Routine Low-Cost Access to Space (RLCAS)

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Primary Objectives of RLCAS

1. Prompt observations to test new scientific ideas and predictions
2. Early and thorough flight tests of new instrument technology
3. Expand the envelope for scientific research and technology development :
   - sounding rockets (SR) give only 5-10 min in space
   - orbital missions could increase time by 1000 – 10,000
   - reduce cost of missions to Earth orbit
   - create technical organization to execute frequent routine orbital missions (analogous to NASA SR program)

SIOSS : Technological and Flight Readiness

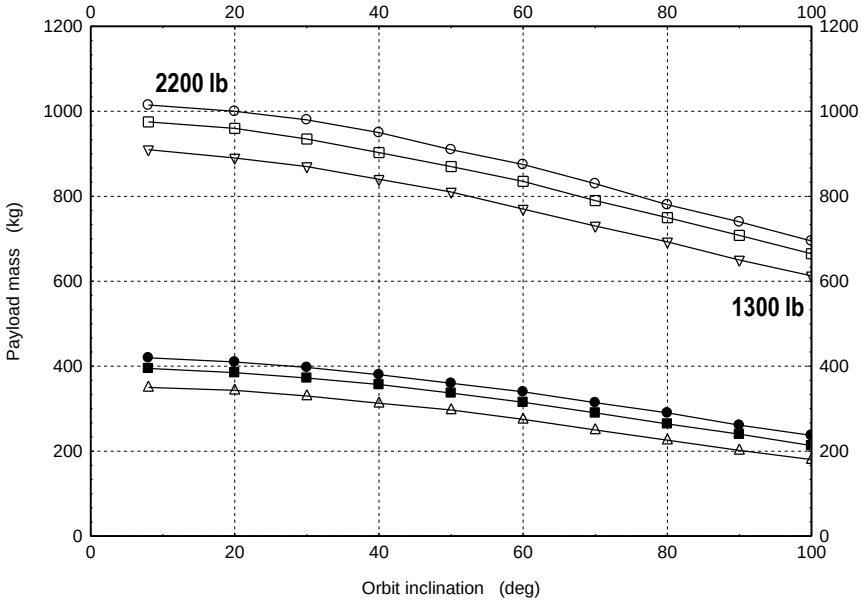
- Role of RLCAS in testing new instrument technology in space ?
- Flight-testing of instruments to demonstrate mission readiness (TRL 6 –TRL 8)
- Prominent example : precise formation flying of up to 50 spacecraft (TA 08)
- Is there a feasible and practical concept for RLCAS ?
- The ASRAT Orbital Sounding Rocket (OSR) concept provides this capability
- OSR fills the gap between $3M SR and ($100-200M) Explorer-class missions
- OSR endorsed in Astronomy and Astrophysics 2010 Decadal Survey report
- Feasibility has been demonstrated in an Engineering Concept Study at Wallops

The Crucible : the NASA Sounding Rocket Program

- Fifty-years of operation with 85-percent success rate : 18 flights in FY 2010
- Serves diverse research community : astrophysics
  solar physics
  upper atmosphere and plasmasphere
- Modest cost : e.g. $2-3 million for astrophysics telescope flight
- Short time scale for testing new scientific ideas : ~ 3 years
- Development and space testing of new instruments
- Training ground for the next generation of space research scientists and technologists

Essence of the Sounding Rocket Approach to OSR

- Establish an OSR management office with its own authority and funding
- Accept a certain level of risk : SR success rate is ~ 85 percent
- Maintain experienced engineering team : optimise transfer of SR experience + hardware
- Use proven (‘off-the-shelf’) components and sub-systems ACS, Data, TM, power….
- Thorough testing of sub-systems and payload : air-bearing, vibration, TV, balance….
- Use a proven launch vehicle with acceptable cost : Falcon 1e : cost $10.5M in FY 2009



Potential OSR User Community

OSR has the potential of serving diverse scientific and technological interests :

NASA : Groups funded by SMD for sounding rocket research and instrument development :

transition to OSR missions increasing time in space by a factor 1000 -10000 :

– astrophysics
– heliophysics
– geospace : upper atmosphere
plasmasphere
– Mars atmospheric entry bodies

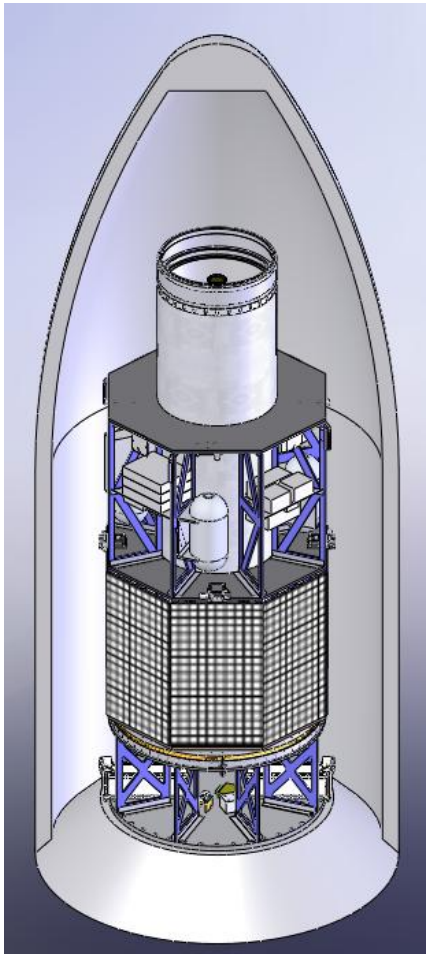
SIOSS : technology development for major missions : astrophysics
heliophysics
planetary science
Earth science

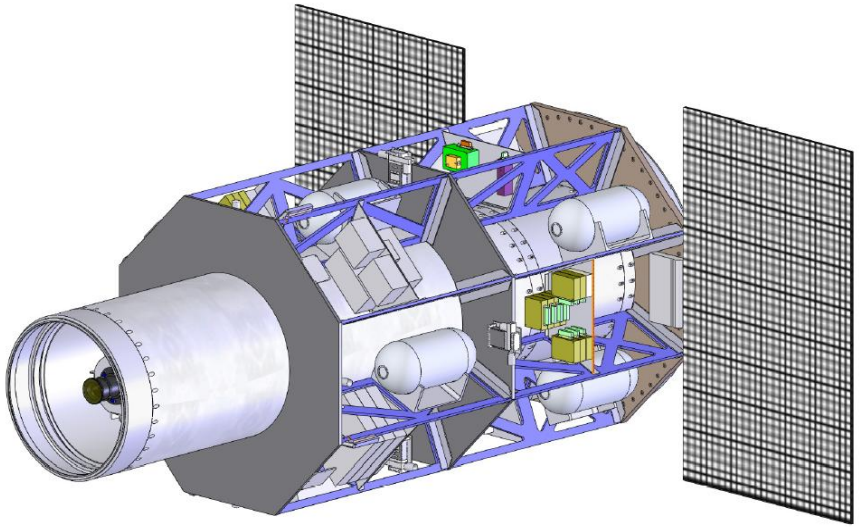
Microgravity : materials research

DoD : Air Force space research programs : Space Test Program (STP)
Operationally Responsive Space Office (ORS)

Universities : opportunities for flying small secondary (piggyback) payloads – e.g. CubeSats

WFF Engineering Concept Study of EDSR (OSR)





Proof-of-concept mission : astrophysics telescope

time to launch - 4 yr

mission duration - 6 days

no major technical hurdles

Principal Mission Characteristics

- Mission duration : 1-3 months
- Launch frequency : > 1/yr
- Mission cost target : $30M

Sub-systems

- Payload under autonomous control by flight computer
- Attitude control system with star-field sensor : stability 1 arc-second
  gas jet control initially
  transition to reaction wheels
- Data system with PCM encoder and 24-hr storage
- Data downlinked every 24-hr by S-band at 4 Mb/s to WFF ground station
  (transition to X-band as data rates rise)
- Power system uses solar cell array and Li ion battery
- Thermal control system : multi-foil blankets : heaters and radiators as needed

How important in the SIOSS Roadmap is the testing of new instrument technology in the real space environment?