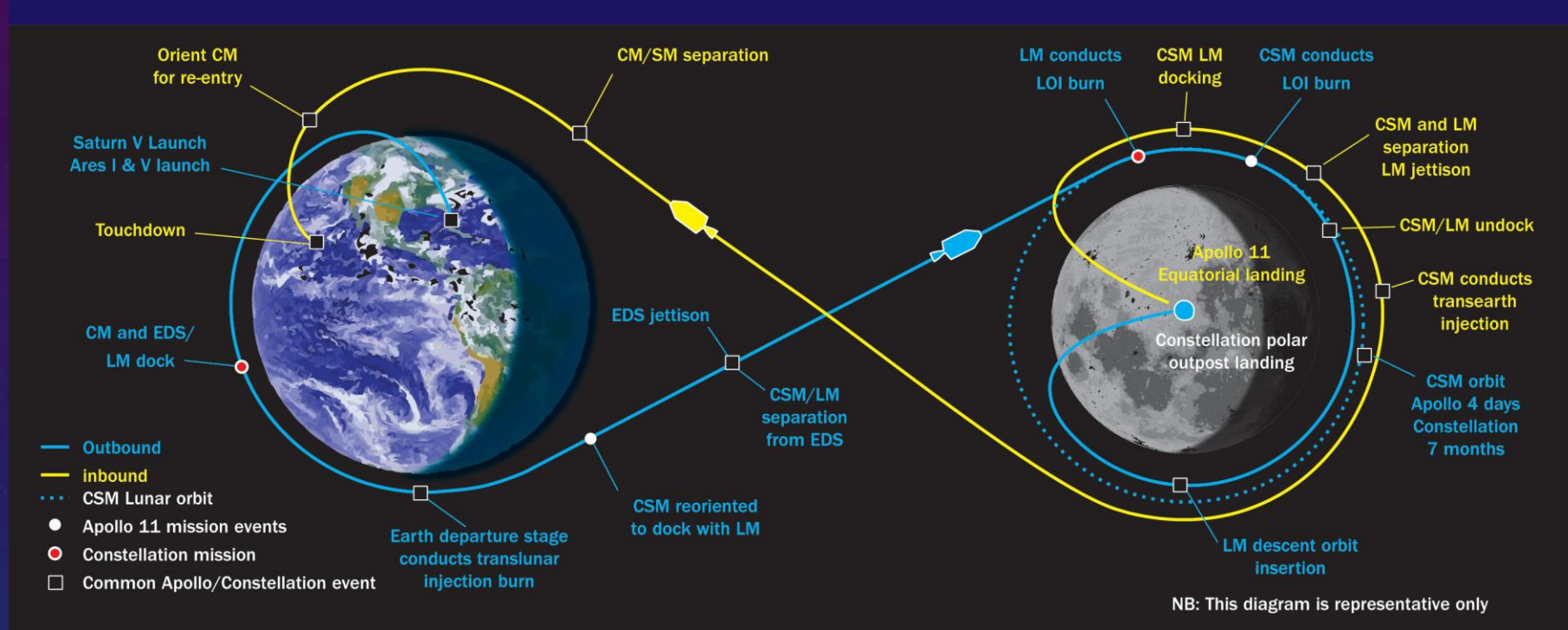
B06901118李高迪

B06901163許庭肇

B07901133顏子鈞

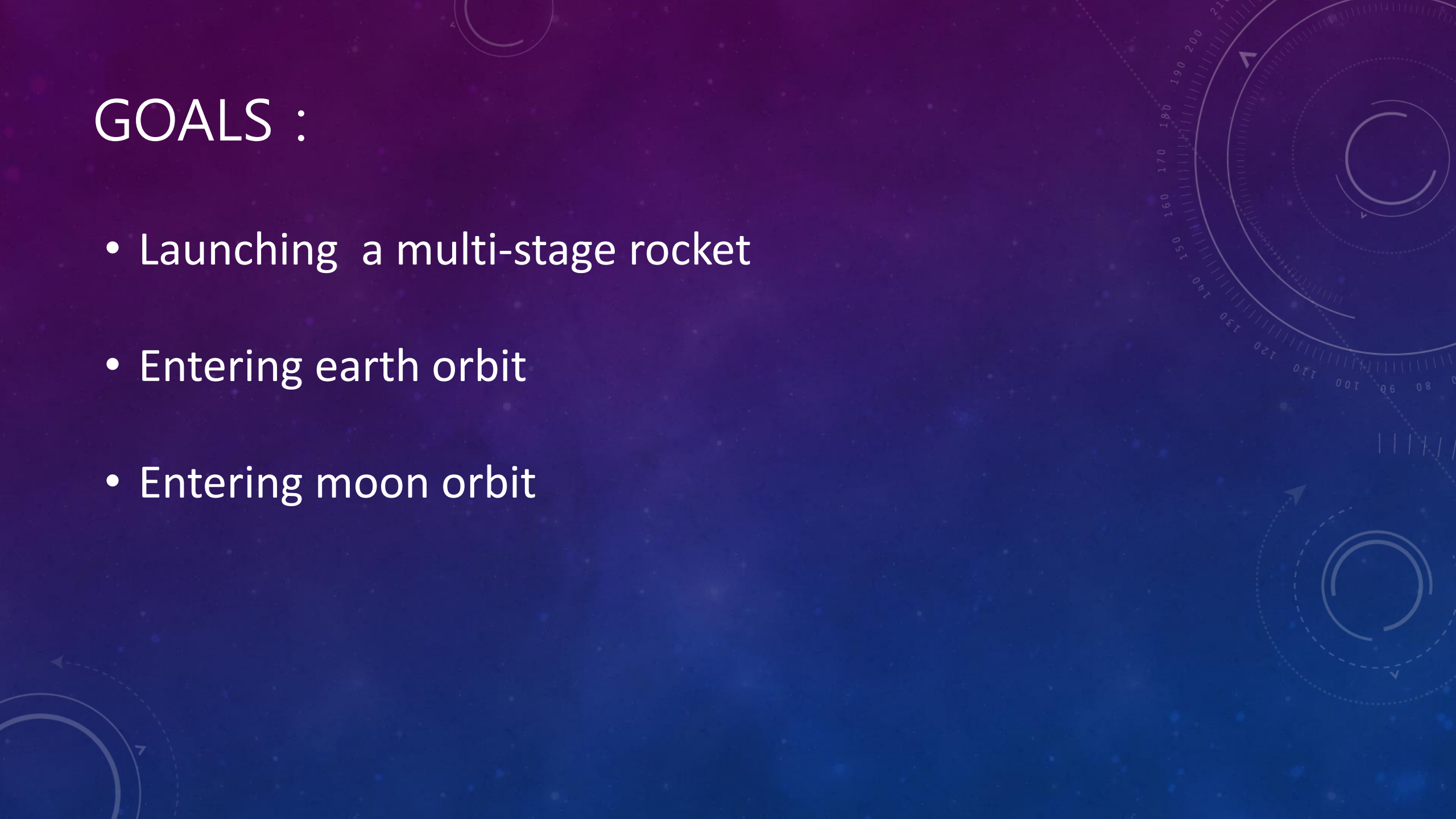
Apollo mission

SIGNIFICANT EVENTS OF THE APOLLO 11 AND PROPOSED CONSTELLATION MISSION



GOALS :

- Launching a multi-stage rocket
- Entering earth orbit
- Entering moon orbit

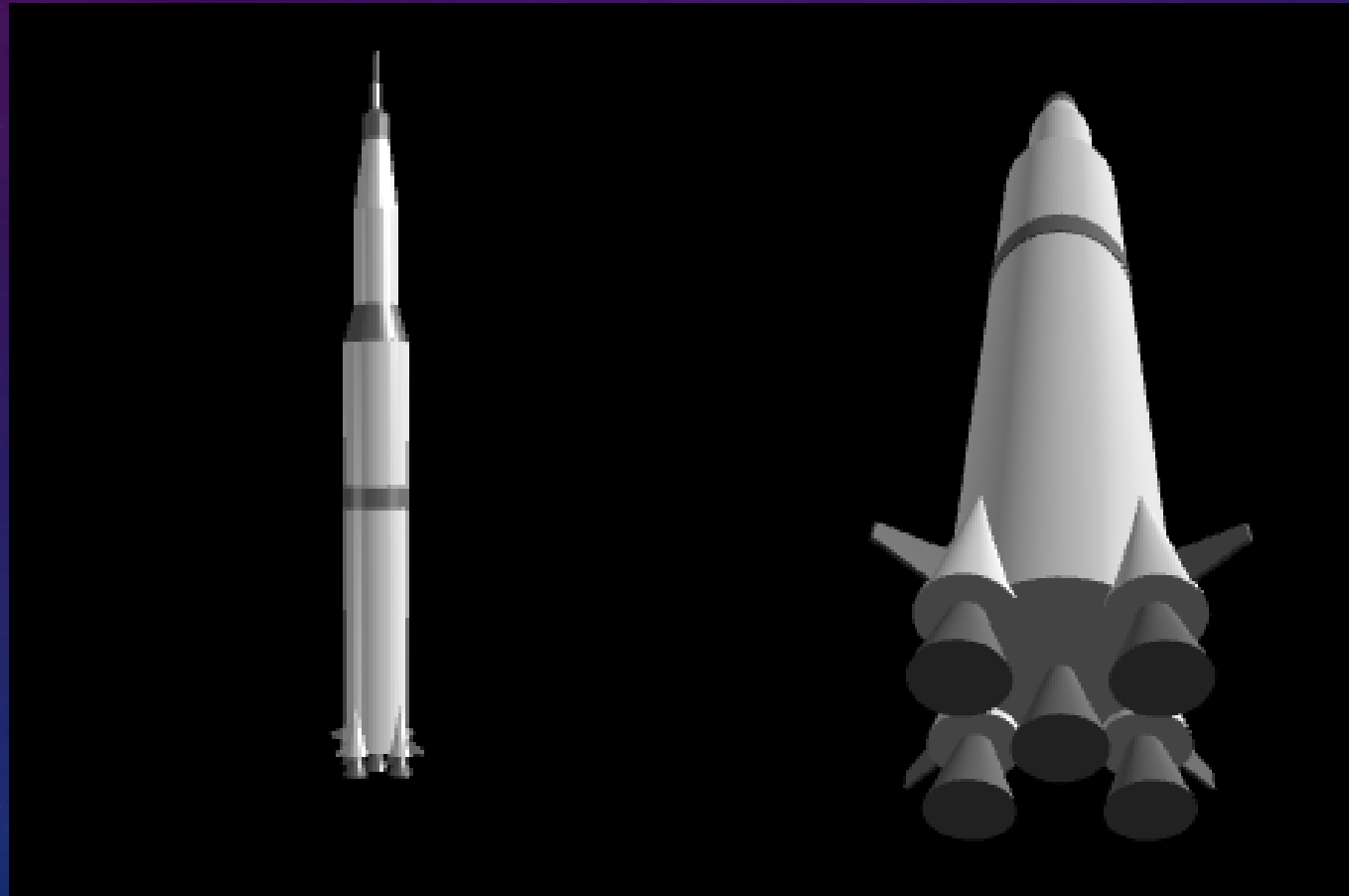


SATURN V



HOW WE BUILT

Compound 18 cones, 5 cylinders, 12 boxes and 3 extrusions.



THRUST

Rocket Thrust Equation

Glenn
Research
Center

The diagram illustrates a rocket engine. On the left, a dashed box represents the **Rocket Body**, containing **Fuel** and **Oxidizer** lines. These feed into a **Nozzle** on the right. The nozzle is shown as a dark, conical shape. From the nozzle's exit, exhaust is shown as blue lines with arrows pointing away. Four red arrows point from the nozzle exit to the following labels: \dot{m} (mass flow rate), V_e (exhaust velocity), p_e (exhaust pressure), and A_e (exhaust area). To the right of these arrows, the ambient pressure p_o is indicated. The word **Exhaust** is written in blue at the bottom right of the exhaust plume.

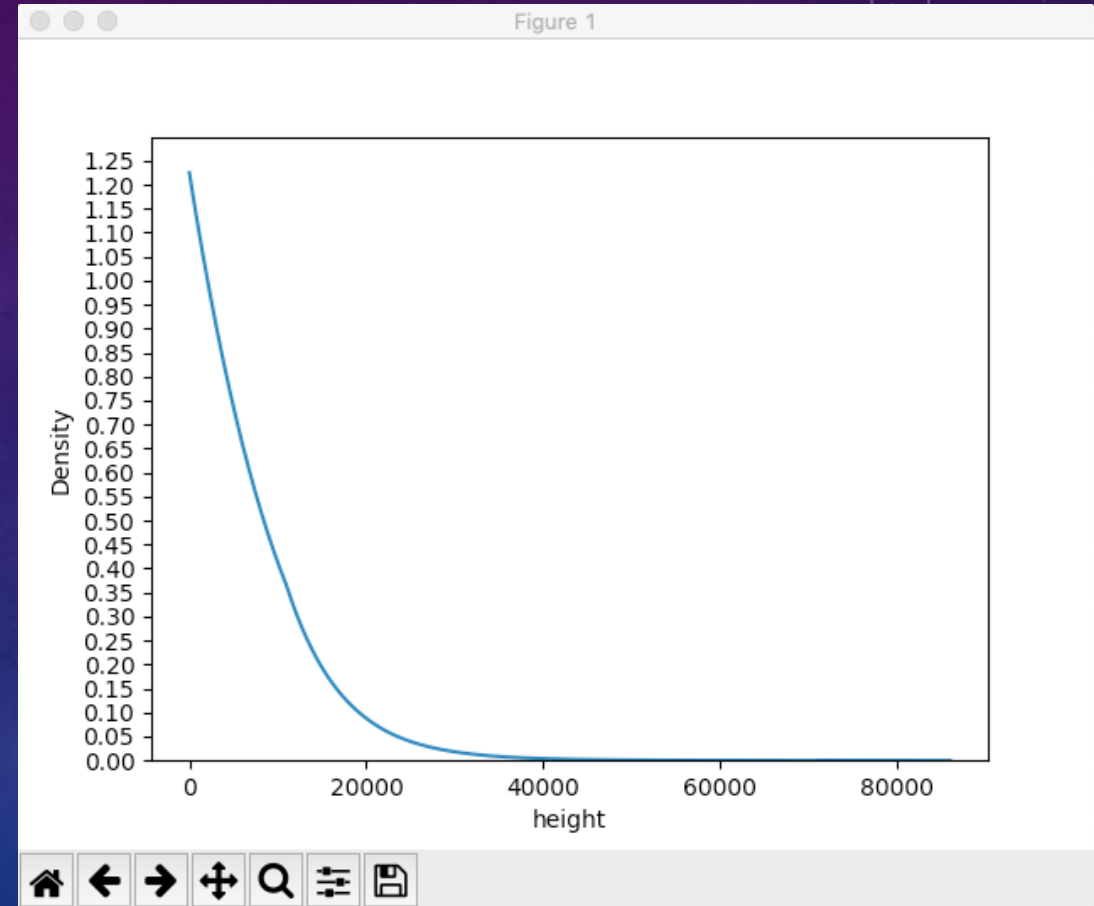
\dot{m} = mass flow rate
 p = pressure
 V = Velocity
 A = Area

Thrust = $F = \dot{m} V_e + (p_e - p_o) A_e$

DENSITY OF AIR

$$\rho = \rho_b \cdot \left[\frac{T_b}{T_b + L_b \cdot (h - h_b)} \right]^{1 + \frac{g_0 \cdot M}{R^* \cdot L_b}}$$

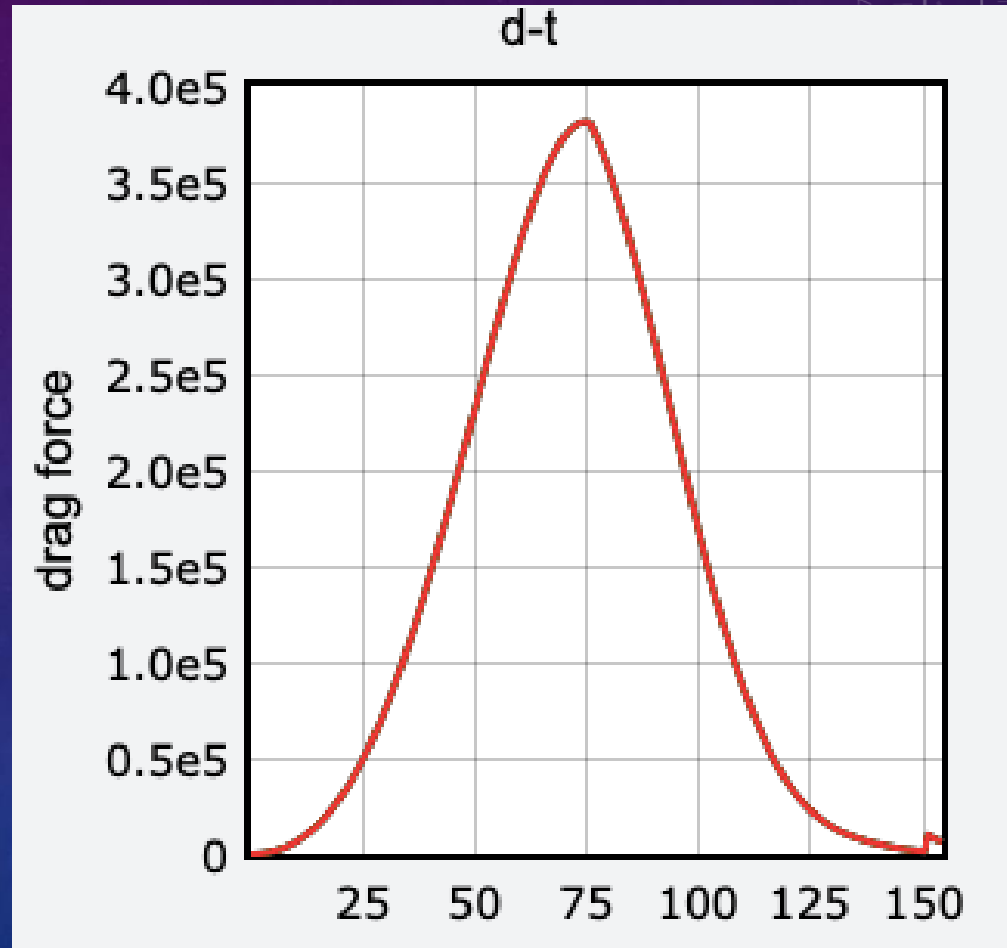
$$\rho = \rho_b \cdot \exp \left[\frac{-g_0 \cdot M \cdot (h - h_b)}{R^* \cdot T_b} \right]$$



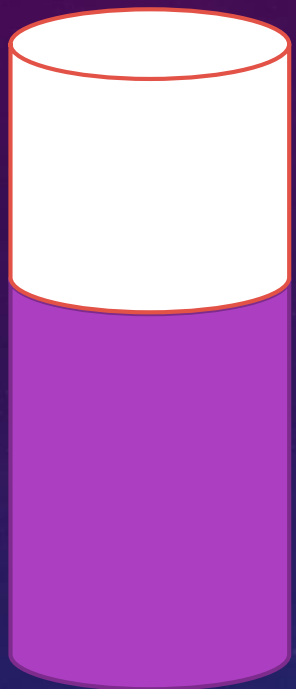
DRAG FORCE

$$F_D = \frac{1}{2} \rho v^2 C_D A$$

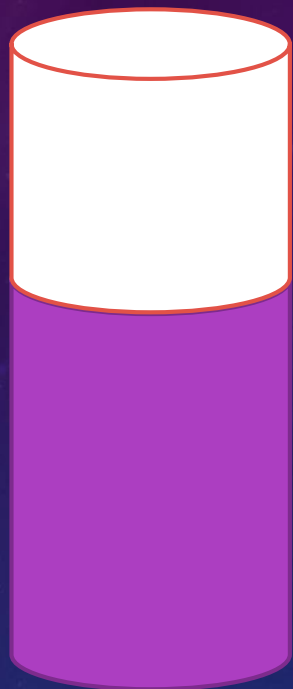
$$C_D = 0.2$$



MULTI-STAGE PROCESSING



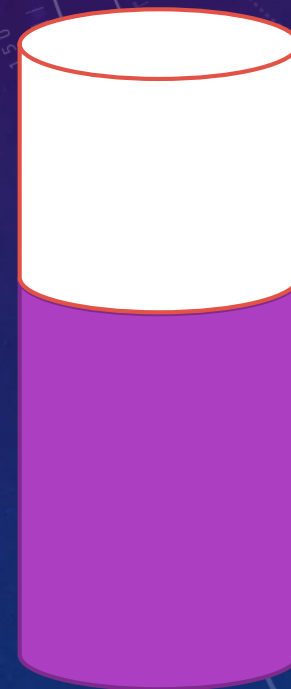
Invisible



visible



visible



invisible

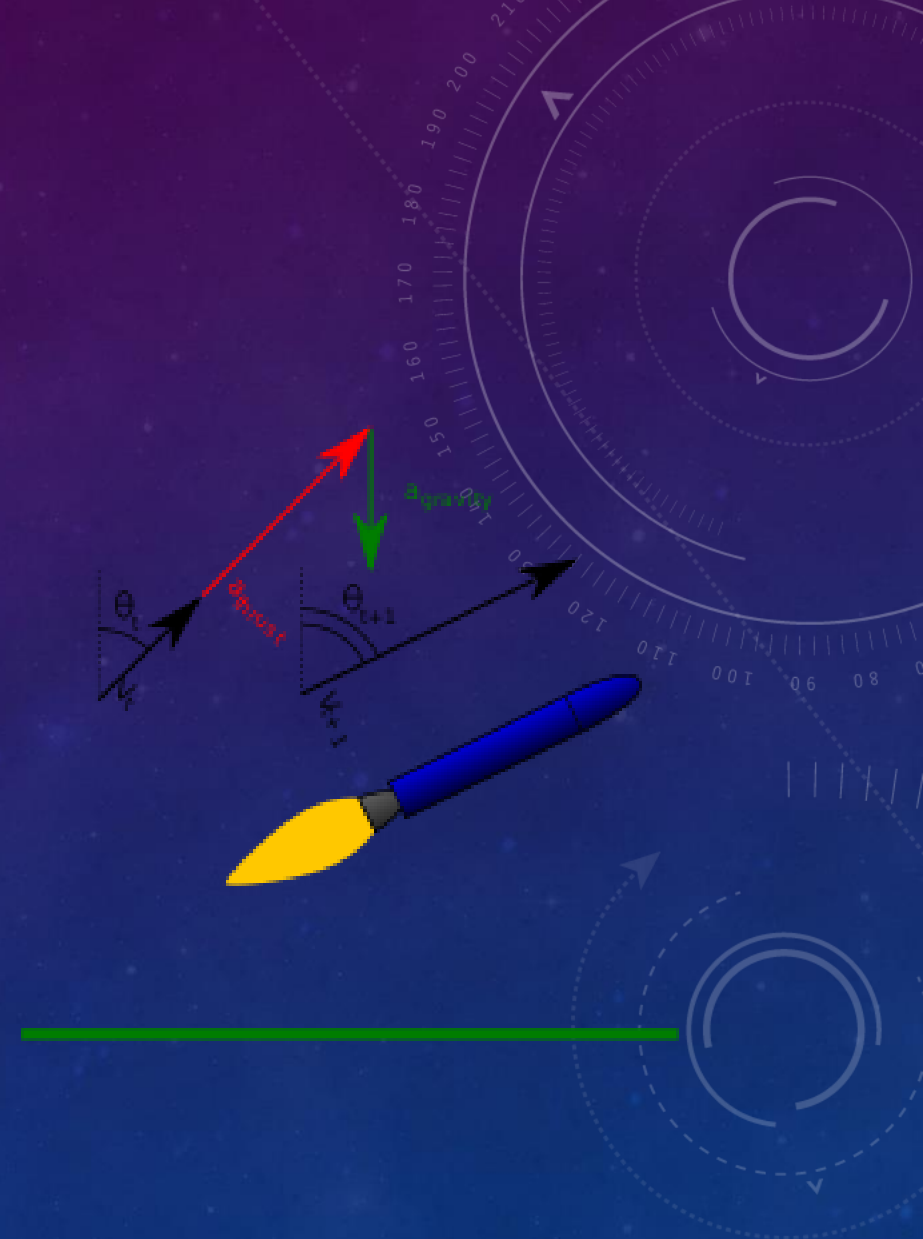
Right position with right rotation speed



ANGLE

gravity turn + pitchover angle

```
if rocket1.fuel_mass > 0 :  
  
    rocketL.r.up  = rotate(rocketL.r.up,angle=-25*dt*pi/18000)  
  
    total_mass = rocket1.total_mass() + rocket2.total_mass() + rocket3.total_mass()  
    dm = rocket1.mass_flow_rate * dt  
    thrust = rocket1.exit_speed*norm(rocketL.r.up)*dm/dt
```



Rocket.up = Rocket.v ?
torque ?

```
rocket1L.r.up = rocket1.v  
rocket23L.r.up = rocket2.v
```


ENTERING ORBIT

Turn off

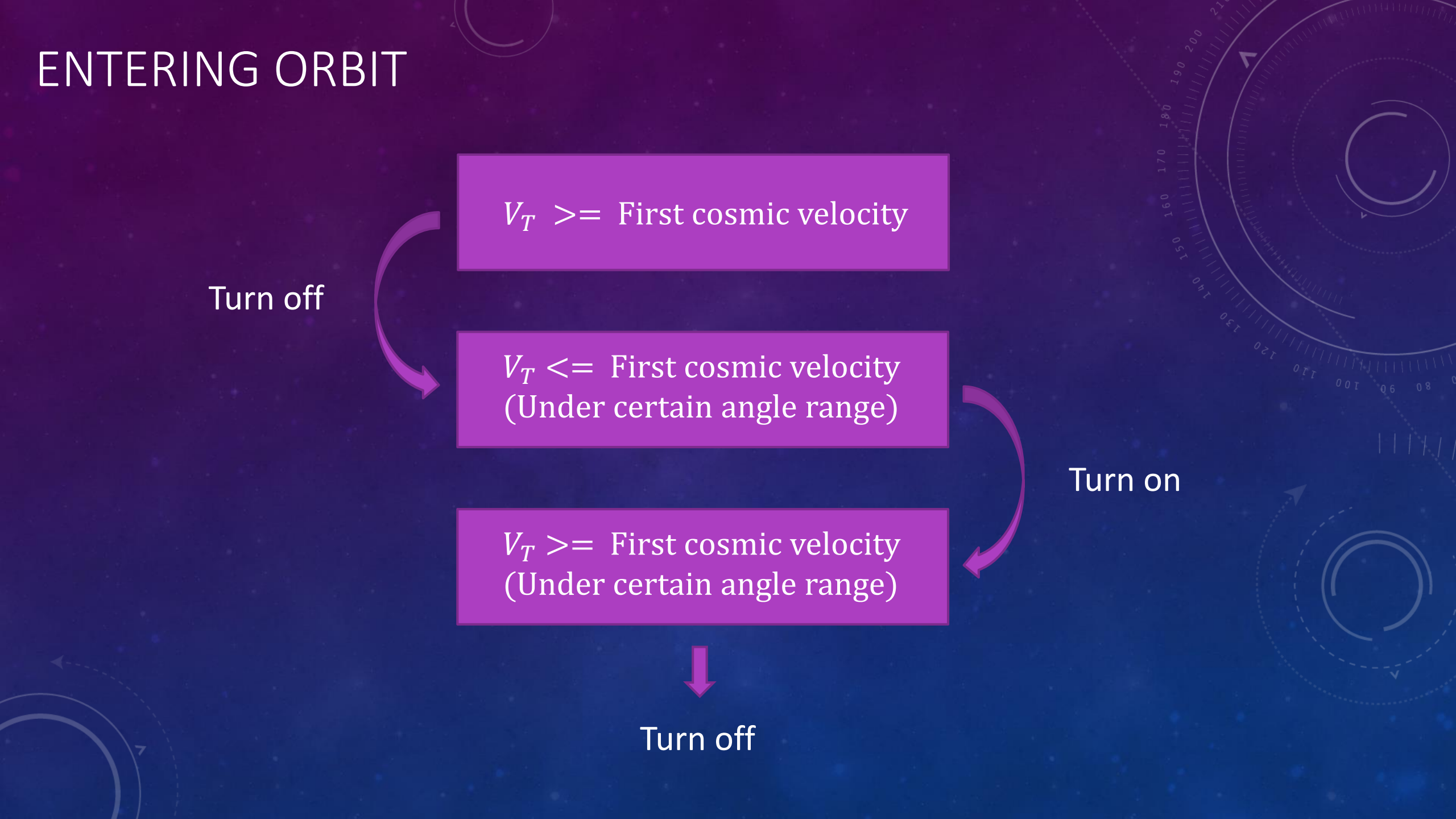
$V_T \geq$ First cosmic velocity

$V_T \leq$ First cosmic velocity
(Under certain angle range)

$V_T \geq$ First cosmic velocity
(Under certain angle range)

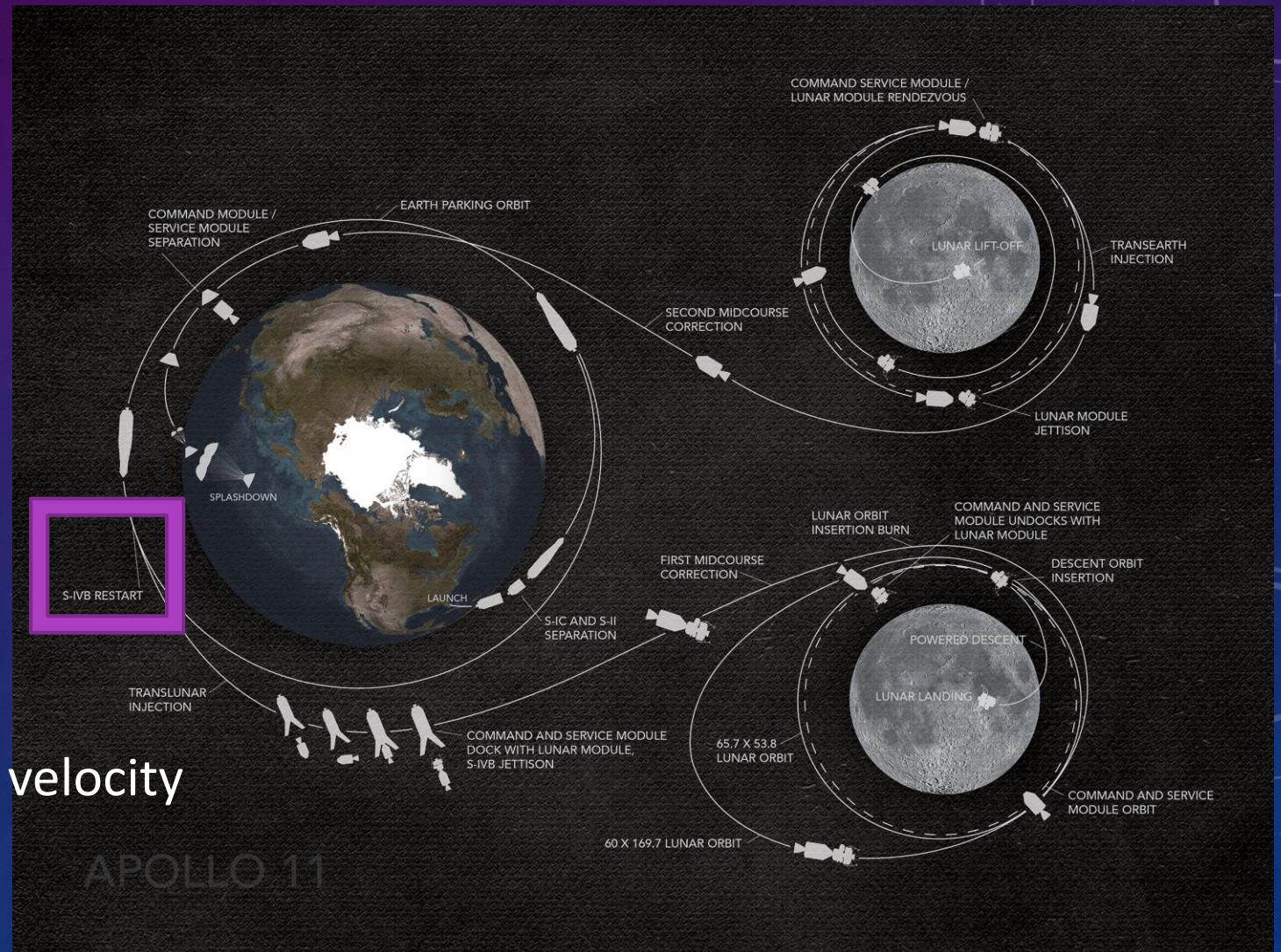
Turn on

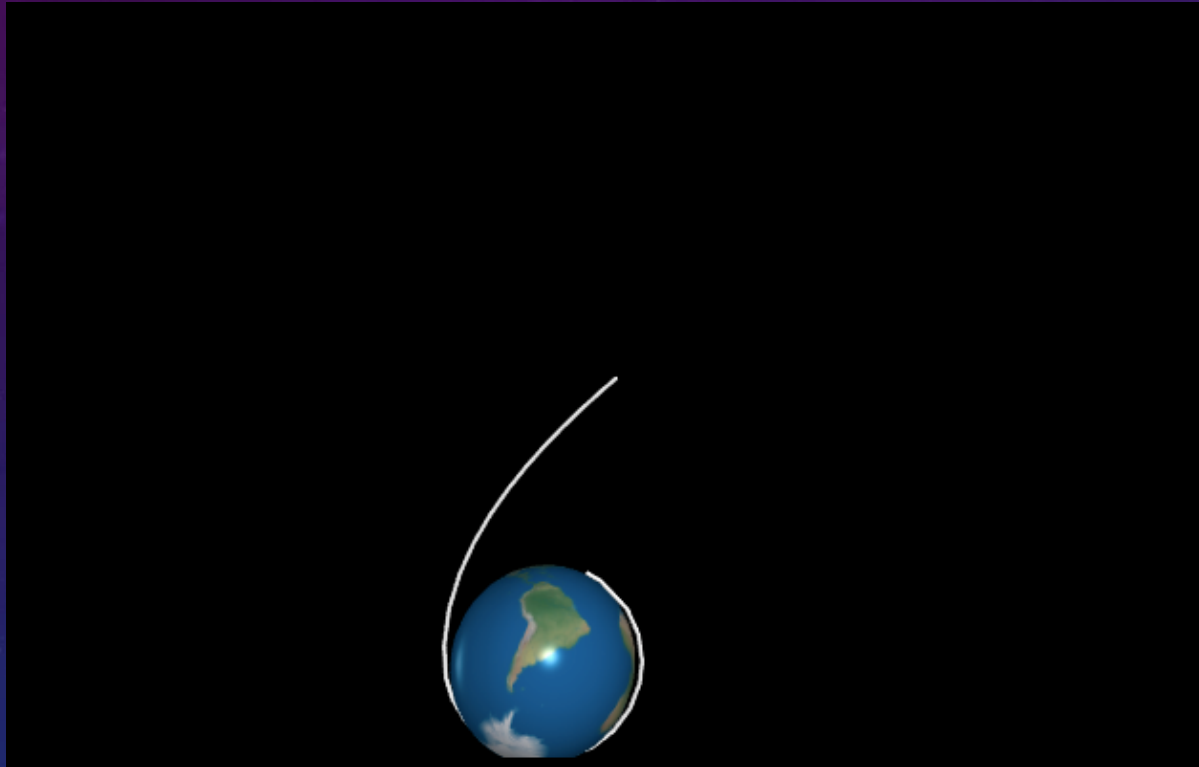
Turn off





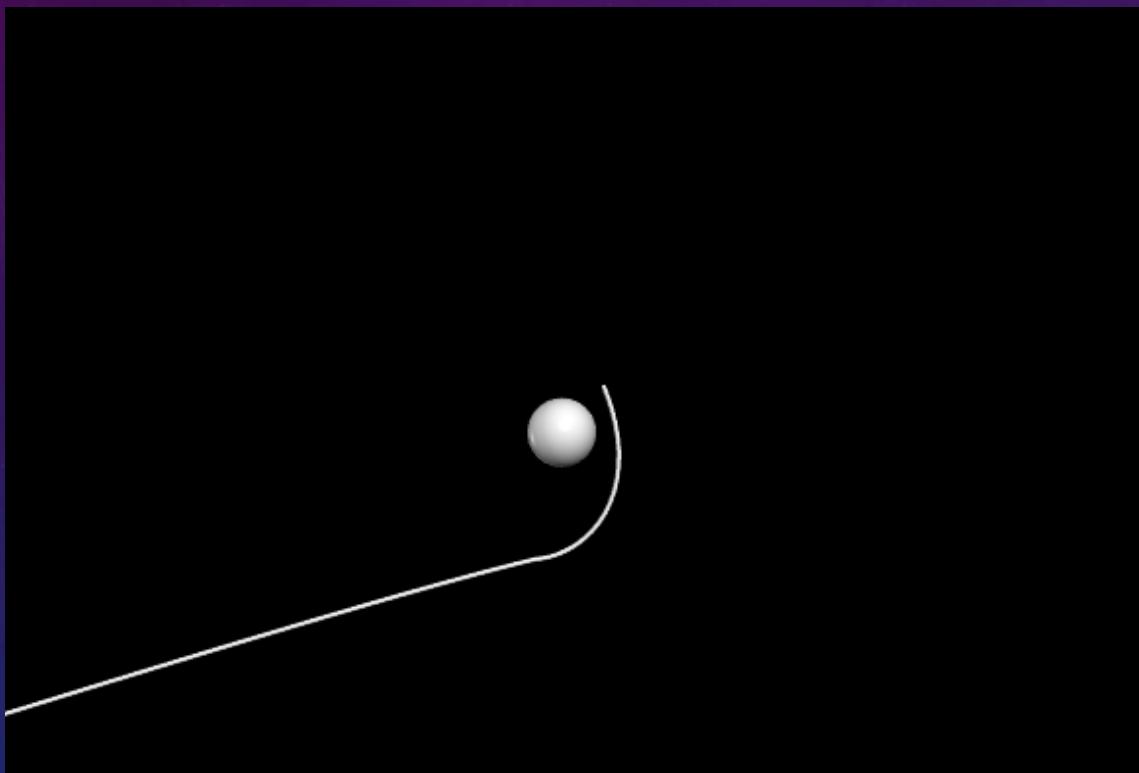
Turn on the engine
Till the rocket reaches the escape velocity



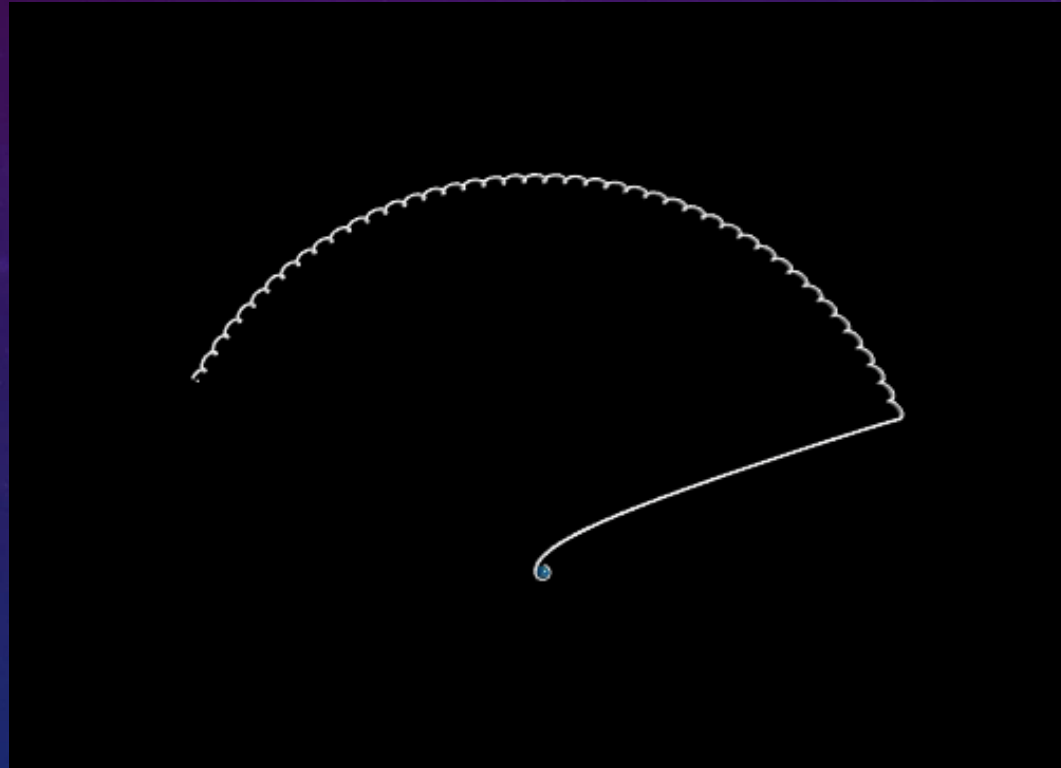


ENTERING MOON ORBIT

- Decelerate
- $V \leq$ first cosmic velocity of moon



AND HERE IT IS



WHAT WE LEFT

- Landing
- Flame

Short Demo video

<https://youtu.be/3Op-GnzcrPo>

