

ENAE 483/788D LECTURE #07
(COST ESTIMATING RELATIONS) PROBLEMS – FALL, 2024

We are going to use the NASA SVLCM costing model (in the lecture notes) to estimate the costs of the New Glenn launch vehicle from Blue Origin. Use the following parameters in the analysis: *Note: in this problem set, as throughout the course, “MT” refers to metric tons, or 1000 kg.*

Parameter	First Stage	Second Stage
Specific impulse (sec)	327.5	356
Total stage mass (MT)	1025	375
Inert mass (MT)	102.5	18.75
Payload to LEO (MT)	–	45

- (1) Calculate the nonrecurring costs for each of the two stages.
- (2) Assume the development of the vehicle took six years. Find the year-by-year costs using a beta function with $c_f = 0.45$ and $P_k = 0.55$.
- (3) Calculate the first unit production costs for each of the two stages.
- (4) For an 85% learning curve, calculate the production costs (unit by unit) for the first 5 vehicles.
- (5) Assume for this problem that the New Glenn is expendable. For simple break-even, how much would you have to charge per flight to amortize both the nonrecurring and recurring costs over the first five vehicles?
- (6) The New Glenn first stage is designed to be reusable. Assume the refurbishment fraction is $f_R=0.03$. What is the simple break-even cost over 25 missions assuming each first stage flies five times?
- (7) Assume as per (2) the development of New Glenn took six years, that the production costs for the first stages are all paid in year 7, and that the cost for each second stage is paid in the year in which it flies. Refurbishment costs for the first stage are also paid in the year of flight. There are 5 flights/year in each of years 7-11 in which you pay production costs for the expendable second stages (with learning curve as per (5)) and refurbishment as necessary for the first stages (no learning effects on refurbishment). What is the total cost in each year of the program from 1-11?
- (8) At a 10% discount rate, what is the net present value in year 0 for each of the costs you calculated in (7)?