Observations on Leveraging "New Space" by Traditional Space Users

**Donald Sather
The Aerospace Corporation
Technical Fellow**

February 2024

Agenda

- Background – Legacy ("Traditional") Space vs. "New Space"

- What Products & Services Does "New Space" Have to Offer?

- Drivers for Legacy Customers to Adopt "New Space"

- Challenges to Leveraging "New Space"

- Suggested Bridges to be Built

- Summary

Background
Legacy ("Traditional") Space Genesis and Paradigms

- Until the 2000's "space" was largely the domain of large nation-states and very large mega-corporations that could afford the large price tag of space access and operations
  - *Most space related technologies (including ground) were considered part of national defense or corporate intellectual property that was tightly export controlled or classified*
    - Government was primary funding source and consumer
  - *Nation-states had to develop their own launch facilities, ground networks and associated infrastructure*
    - Government cooperation with mega-companies allowed private companies to leverage launch facilities, boosters, & satellite technology
  - *Satellites were largely custom built to fulfill a specific mission*
    - Usually meant custom ground infrastructure (including software) to control it
    - Expensive with a long lead time
    - Mega corporations, largely operating in the communications market, lead to more standardized satellite products/offerings in that specific area
- Resultant Paradigms
  - *Long lead times, high launch costs coupled with cumbersome and fickle funding & acquisition processes of nation states required a "risk averse" posture*
  - *High launch costs coupled with slow & costly replenishment also necessitated a long design life (7 to 10+ years)*
    - Even higher satellite costs
    - Inability to enhance capabilities in a timely fashion

Due to national importance, long lead time and expense: failure was never an option - no rapid reconstitution options.

Background
"New Space" Origins & Paradigms

- Mid-1990's/2000's rise of truly commercial launch/ground networks and bus/payload miniaturization using COTS components ("small sats") ushered in "New Space"
  - *Significantly lowered space entry & operational costs opened space to a whole new group of users*
    - Some smaller nation states are now operating in the space domain
  - *Multiple companies now offer services & products using their own assets in space*
  - *Multiple companies now offer launch/satellite/ground services which will accommodate further growth in the space domain*
- Resultant Paradigms
  - *Lower launch and satellite costs as well as shorter satellite (bus & payload) turnaround times have significantly changed the risk calculus for private companies working in the space domain*
    - Private companies are for profit and have a business plan
      - *Much more oriented to **risk management** than **risk aversion***
      - *Failure, within bounds of business plan and architecture, is expected and accounted for*
  - *Lower launch costs & lower replenishment cost has also led to cost effective on-orbit sparing and a shorter design life*
    - Shorter design life can decrease satellite test & build costs and accelerate schedule
    - Enables new on-orbit system enhancements to be brought on-line quicker
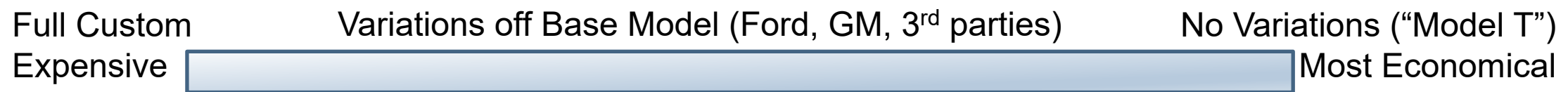   - Increases system resiliency

"Legacy Space" was largely government funded/managed, "New Space" is dominated by private businesses. Government and businesses often have very different objectives and business processes/practices.

What Products & Services Does "New Space" Offer?

- Satellite busses/payloads and associated ground products
  - *Spectrum of offerings is very similar to evolution in the automobile industry*
    - Start for many was no variation of base model
    - For some, gradual evolution to provide various levels of customer control and associated price points
      - *Some New Space bus vendors may have to evolve product line to meet customer needs*
  - *Potential rise of 3rd party vendors who take another provider's base model and customize to customer specifications*
- Current ground related service offerings range from satellite contact to flying a satellite and everything in between
  - *Some companies will broker custom packages to meet specific user needs*
- Many New Space products meet legacy user needs and can be/are incorporated into legacy missions
  - *Imagery*
    - Used by all levels of government including local building inspection & property tax assessment
  - *Communications*
    - United States Government leases >$1B/year for telecommunications (SpaceNews, 11/29/2012)
  - *Other*

Range of Automotive Services

Full Custom	Variations off Base Model (Ford, GM, 3rd parties)	No Variations ("Model T")
Expensive		Most Economical

"New Space" offers goods and services that are often less costly than their legacy counterparts while meeting needs

Drivers for Legacy Customers to Adopt "New Space"

- Reduced Cost
  - *Cost to maintain single user ground/launch infrastructure is often too high*
    - Too expensive to expand
  - *Cost of large, fully custom large satellites too high for many applications*
  - *New Space offers opportunities to expand capability at a significantly lower cost*
- Quicker Time to Market
  - *Legacy missions need to be more responsive to changing world*
  - *Rapid time to market is a hallmark of "New Space"*
  - *Offers rapid replenishment*
- Rapid Innovation
  - *With the influx of new vendors and competition in "New Space" innovation will be critical for New Space market survival*
    - Legacy Customers can reap the innovation benefits instead of having to pay for it

- Why should "New Space" care about Legacy Customers?
  - *Still a significant, steady customer of space products and services*
  - *"New Space" currently uses Legacy infrastructure*

Legacy Customers cannot continue to meet their own mission needs without the prudent use of "New Space"

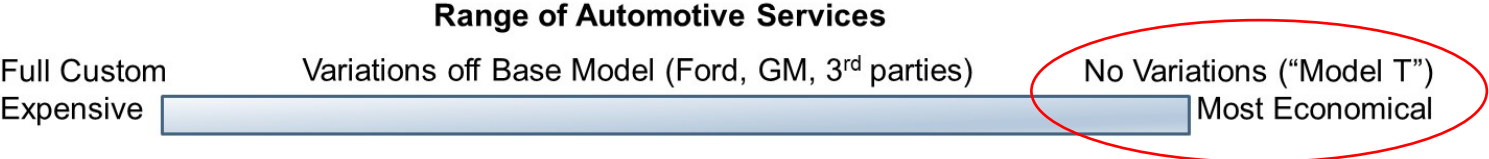# Challenges to Leveraging "New Space" (1/2)

- Lack of Change Control & Delivery
  - *Vendor may change offering design at any time to meet business objectives*
    - Changes ***may*** still meet or improve performance characteristics – or not
  - *Vendor may control software release dates, delivery format (VM or container structure) and delivery method which may not be in accordance with established legacy "requirements", practices & methods*
    - Can sometimes be negotiated
  - ***Potential Legacy Impacts:*** *potential conflict with system freezes or design reviews as well as cyber policy and implementation issues*
- Limited insight into proprietary design detail, parts used, software and "undocumented features"
  - *Visibility limited to what the vendor wants to expose or what can be negotiated*
  - *Lack of "detail" information may not meet expectations "required" in legacy business process reviews and cyber implementations*
    - Requires Customer trust of the vendor for proprietary data they may be unwilling to reveal or a reset of legacy expectations
      - Developing more robust, failure/fault tolerant architectures using lower cost assets may help "expectation reset"
  - *Use of proprietary system components may lead to vendor lock*
  - ***Potential Legacy Impacts:*** *program office may need to set decision authority expectations for reviews and live with or accommodate risk uncertainty. Vendor lock.*

Legacy Customers are generally not a culture of trust without verification

Challenges to Leveraging "New Space" (2/2)

- "No Variations" leaning vendor's design offerings are designed for a **specific** environment, architecture, and business plan
  - *Often attractive due to price point and delivery schedule but may require significant mission tailoring to match design characteristics*
    - Potential performance in a different mission environment, CONOPS or architecture than the Vendor's requires evaluation which may rely on design insight/data that is unavailable or only available at additional cost
  - ***Potential Legacy Impact:*** *Offering may not meet even tailored mission needs & inability to verify requirements*

Range of Automotive Services

Full Custom	Variations off Base Model (Ford, GM, 3rd parties)	No Variations ("Model T")
Expensive		Most Economical

- Legacy Customers will have to adapt to doing business with "New Space" sooner rather than later
  - *Eventually the space domain will be dominated by commercial entities*
    - Currently, over half the satellites in earth orbit are "New Space" commercial and this is growing
  - *Legacy Customers will have less impact or control of commercial product offerings and their evolution as their market share diminishes*
    - Lesson learned from the US semiconductor industry's relationship with the US government – a Cautionary Tale
      - *Legacy Customers should influence change while there is still an incentive for "New Space" to do so to ensure future supply of required niche capabilities/products*

Legacy users need to plan & act now to ensure continued supply of products that meet projected mission needs or learn to live with whatever commercial industry is offering

Suggested Bridges to be Built

- Legacy
  - *Better align mission requirements and resultant architectures to leverage "New Space" offerings*
  - *Work with "New Space" sooner to better align business practices/offerings while Legacy still has market share to influence change*
  - *Develop a database that tracks "New Space" component procurements and anomalies*
    - This is data most vendors typically do not share
    - Would provide insight into an offering's performance in different environments
      - *Similar to accessing 3rd party data gathering sources before buying a car*
    - The wider the database contributors the better – can be program agnostic
  - *Revamp funding, acquisition & security processes to better match or mesh with "New Space" practices*
  - *Cultural change to realize every project doesn't need to own/control all aspects of its operation*
    - Take advantage of "New Space" services where appropriate
    - Learn how to effectively contract with them
  - *Realize if "New Space" suppliers are not cyber savvy they won't be in business for long – "different" does not necessarily mean "inadequate"*
- "New Space"
  - *Be more open with Legacy Customers*
  - *Be sensitive to Legacy Customer cyber needs*
  - *Offer some flexibility in offerings or risk Legacy business loss*
    - Perhaps offer specialized optional packages to offer better performance in certain popular environments (higher radiation, better stability, better slew, more polar/southern hemisphere ground coverage, etc.)
      - *Nobody in the automotive industry still has an "any color you want as long as it's black" mentality – Henry Ford reference to Model T*
      - *Takes market research to get it right*

With a bit of flexibility on both sides, lasting bridges can be built

Summary

- While "Legacy Space" was largely government funded/managed, "New Space" is dominated by private businesses
  - *Business motivations, practices and process that govern "New Space" are different than Government run Legacy*
  - *There is a tolerance for failure in "New Space" in accordance with a business plan and associated architecture*

- "New Space" offers goods and services that are often less costly than their Legacy counterparts

- Currently, there are significant challenges to working with "New Space", but bridges can be built

- Legacy users need to learn to work with "New Space" sooner rather than later
  - *Legacy space is losing market share which will diminish their influence over products and evolution*
    - Prepare for a day when there are no commercial offerings that meet specific mission requirements and legacy providers have shifted focus to the lucrative commercial market – lesson learned from semiconductor market
  - *Build bridges while there is still market share influence*

Bridges between Legacy and "New Space" will need to be built sooner rather than later.
Onus is on Legacy to build lasting bridges that can ensure the future supply of products that meet niche needs