



# *Prospects for Affordable Access to Space for Small Payloads, 2003-2012*

*Jeff Foust*

*Futron Corporation*

*17<sup>th</sup> Annual AIAA/USU Conference on Small Satellites*

*2003 August 12*



## *Introduction*

---

- Affordable access to space has been among the biggest challenge for small payloads
- At same time, launch industry in turmoil because of lack of demand for launch services
- Despite problems, new vehicles still being developed
- Need to determine size of launch market over next ten years
  - » Total launch capacity available under various scenarios
  - » How much of that capacity will be affordable



## *Methodology*

- Focus on “small” launch vehicles as defined by FAA
  - » Less than 2,268 kg (5,000 lbs) to LEO
  - » Designed to focus on vehicles where one or several small satellites serve as the primary payload and thus drive launch demand
- Study vehicles that fall under this category based on a set of criteria
- Construct set of models to determine maximum number of available launches in 2003-2012 time span
  - » Baseline, Robust, Restricted



## *Criteria*

---

- Availability
  - » Number of launches per year based on recent history of current projections
- LEO Capacity
- Success Percentage
- Launch Price
  - » Both vehicle price and price per 100kg payload
- Probability of Entering Service
  - » Existing, High, Medium, Low



## *Vehicles Considered*

Air Launch

Minotaur

Taurus

Angara 1.1

Pegasus XL

Vega

Athena 2

RASCAL

VLS

Cosmos

Rockot

Volna

Dnepr

Shavit 1

Xerus

Eagle/Eaglet

Shtil

Falcon

Sprite Mini-Lift

J 1

START/START 1

M 5

Strela



## *Baseline Model*

- Includes “existing” (except for Athena 2 and J 1) and “high” probability vehicles
- Total of 277 launches available; 100 on vehicles with cost < \$1M/100 kg
- 20 of those 100 on vehicles with capacity < 500 kg
  - » 60 on vehicles with capacities 1000-1999 kg
  - » 20 on vehicles with capacities 2000+ kg



## *Robust Model*

- Baseline + “medium” probability vehicles
  - » Includes RASCAL and Xerus RLVs
- Total of 431 launches available; 190 on vehicles with launch costs < \$1M/100kg
- 110 of those 190 on vehicles with capacities < 500kg
  - » 60 on vehicles with capacities of 1000-1999 kg
  - » 20 on vehicles with capacities of 2000+ kg
- Low cost stats somewhat skewed because they exclude Xerus (\$500,000 for 10 kg payloads)





## *Restricted Model*

- Baseline minus several vehicles
  - » M 5, Shavit 1, Shtil, START, VLS, Cosmos (after '08)
- Total of 212 launches available; 75 on vehicles with launch costs  $< \$1\text{M}/100\text{kg}$
- 10 of those 75 on vehicles with capacities  $< 500\text{ kg}$ 
  - » 45 on vehicles with capacities of 1000-1999 kg
  - » 20 on vehicles with capacities of 2000+ kg





## *Conclusions*

- Development of suborbital RLVs offers best prospects of increasing dedicated, affordable launch opportunities for small payloads
- However, current launch capacity already exceeds demand (12-15 launches/year for small vehicles)
- If small satellite community wants more affordable launch options, it must demonstrate to funding sources (government and private) that the demand is there and is unsatisfied by current vehicles