Program Summary
Model 281 Proteus

Proteus Name

Suggested by Peter Lert

A sea-god in Greek mythology who was capable of changing his shape at will [Collins English Dictionary]. In Greek mythology, PROTEUS was the old man of the sea. He was the shepherd of the sea's flocks (seals, porpoises, etc.) and was said to know all things, past present and future. Proteus disliked telling what he knew and, to get information from him, he had to be caught during his midday siesta and bound with ropes. However, catching him was very difficult as Proteus could change his shape and take on any form at all. If he could be caught, Proteus would then answer any question. From this power of being able to assume any shape he pleased, Proteus came to be regarded as a symbol of original matter from which the world was created. His name was the basis of the English word protean meaning flexible or malleable.

Pretty? Ugly?

You decide

The Commercial Telecom Requirement:

Place a large antenna 10+ miles above Population Centers

Steel Tower? - Cannot get a building permit.

Solution - Fly forever in an 8 NM diameter orbit at 52,000 to 65,000 ft.

Carry a big down-looking antenna.

Hold antenna ~ level (pitch & roll) in any winds.

Power and cool 20 to 30 kW for payload.

Operating costs **minimum.**

Reliability **maximum.**

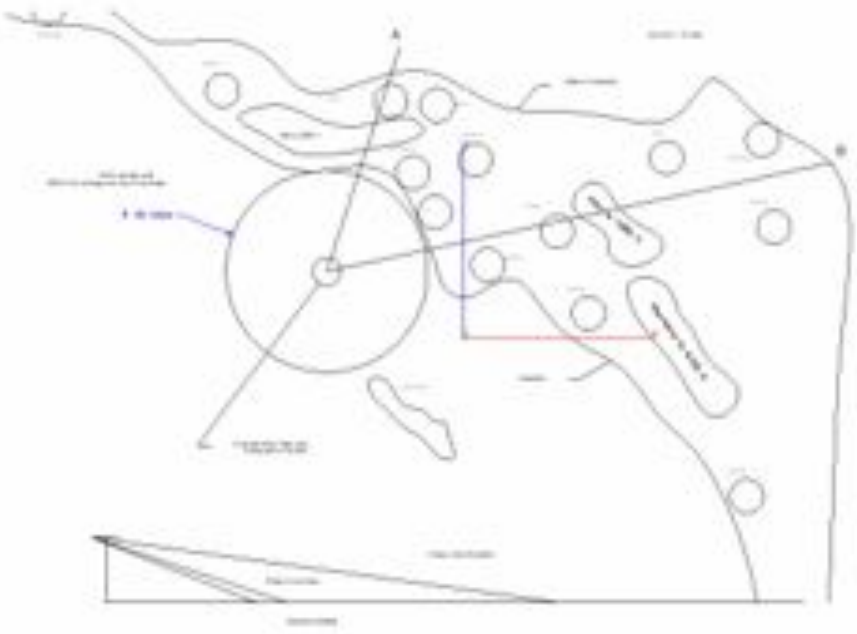
20 ft Dia Antenna

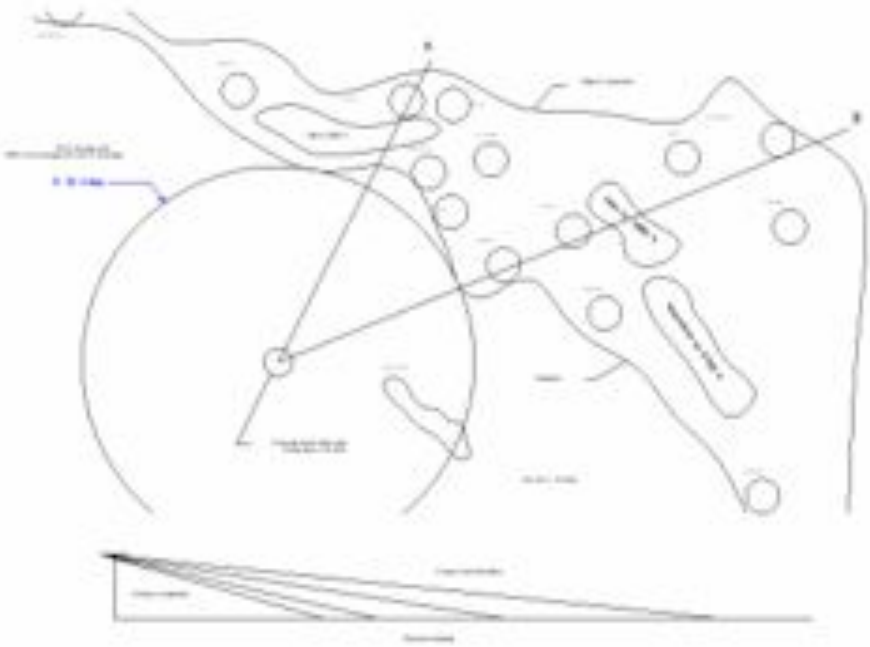
Antenna Front or Side View

Coverage Requirement - All elevations within 15 deg below horizon, all azimuth

Cannot Fly off-shore
Thus UAV is not an option

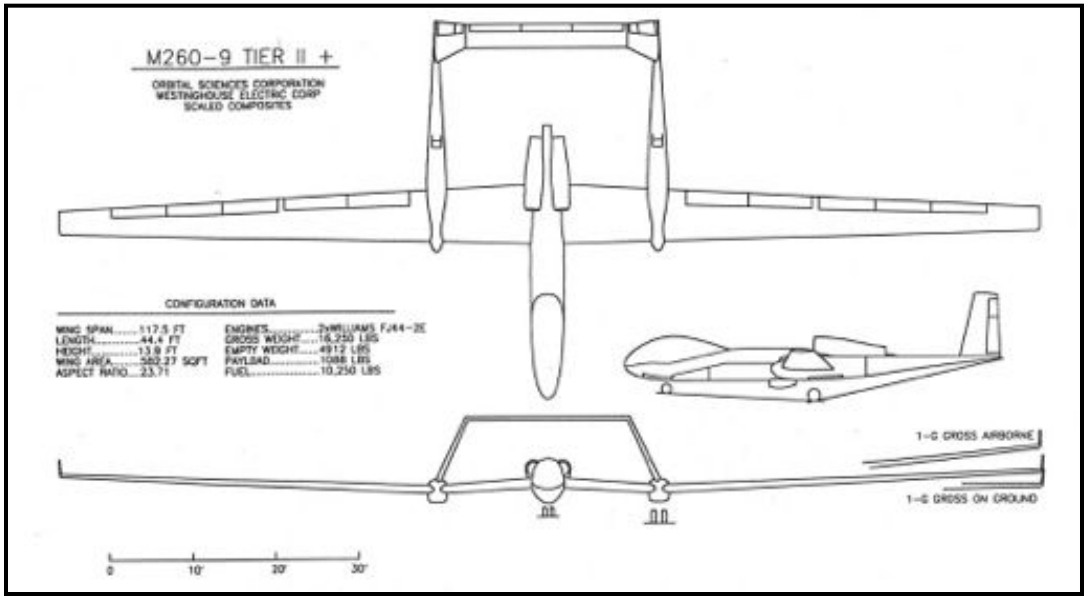
Southern California coverage for an off-shore orbiting UAV

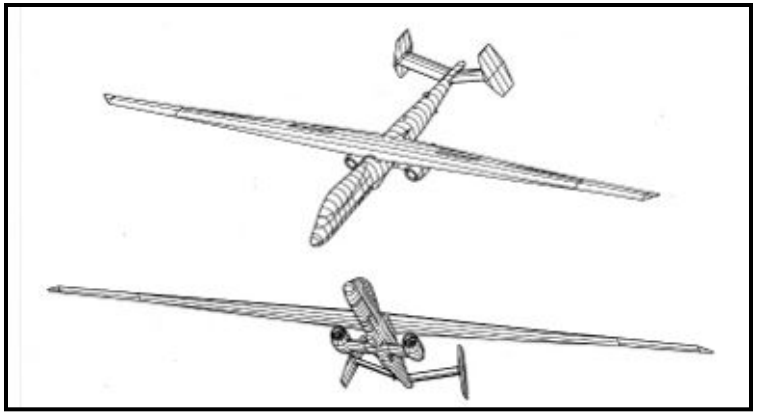




The Scaled Challenge: Manned High-flyer. The courage to try

- Proteus was our first manned high-flyer design; 65kft target. Our previous experience was 41kft (Starship and Triumph).
- Design experience was gained during the Tier-2+ competition in 1994 (OSC, Martin and Northrop). We lost to the Teledyne-Ryan Global Hawk, but we were encouraged to develop a similar-capability aircraft.





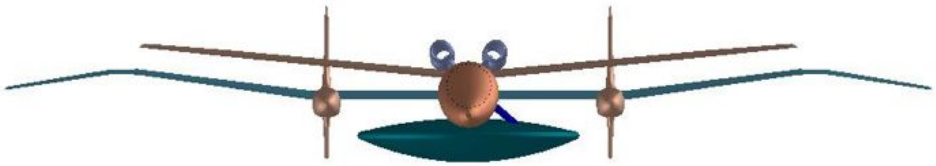
Proteus
Original Telecom Payload
Model 281 Configuration

External, Tilting Antenna

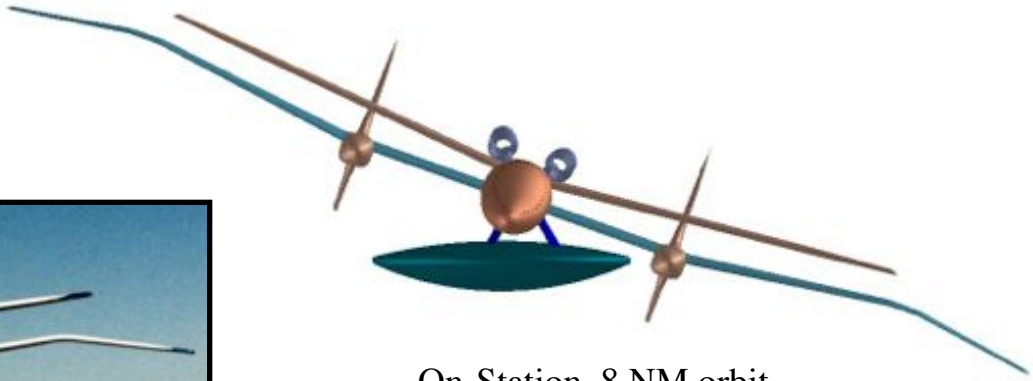
Modular Payload Integration

Wide-Stance Landing Gear

Takeoff/Landing



Loiter



On-Station, 8 NM orbit

Proteus Model 281
Program Schedule Summary

- Prelim Design - Nov 1994 to May 1996
- Decision, by Wyman Gordon to fund Proteus program Nov 96
- Phase 2, detail design and build prototype Dec 96 to July 98.
- Early flight test milestones
  - Runway flights - 25 Jul 98
  - 1st flight Mike Melvill, - 26 Jul 98
  - Flight 10 & 11; Angel and Public flight demos Melvill/Siebold - Sept 22/23 98
  - Flight 13; Phase 1 complete. Shane, 45Kft. - Oct 3 98
- Paris Airshow and European marketing (flight# 24 to 39) – June 1999
- Oshkosh Airshow (flight# 41 to 44) – July/Aug 1999
- World Record Altitude flights, with Pressure suits – Oct 2000
- Customer research flights - proprietary

Photos of the Fun

Photos of the Fun

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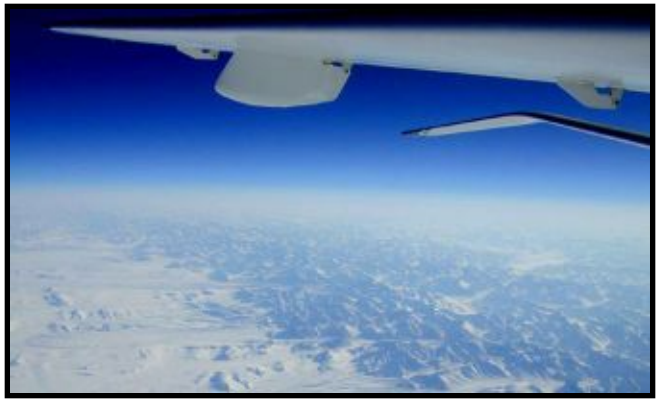
Oshkosh

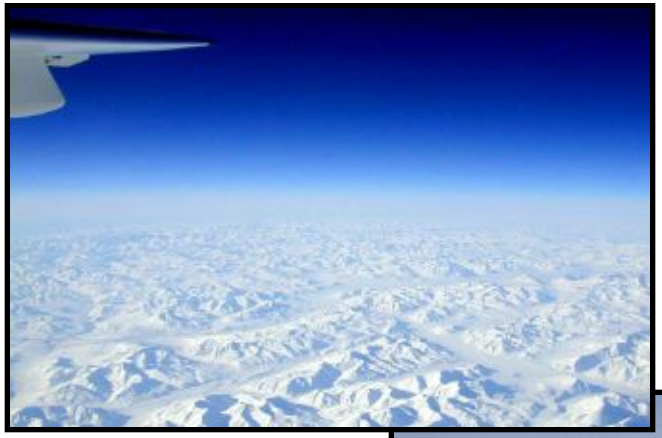
Darwin, Australia

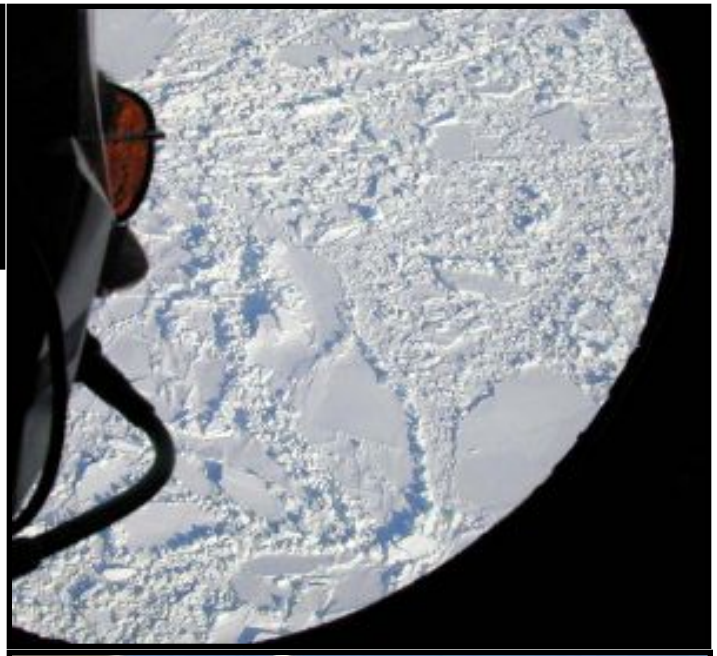
Hawaii

Guam

North to Alaska and the North Pole





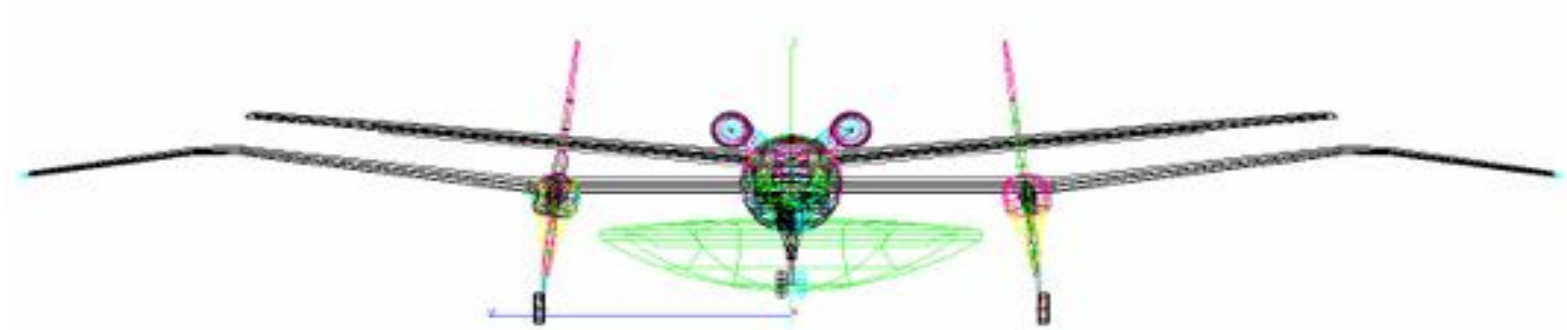


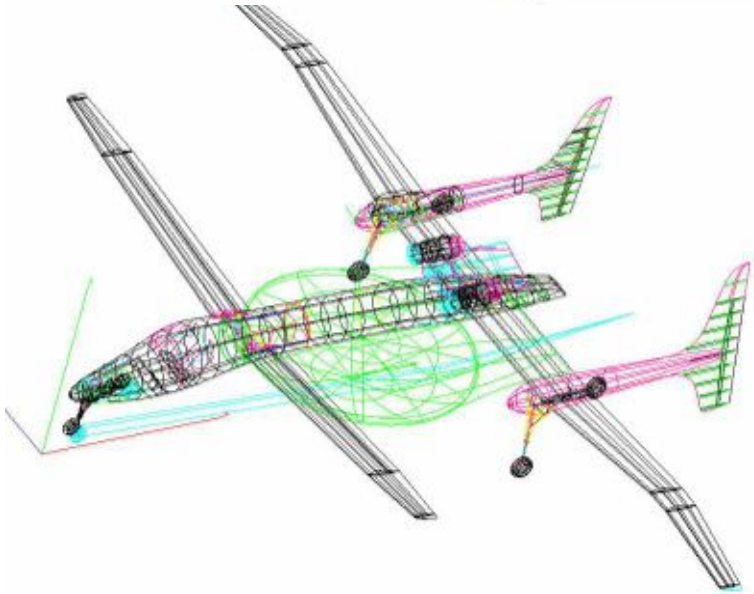
Welcome Home!

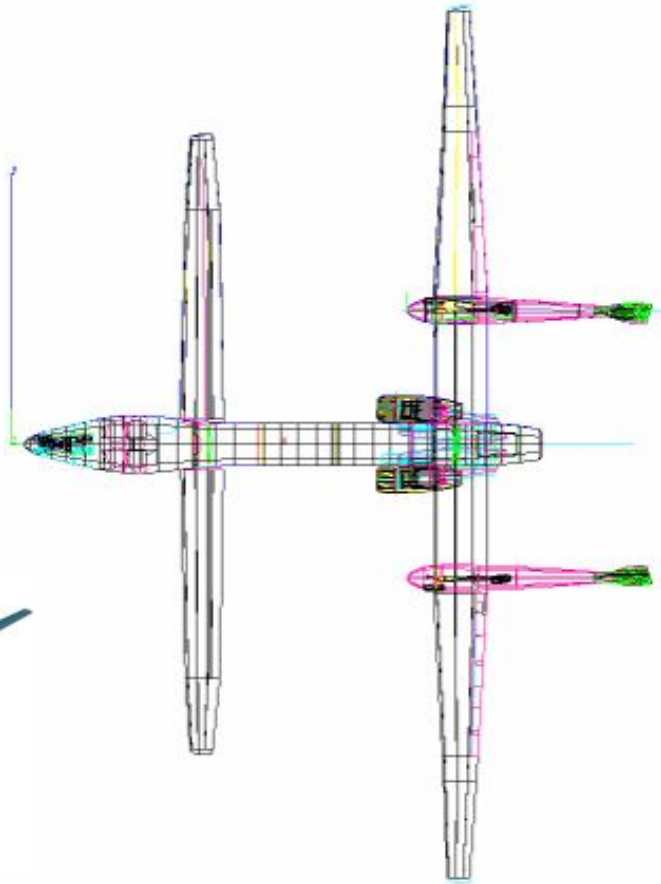
Early Proteus Concepts

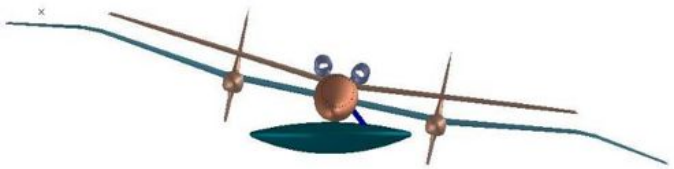
proprietary

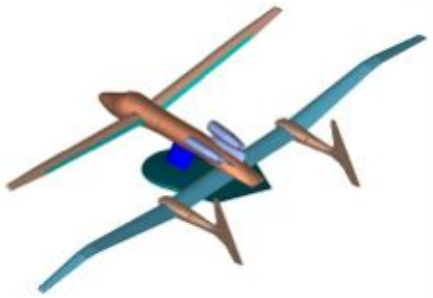
Final Configuration
Model 281-24 Proteus











Proteus
General Mission Capabilities

- Commercial Telecommunications
- Reconnaissance
- Communication/Data Relay
- Atmospheric Sciences
- Micro-Satellite Launch
- Space Tourism

Original Design Spec
Proteus Model 281 N281PR

- Wing span: 78 ft, extendable to 95 ft.
- Total wing area: 479.2 sq. ft.
- Length: 56.3 ft
- Height: 17.6 ft
- Payload Power 20-30 kW
- Empty weight: 5900 lb
- Design gross weight: 12500 lb
- Fuel capacity: 5900 lb

Modularity is Key to Multi-Mission Capability

- Mid Fuselage is a Dedicated Payload Component
- Wing and Canard tips can extend to adapt the Vehicle Aerodynamics to a wide range of Payloads

Proteus
Commercial Telecommunications

- Payload power = continuous, thermal-managed 20 to 30 KW
- Quick reaction vs. tower fill-in
- Operating costs less than satellites
  - Ops cost is primary design driver
- Endurance at 12,500 lb takeoff weight = 12 hours on-station
- Altitude = 52,000 ft to 64,000 ft
- External antennae up to 18 ft dia
  - Active roll tilt or north-aiming
- Continuous Presence Mission

Proteus
Reconnaissance Missions

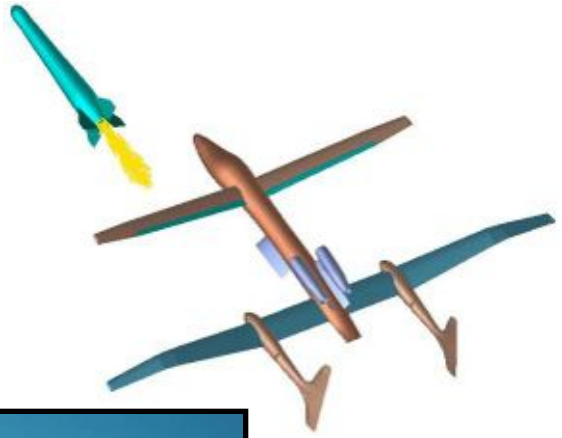
- Payload power = continuous, thermal-managed 20 to 30 kW
- Operating costs very low due to continuous-presence heritage
- On-Station capability (14,000 lb takeoff)
  - 22 hours at 500 NM radius
  - 12 hours at 2000 NM radius
- Altitude = 48,000 ft to 64,000 ft
- External antennae and wing configuration allows uninterrupted field-of-view in turns
- Advantages over large UAV
  - Cost
  - Operational flexibility
  - Reliability
  - Response
  - Easy to adapt payload modifications

Proteus
Atmospheric Science Missions

- Payload power = continuous, thermal-managed 20 to 30 kW
- Operating costs extremely low due to continuous-presence heritage
- On-Station capability (12,500 lb takeoff)
  - 19 hours at 500 NM radius
  - 2 hours at 2900 NM radius
  - Range allows south-pole sampling
- Altitude = 54,000 ft to 66,000 ft
- Advantages over current assets
  - Continuous sampling surveys feasible
  - Operational flexibility
  - Reliability
  - Response
  - Easy to adapt payload modifications

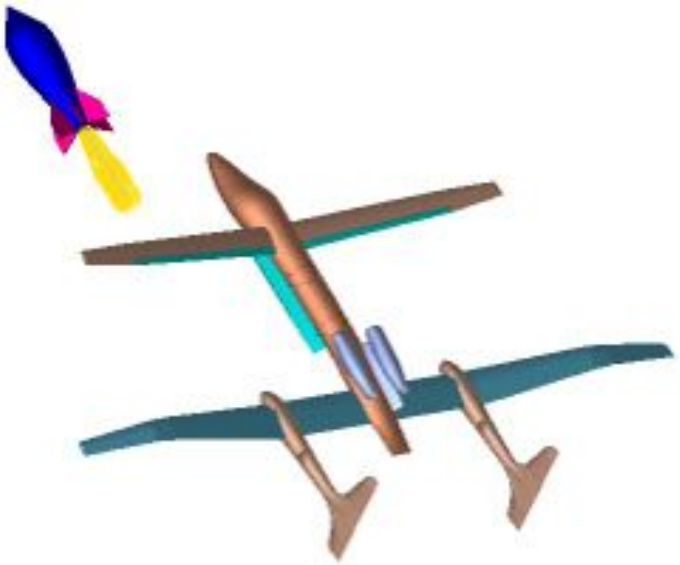
Proteus
Micro Satellite Launch Mission

- Payload to LEO = 70 lb
- First stage operating costs extremely low due to continuous-presence heritage
- Lofted air launch parameters
  - Altitude = 34,000 ft
  - Gamma = 50 deg
  - Velocity = 320 fps
- Launch site flexibility - global
- Rocket vehicle specification
  - GLOW = 6,900 lb
  - Booster reusable (expanded nozzle)
  - Upper stage expendable
- Minimum launch costs (total < 1M$)
  - Launch facility
  - Sea recovery



Proteus
Space Tourism Mission

- Sub-orbital Spaceship with 3-Astronaut crew
- Lofted air launch. Side-saddle, left wings extended.
- Airborne or sea recovery
- Launch parameters
  - Altitude = 32,000 ft
  - Gamma = 62 deg
  - Velocity = 280 fps
- Performance = 140 KM apogee, 4 min at zero-g
- Launch site flexibility - global
- Spaceship specification
  - GLOW = 6,100 lb
  - Thrust 9,400 lb SI = 205 PR = 0.68
  - High-drag reentry/recovery configuration



The Proteus-Launched Spaceship Concept

~1996

proprietary

Proteus
Optionally-Piloted Issues

- Initial Telecom Configuration is Two-Crew
  - Allows near-term operations over population centers
  - Two-pilot certification, single-pilot for on-station
  - Cockpit has 6,000 ft “shirt sleeve” environment at 50,000 ft
  - Sleep cycle on station
  - Lower cost operations than UAV
- Most missions benefit from piloted utility
  - Cost, airfield availability, route flexibility
- Pilot station can be retained even for UAV applications
  - Ferry, FCF, software verification
- Safety Pilots for development of UAV FCS/Autoland

Proteus

- All-composite airframe
  - Some production structure concepts employed
  - Several small windows, small plug-type door
  - Integral fuel tanks

Landing Gear

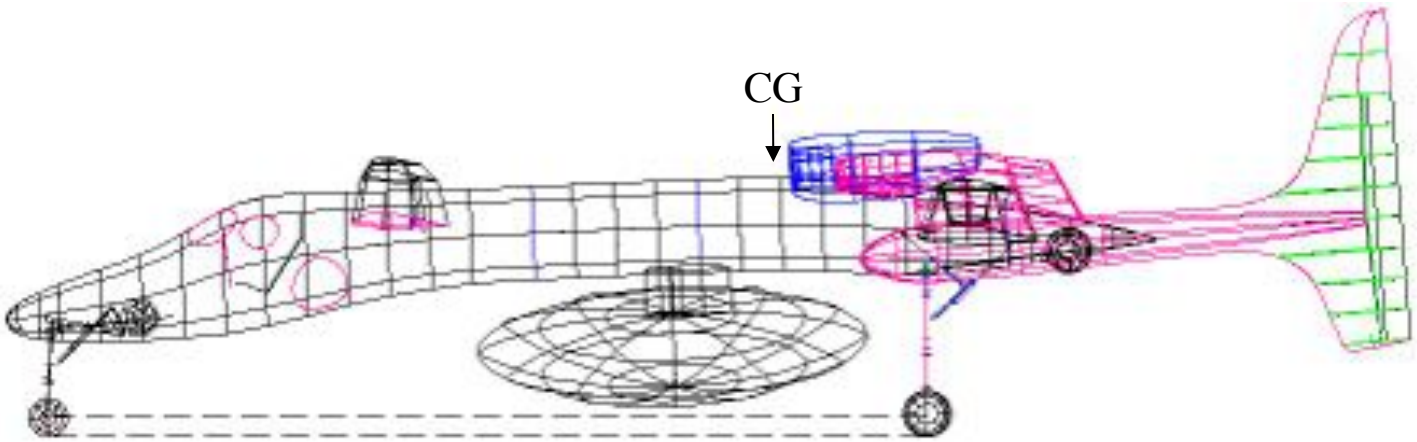
Lift-dump without spoilers

Takeoff - Level fly-off at AOA = -2 deg CL = .65 109 KCAS (aft stick)

Landing - Touchdown mains at AOA = +2 deg CL = 0.9 68 KCAS

Nose gear Slaps-down after touchdown to CL = .25 at AOA = -3 deg (fwd stick)

Dumps 72% of landing lift without needing a spoiler system



Questions?