

# The Hybrid Space Program: A Commercial Strategy for NASA's Constellation Program

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5 August 2009



# Introduction

## Space Shuttle Columbia Tragedy

- Shifted National Space Policy

## Vision for Space Exploration (VSE)

- Finish International Space Station
- Retire Space Shuttle Fleet
- Develop New Crew Exploration Vehicle & Launch Vehicles
- Land Humans on the Moon by 2020



# Enter Commercial

## Aldridge Commission Formed

- Examined and reported on NASA's philosophies
- Two of the eight recommendations focused on commercial participation
- Stated one of the VSE's primary purposes: commercialization of space
- Low Earth Orbit (LEO) realm of commercial sector

## Exploration Systems Architecture Study (ESAS)

- Three month study on how to make VSE a reality
- ESAS conducted trade studies on VSE options



# Road Map Drawn

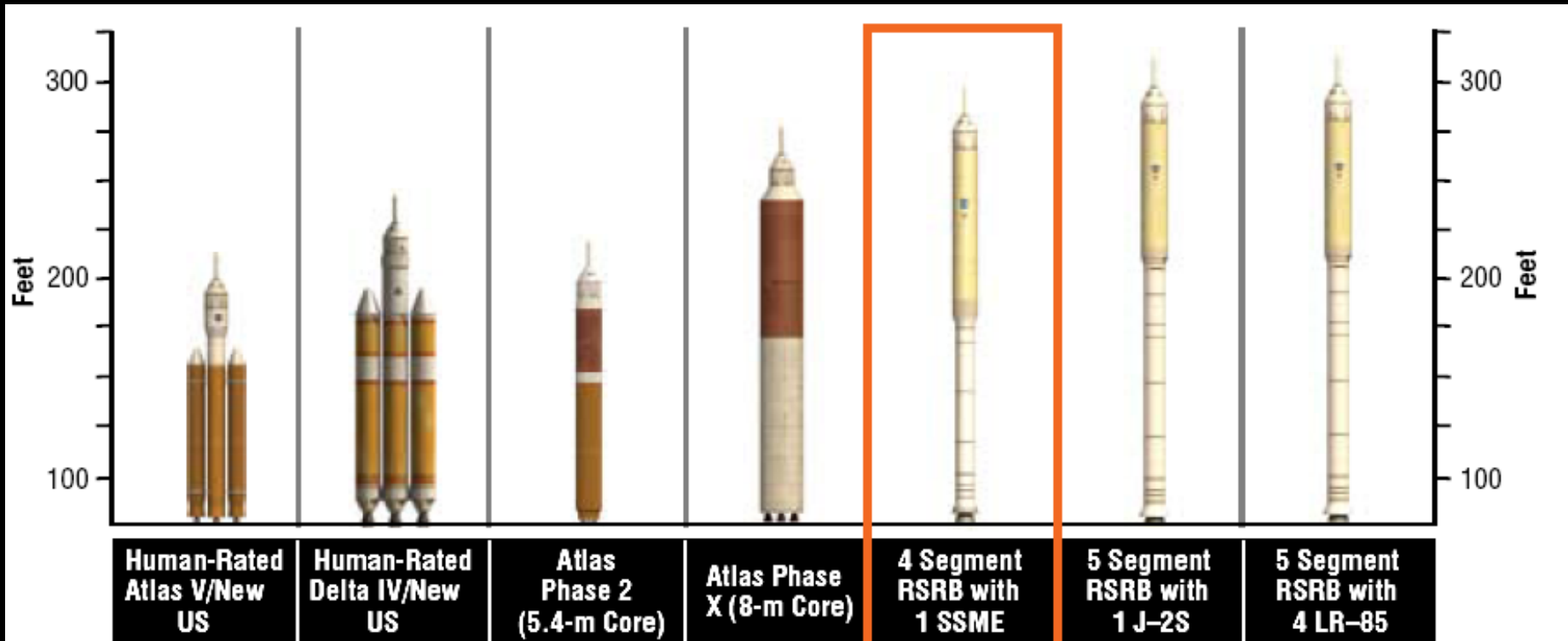
## Lifting the Vision

- Launch vehicle choice is very problematic
  - Choice is primarily trade study based
  - Clean sheet designs avoided
- VSE demanded crew and cargo separate as much as possible
- ESAS looked only at multi-launch strategy



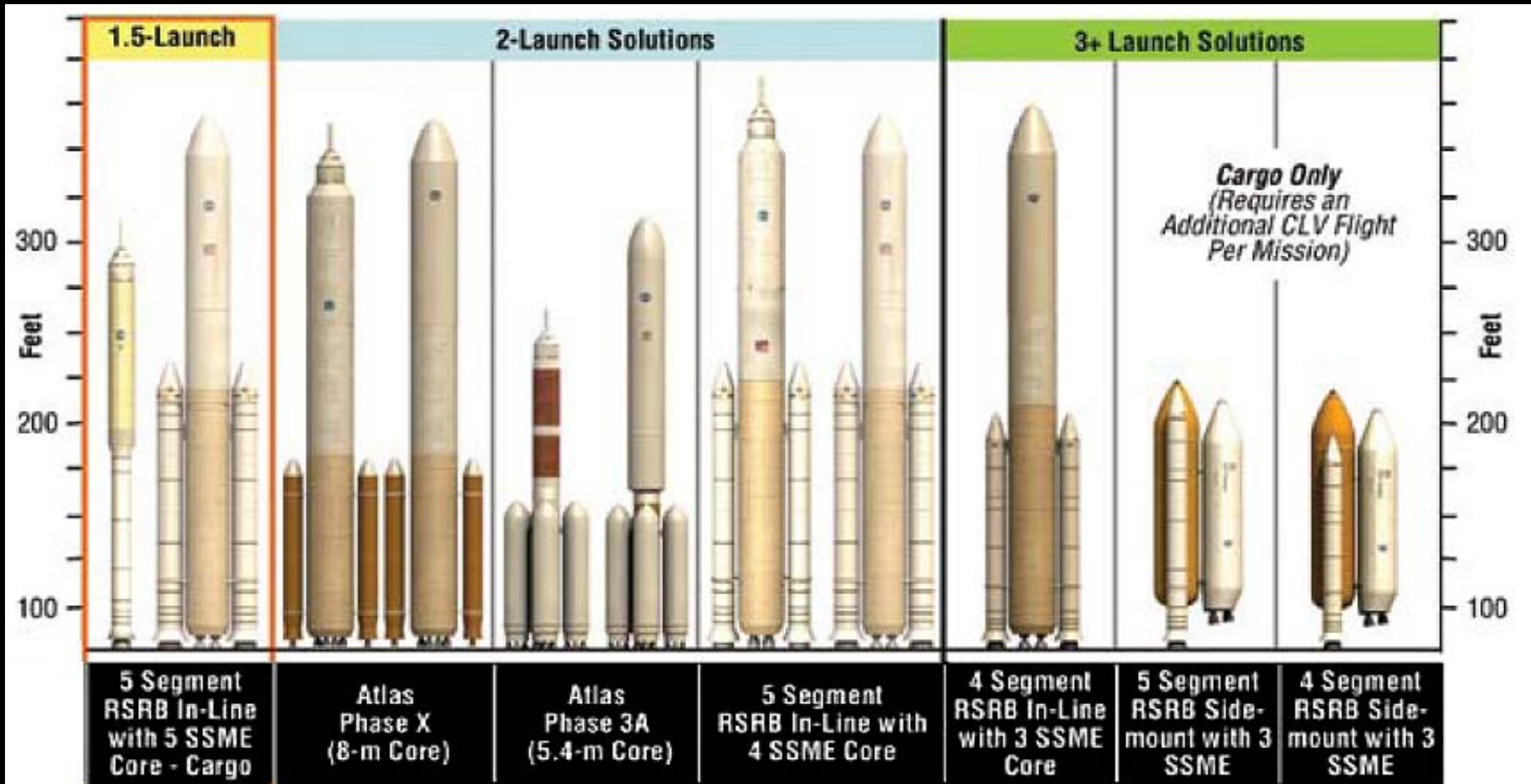
# Road Map Drawn

## Crew Launch Vehicle – Ares I



# Road Map Drawn

## Cargo Launch Vehicle – Ares V



# Constellation Emerges

## Project Constellation, Six Years Later

- Strong controversy on launch vehicle choice emerges
- Ares I embroiled with technical issues
  - Thrust Oscillations on SRB
  - Abort System Controversy
  - Significant Loss of Capability
    - Crew down to 4
    - Back to water splash downs



# Program Sustainability Issues

## Ares Woes

- Behind Schedule
  - Initial Operating Capability – 2014
  - Reality – March 2015
  - CBO estimates an additional 18 month delay could occur if NASA funding increases only by 2% annually
    - Reliance on Russian vehicles for most of the decade



# Program Sustainability Issues

## Ares Woes

- Soaring Costs
  - Developing space launch vehicles is costly
  - That said, LEO capability originally expected to cost \$28 billion
  - NASA now publicly acknowledges could cost \$36 billion, maybe more (~ \$44 billion)
  - To put in perspective, FY 2010 Budget proposed at roughly \$18 billion for entire agency



# Program Sustainability Issues

## Too Many Responsibilities, Too Little Resources

- Agency Goals are Unsustainable
  - Current Responsibilities Include:
    - ISS Construction, Maintenance
    - Space Shuttle Program
    - Ares I and Ares V development
    - Lunar Exploration Planning (month-long sorties)
- Agency budget accounts for less than 1% of the Federal Budget



# Program Sustainability Issues

## Bleak Funding Realities

- At height of Apollo, agency received 5% of Federal Budget, with only one space-related goal
- CBO analyzed scenarios for future NASA budgets to 2020
  - In 3 of 4 scenarios, U.S. involvement with ISS must end in 2015
  - Dramatic infusions of funding must occur if ISS is to be saved



# Program Sustainability Issues

## Prime Example of Unsustainable Space Policy

- NASA acknowledges end of ISS coming in 2016
- \$100 billion space station
- Largest ever space station ever
- First and only national lab in space
- 14 international partners
- Will have been fully operational for five years



# Commercial by Necessity

## A New Approach at NASA

- ISS example points to need for rethinking strategy at NASA in Post-Apollo world
  - New funding is not likely, NASA must adjust
- One program has led the way:
  - Commercial Orbital Transportation Services (COTS)
  - When shuttle ends, cargo capability lost



# Commercial by Necessity

## A New Approach at NASA

- Nearly 37 metric ton shortfall when Shuttle ends
- No vehicle (in U.S. or otherwise) exists to return experiments
- COTS program hosted a competition among commercial
  - Winners are to demonstrate cargo capability to ISS



# Commercial by Necessity

## A New Approach at NASA

- COTS offers a viable case study for commercial
  - Utilizes the Space Act Agreement
    - Avoids 'cost, plus award fee' federal acquisition model
    - Fixed price milestones used
  - Two companies were awarded contracts in the original competition: Space X and Rocketplane-Kistler
- Rocketplane-Kistler was terminated, speaking to advantage of Space Act and COTS model



# Commercial by Necessity

## A New Approach at NASA

- After Rocketplane-Kistler was terminated from COTS, Orbital Sciences Corporation was added to the contract
- SpaceX and Orbital Sciences serve as a model of success for commercial LEO transportation

## Orbital's Approach

- Orbital has met ten of twenty-one milestones to demonstrate cargo re-supply capability
- Orbital is on track to begin transporting cargo by 2012



# Commercial by Necessity

## SpaceX's Approach

- SpaceX could transport human crews to the ISS by 2012
  - This would reduce the gap in U.S. human spaceflight by at least three years, maybe more
- SpaceX has completed 14 of 21 demonstration milestones for ISS re-supply



# Lessons from COTS

## Commercial is Proving Itself

- No flights have taken place yet
  - NASA has been so impressed, it has begun the process of procuring its first commercial re-supply flight
- Serious capability
  - Falcon 9 carries 6 to ISS, Ares I carries 4 to ISS
- Human crew demonstration by NASA would only cost an additional \$300 million
- Ares I has cost over \$3 billion so far alone



# Sustainable Strategy

## How to Make Commercial a Reality

- Policy Recommendations :
  - Congress and NASA should exercise COTS capability D to demonstrate commercial market's ability and offer crewed precedent
    - Crews could be at ISS by 2012, 3 years ahead of Ares I
  - Congress should refrain from diverting the \$150 million stimulus intended for NASA's commercial crew and cargo office



# Sustainable Strategy

## How to Make Commercial a Reality

- Policy Recommendations :
  - Congress should pass legislation to extend Space Act acquisition authority to 'services' procurement
    - Currently, Space Act procurement can only be used for technology demonstration
  - Congress should pass a NASA authorization act establishing a commercial competition to determine a replacement commercial LEO capability for Ares I
  - The President should cancel the Ares I program and shift its funding to a commercial competition winner



# Sustainable Strategy

## How to Make Commercial a Reality

- Policy Recommendations :
  - President should order NASA to implement the winner of the commercial competition for LEO capability into the Constellation program
    - LEO services should be procured using Space Act with fixed-price milestones, modeled after the COTS program



# Conclusion

- By implementing these policy recommendations, NASA can utilize the commercial market to ensure the sustainability of Project Constellation
- The commercial space industry has demonstrated robust capabilities
- The time has come to make use of this capability to further enable the Space Agency



Questions?

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Special Thanks to Bruce  
Mahone and Tim Mellon of SAE  
International for their Support  
and Guidance

