Small Unit Space Transport and Insertion (SUSTAIN)

Study prepared for:

LTC Paul E. Damphousse, USMC
Chief of Advanced Concepts

National Security Space Office
Pentagon

LTC Robert Lancaster
Branch Chief of Innovations

HQ, AF Security Forces Center
Lackland AFB, Texas 78326

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2009	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Small Unit Space Transport and Insertion (SUSTAIN)	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of North Dakota**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**22**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Authors

Dr. John M. Jurist Dr. David Livingston	University of North Dakota
Maj. David C. Hook, USAF (ret)	Planehook Aviation Services
Dr. James R. Wertz Dr. Robert Conger Dr. Thomas Bauer	Microcosm

Requirement

- Marine squad of 13 riflemen
- Field supplies
- Any potentially hostile area in the world
- 2 hours transport
- Retrieve

Specification

- Life support for up to 4 hours
- 220 pounds per man
- 150 pounds of supplies per man
- Times 13 men
- Deliverable payload of 4,810 pounds
- Plus the life support system
- Near term assumed to be 5 to 10 years

Solution

- Near term assumed to be 5 to 10 years
- Solution: Existing technology or slight extension
- Far term: Better materials, exotic propulsion, etc.
- Issues: Technical, security, safety, logistical political, policy, economic

Goals of Presentation

- Open session:
  - Characterize concept
  - Outline issues
- Closed session:
  - Specifics
  - Quantitative

Overview - 1

- Hypothetical future
- US may lack network of foreign bases
- Ability to project small force units rapidly
- Essential to US interests

Overview - 2

- LEO requires 90 minutes
- Allowing 15 minutes for orbital insertion
- Allow 15 minutes for de-orbit, re-entry, and landing
- Any location on earth within about 75 minutes of travel time
- Proven aviation technology limited to several thousand MPH
- Worst case of about 12,500 miles requires ***average*** speed of at least 6,250 MPH
- R&D almost certainly falls outside 5 to 10 year range
- Use of, and travel through, space required for near term

Overview - 3

- Extraction is tough nut
- Many conceivable solutions physically possible
- Without enormous R&D budgets, most technically possible approaches are not feasible
- Several are potentially feasible but not practical with current technology
- Timetables exceeding 10 years rejected

Overview - 4

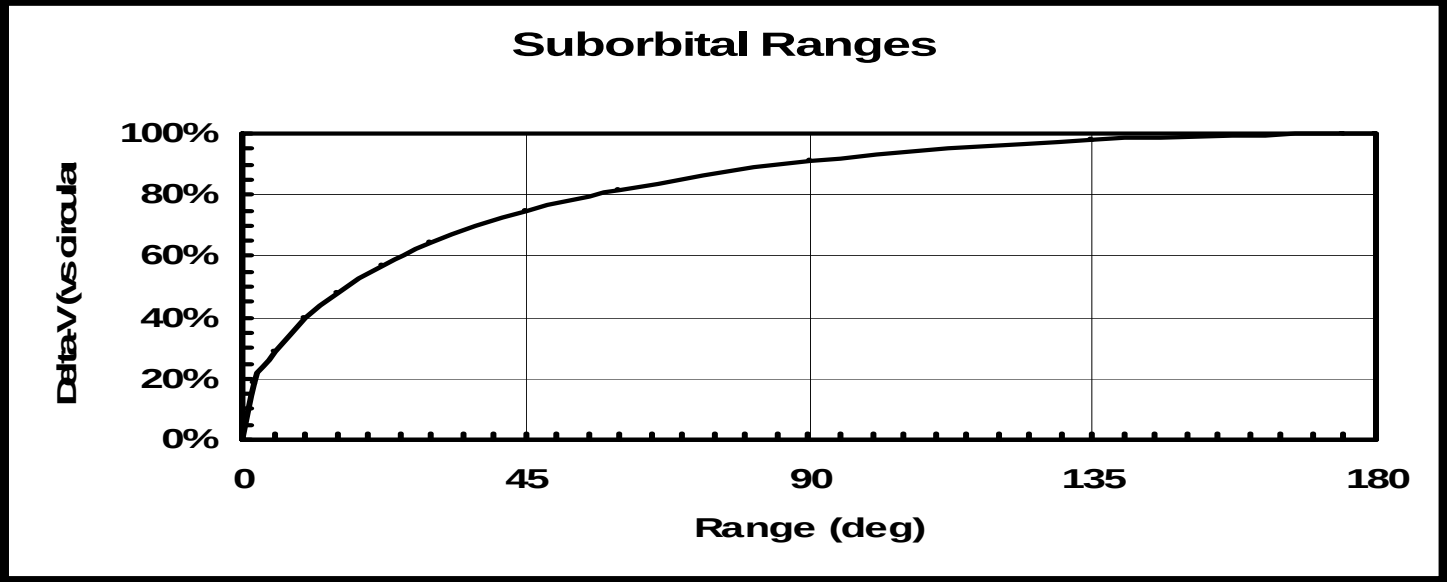
- Vertical take off and landing
- Similar to DC-X concept
- Blue Origin, Armadillo
- High delta-V
- Can’t withdraw and re-enter LZ

Overview - 5

- Aerospace Plane
- Similar to Saanger concept
- Payload, R&D time problematic
- Suborbital space plane payload, TPS
- Delta-V of current concepts

Overview - 6

- Aerospace Plane
- Delta-V = LEO vs current concepts



Overview - 7

- Delta-V = LEO vs current concepts
- Basing on both coasts doesn’t gain much
- Staffed multiple space bases with RVs prohibitive

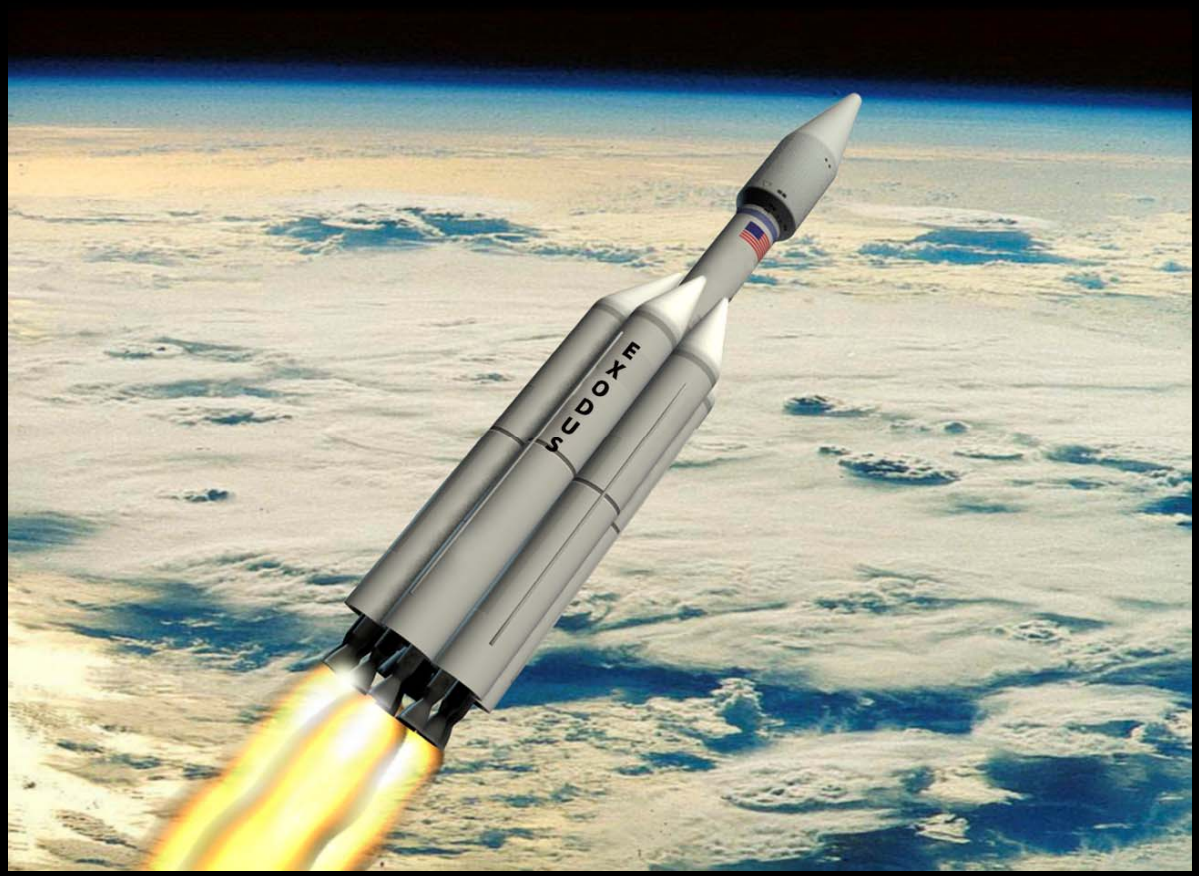
Our Approach - 1

- Infrequent use - storage
- Cost, simplicity, responsiveness, reliability
- 15,000 lb capsule landed
- Existing insertion vehicle concept
- Capsule recovery

Our Approach - 2

- Microcosm Scorpius – Exodus (19,700 lbs to LEO)
- Significant R&D via Responsive Space
- Most major systems developed and flight tested
- Cheap, simple, responsive, reliable, scalable
- Modular 1st and 2nd stages
- Ablative, composite, Tridyne pressurized
- Very few parts, modules drive down production costs
- WSMR 2 flights within 8 hours < 20 men

Our Approach - 3



Our Approach - 4

- Extraction – use AES rocket & FRS
- Fulton Recovery System (FRS) exists
- First tests involved airmen and a very nervous sheep
- The sheep died (strangled)
- Multiple FRS recovery variants

Our Approach - 5

- Pitch capsule after liftoff (alternative)
- Quantitative analysis & defense discussed in closed session
- Timing, security, safety, AC, logistics, mission constraints discussed in closed session

Big Issues - 1

- Political, policy, economic issues may be more difficult than technical and engineering issues
- Byzantine policy organizations, panels, committees influence multiple targets

Big Issues - 2

- Institute For Defense Analysis 2008 report
- National Space Forum 2008, sponsored by Eisenhower Center for Space and Defense Studies at the US Air Force Academy and by the Center for Strategic and International Studies (CSIS)
- Various other CSIS space policy statements
- Center for Defense Information (CDI)
- Private organizations such as the Secure World Foundation
- Relevant books in popular press, such as *Twilight War*

Conclusions

- Doable in 5-10 year timeframe
- Technically feasible
- Capsule and recovery R&D dominate program cost
- Politics & economics trump all
- Detailed report & spreadsheet available for govt and other appropriate people

Acknowledgements

- Coinvestigators/coauthors
- Supported by a study grant from

  CRM, Inc.

  Billings, Montana

THANK YOU !!!