Briefing for UN/Dream Chaser Mission Payload Providers

John Roth – VP Strategy & Business Development

THE *DREAM CHASER*® SPACECRAFT OVERVIEW

Sierra Nevada Corporation's
Space Systems Business Area

A Legacy of Flight Heritage and Innovation

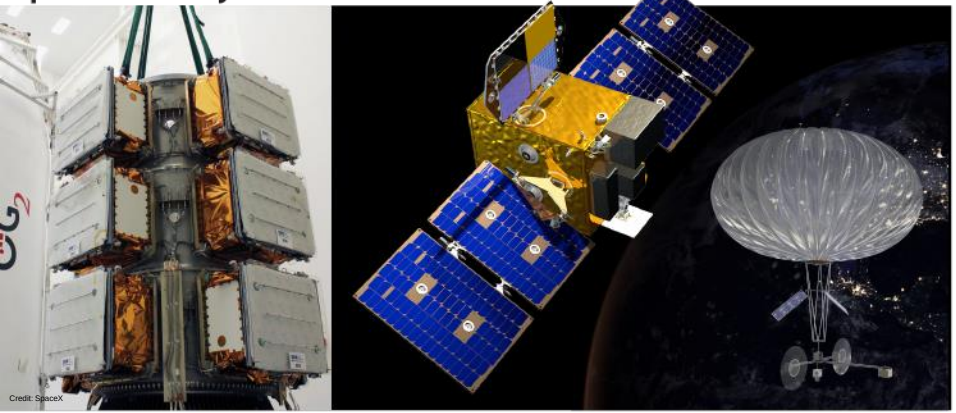
Proven Experience

- 30 years of spaceflight heritage
- 450 space missions supported
- 4,000 products delivered on-orbit
- Launching products ~every 3 weeks
- 70+ successful NASA missions
- Supplier to nearly all flagship and interplanetary NASA missions
- Providing cargo services to the International Space Station under NASA resupply contract

Trusted Supplier to NASA for Interplanetary Missions

Space Systems Product Lines

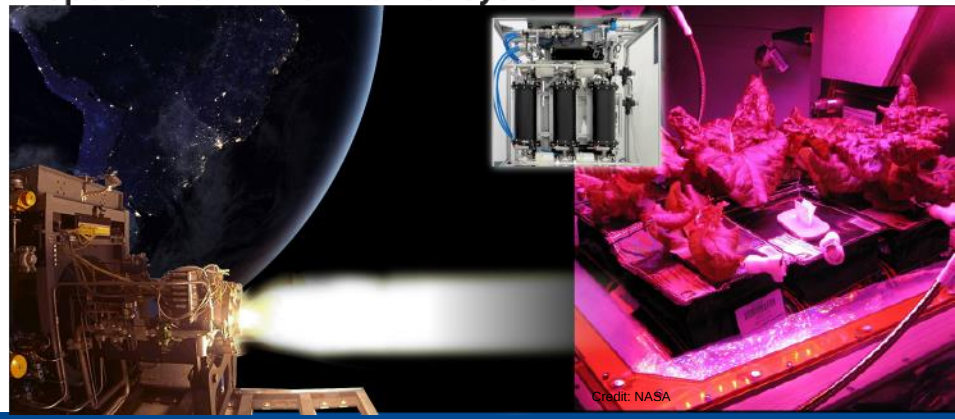
Spacecraft Systems



Space Technologies

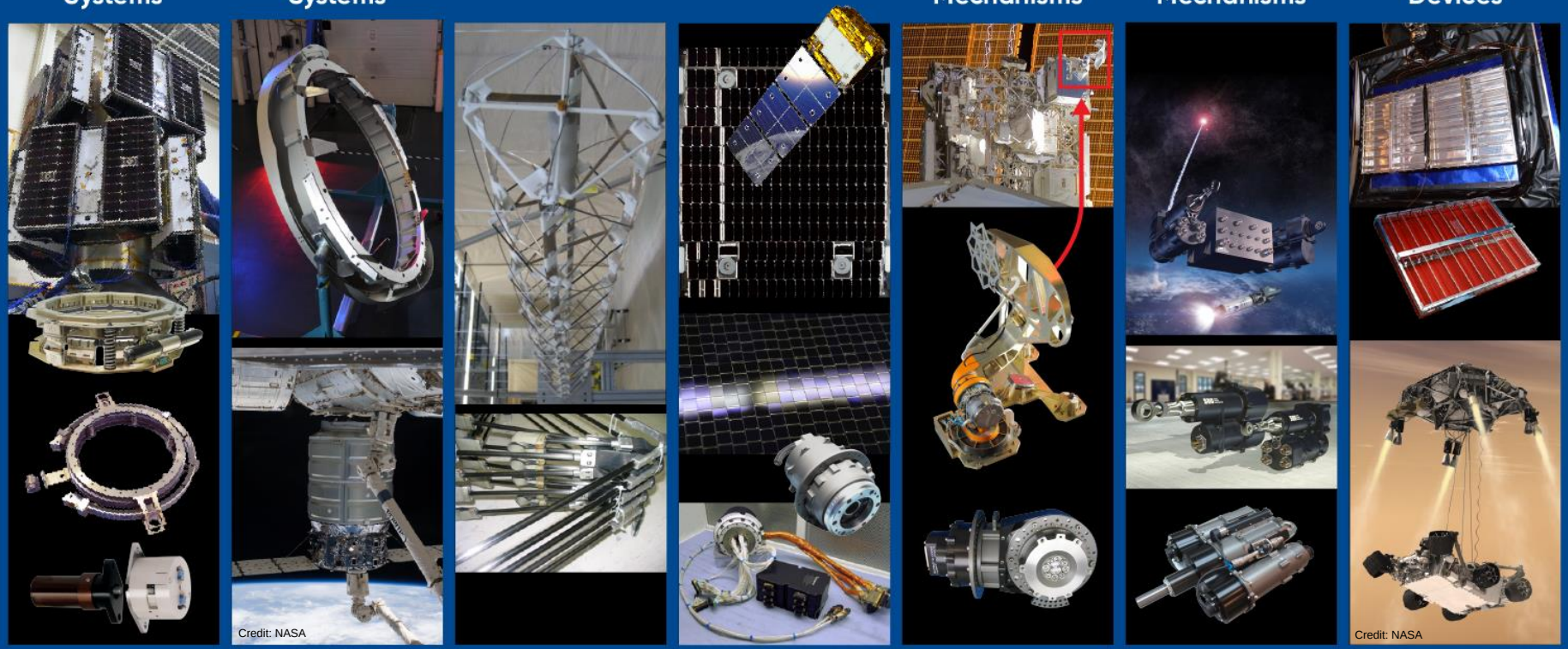
Space Exploration Systems

Propulsion & Environmental Systems



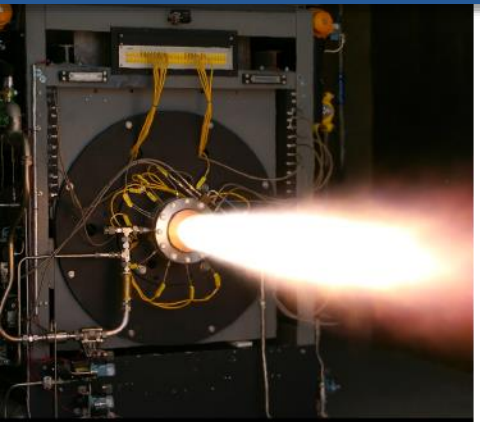
Full Range of Spacecraft Subsystems

Thousands of Products Flown



Propulsion & Environmental Systems

Propulsion Systems

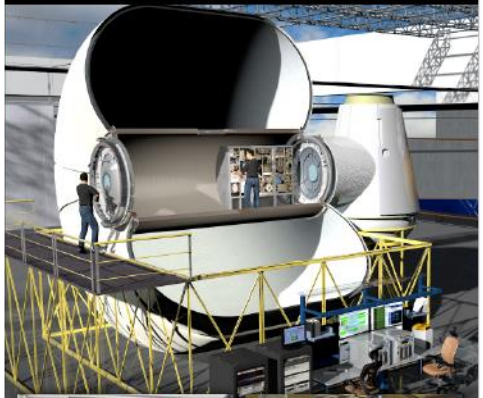


- RCS/ACS
- Upper Stage
- Boost
- In-Space

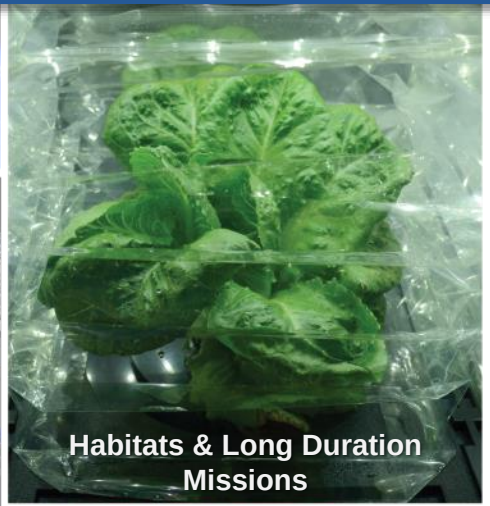
Environmental Control & Life Support Systems

Credit: NASA

Full Close-Loop Systems



Bio-Production & Bio-Products



Habitats & Long Duration Missions

Credit: NASA

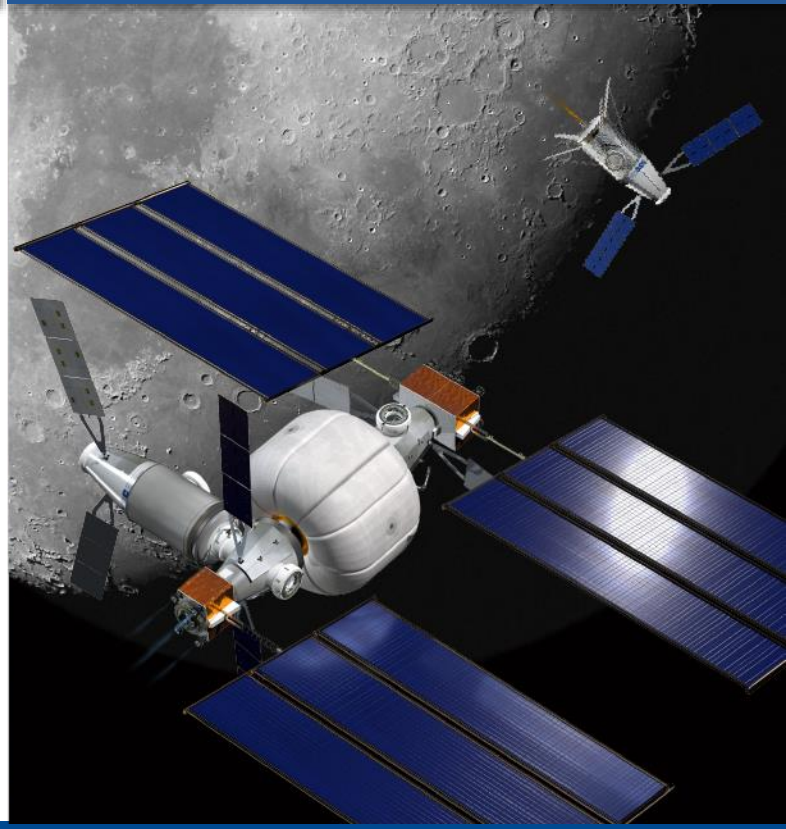
Science Payloads

Space Payloads for Science & Engineering

Space Exploration Systems

Space Transportation & Space Missions

Habitats & Landing Systems



Dream Chaser Space Vehicle

- Only runway-landing Space Vehicle actively in development
  - Capable of landing at spaceports and airports that can accommodate large commercial planes
- Crewed or uncrewed transportation to and from Low-Earth Orbit (LEO)
- Non-toxic propulsion for launch abort, orbital translations, attitude control, deorbit
- < 1.5g re-entry profile and >1,500 km cross-range capability
- Designed to launch on a variety of launch vehicles

Credit: NASA

Crewed Dream Chaser

Uncrewed Dream Chaser

Respect the Past…Embrace the Future

History: Dream Chaser Program

- **1982-84**: ½ scale Russian BOR-4 orbital flights
  - Recovery photographed by Australian Royal Air Force P-3 Orion aircraft
- **1983-95**: NASA Langley development of HL-20 (based on BOR-4 images)

- **2005-10**: SpaceDev (later acquired by SNC) modified the HL-20 into the Dream Chaser spacecraft
- **2010-14**: SNC awarded NASA's CCDev 1, CCDev2, CCiCap and CPC contracts to continue development
- **2014-15**: SNC modified the Dream Chaser spacecraft to become the Dream Chaser Cargo System for NASA's CRS2 program

- **2016:** SNC awarded ISS Cargo Resupply Contract
- **2017:** Successful Approach and Landing Test

NASA CRS2 Program

Cargo Up to Space Station, Disposal and Rapid Cargo/Science Return

Mission Flexibility: 10+ day on-orbit loiter for pre-docking checks and phasing

Mission Capability: Propulsion used for ISS dock/undock, deorbit, entry and ISS reboost

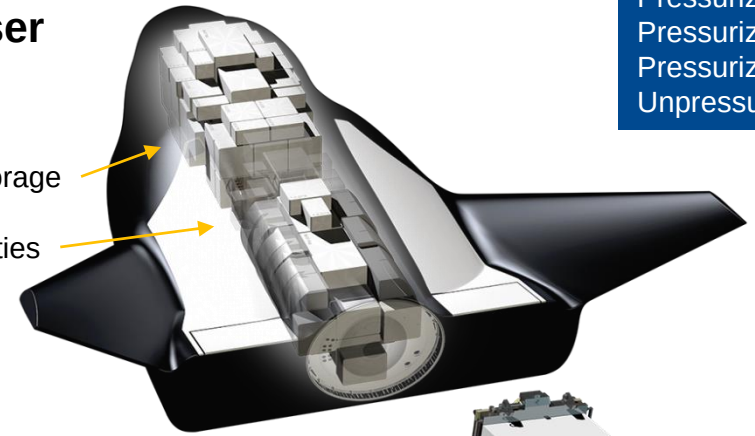
CRS2 Concept of Operations (Video)

Dream Chaser Cargo System Features

Pressurized/Unpressurized Upmass:	5,500 kg
Pressurized Return:	1,925 kg
Pressurized Disposal:	3,250 kg
Unpressurized Disposal:	1,500 kg

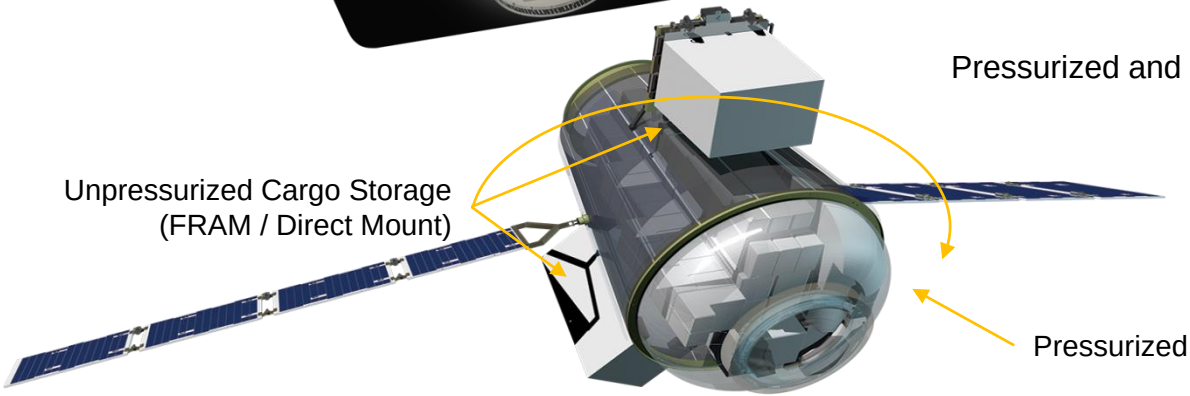
Uncrewed Dream Chaser

Pressurized Cargo



Cargo Module

Pressurized and Unpressurized Cargo



Extensive Testing on Prototypes

Credit: NASA

Credit: NASA

Dream Chaser Atmospheric Flight Test Vehicle at NASA's Armstrong Flight Research Center

SNC Dream Chaser: A Salute to the Past

NASA Armstrong Flight Research Center: 40 Years of Flight Testing

Credit: NASA

Shuttle Enterprise 1977

Dream Chaser 2017

Making Space History

NASA's Space Shuttle Enterprise

Final Flight
October 26, 1977

SNC's Dream Chaser engineering test article

First Flight
October 26, 2013

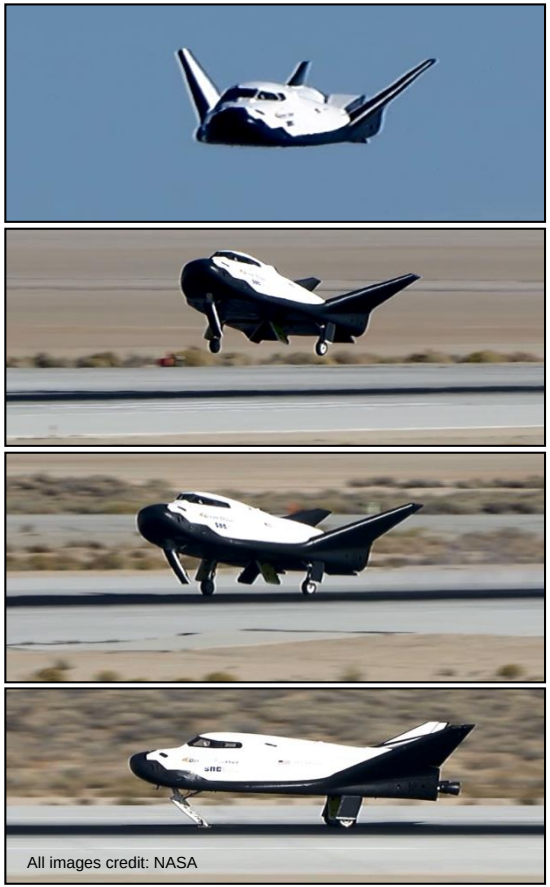
Second Flight
November 11, 2017

All images credit: NASA

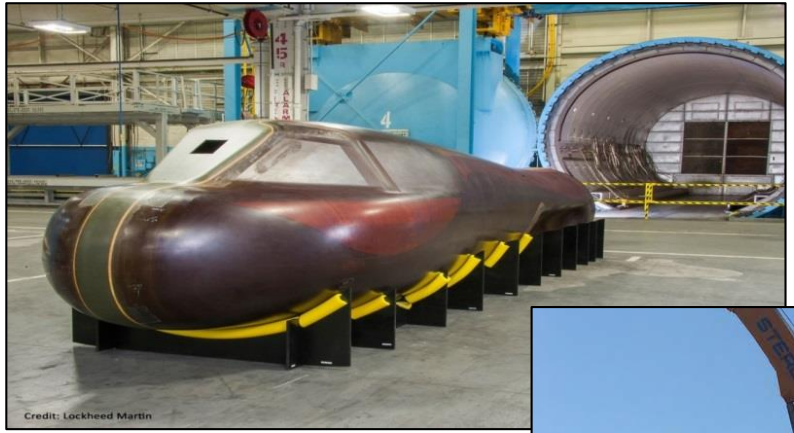
Dream Chaser Flight Test

November 11, 2017

- **Conducted at Edwards AFB, California**
  - Supported by NASA Armstrong Flight Research Center
  - Carried to altitude by a Columbia Helicopters Model 234-UT Chinook
- **Drop Parameters**
  - Release altitude: 12,324 ft
  - Release equivalent air speed: 66 mph
  - Max Speed attained: 330 mph
  - Flight Duration: ~60 seconds
- **Landing Parameters**
  - Landing speed: 191 mph
  - Touchdown point: 1,250 ft down runway
  - Rollout distance: 4,200 ft
- **Results**
  - Validated the aerodynamic performance of the spacecraft in the final approach and landing phase of flight
  - Validated orbital vehicle avionics and flight software


All images credit: NASA

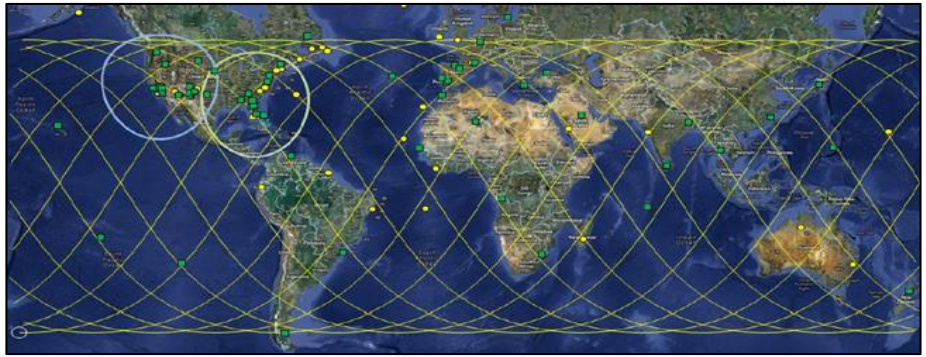
Dream Chaser Orbital Vehicle in Production



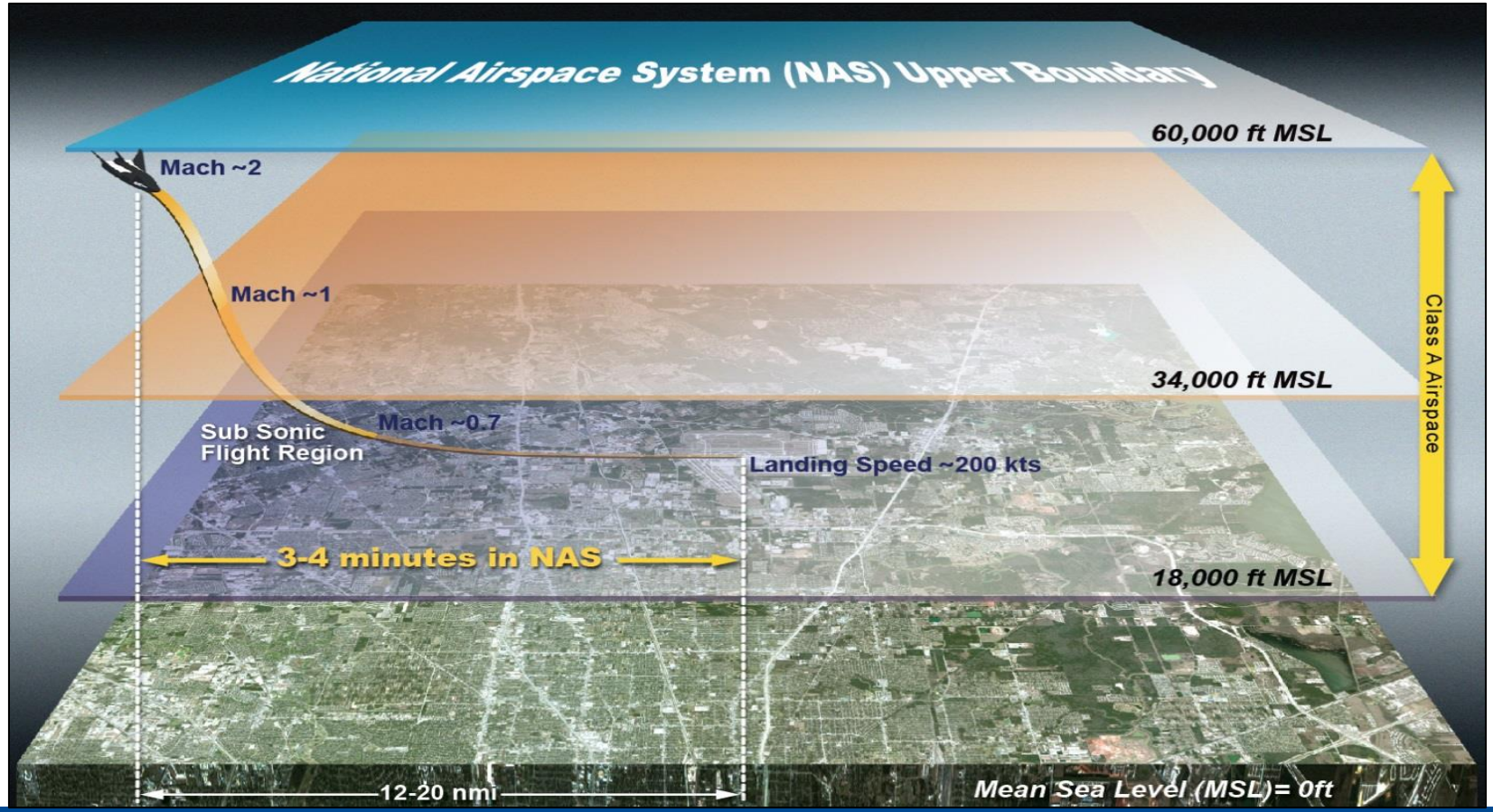
Orbital Vehicle Pressure Test Article (PTA) for modal testing

Dream Chaser Landing Capability

- **Low-toxicity fluid commodities to enable runway landings around the world**
  - Can land at any runway that supports a B737 or A320 aircraft
- **Basic runway landing**
  - Nominal 3,000 meter
  - >1,000 nmi cross-range capability
- **Tri-landing gear configuration**
  - Two main landing gears with wheels
  - One nose landing gear with a nose skid
- **Licensing and approval must be in place before a landing**

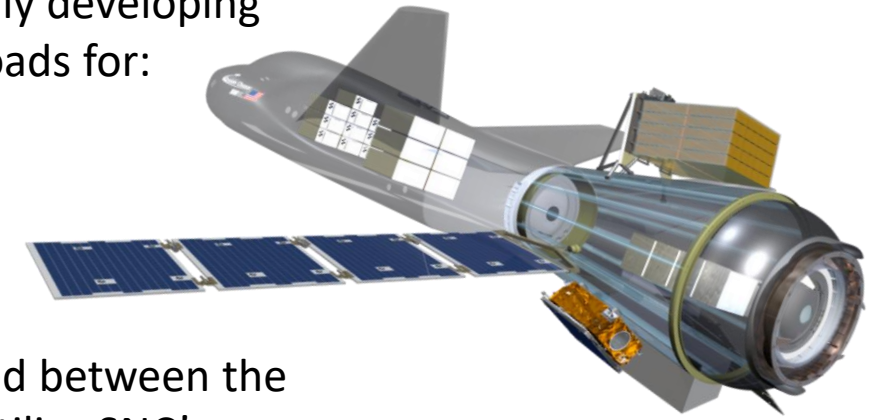


Dream Chaser Impact on Local Airspace



United Nations / Dream Chaser Mission*

- Most ambitious program under HSTI is to fly the first United Nations sponsored, multi-country space mission that will provide Member States, especially developing countries, the ability to build and fly payloads for:
    - Microgravity science
    - Remote Earth sensing
    - Hardware qualification

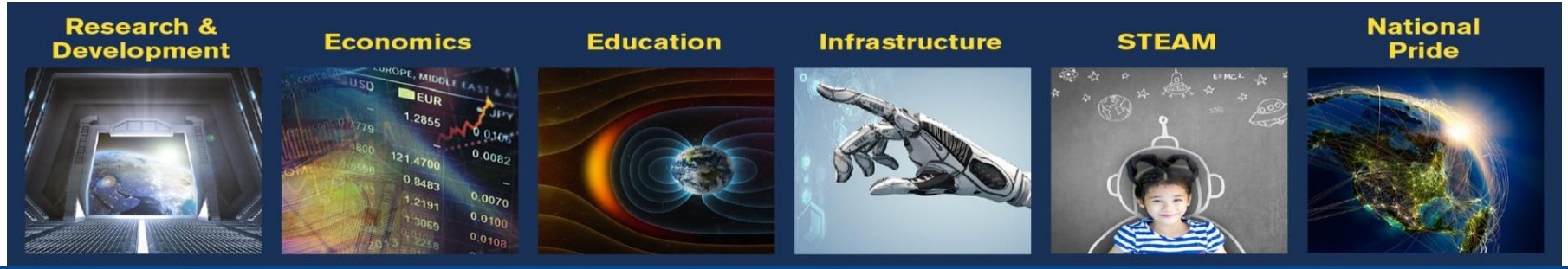


- Memorandum of Understanding concluded between the United Nations and SNC in June 2016 to utilize SNC's Dream Chaser space vehicle as the host for UN Member States payloads

*Working title; based on UNOOSA/SNC collaborative effort of utilizing Dream Chaser for the benefit of developing countries

Benefits for Participating Countries

- **Research & Development:** of new space-related knowledge-based industries to support space science understanding and development of experiments in diverse economic sectors.
- **Economic:** growth in high technology fields.
- **Education:** formation of academic centers of excellence to study various aspects of space: space sciences, environmental sciences, atmospheric physics, etc.
- **Infrastructure:** creation of the supporting infrastructure for development of experiments, robotics for manipulating experiments and providing ground operations for (their) space missions.
- **STEAM:** inspire participation in the space program, encouraging education and work in science, technology, engineering, arts and mathematics (STEAM).
- **Pride:** of supporting international cooperation and global promotion of peaceful uses of outer space.



UN / Dream Chaser Mission Call for Interest

- **Purpose**
  - To determine interest level from member countries to have a free-flight mission
  - Get a preliminary understanding of the types of payload accommodations of interest
    - Internal, external, satellite deployment

- **Results**
  - Exceeded our expectations
  - 150 Responses from 75 countries
  - Variety of payload types

Orbital Space Mission
UNOOSA Call for Interest

APPLICATIONS FROM: 25 SEPTEMBER - 15 NOVEMBER 2017

Important Links:

Call for Interest and Response Form

The United Nations Office for Outer Space Affairs (UNOOSA) is partnering with the Sierra Nevada Corporation (SNC) to offer United Nations Member States the opportunity to participate in an orbital space mission utilizing SNC's Dream Chaser® space vehicle. The mission will be open to all Member States of the United Nations, and developing countries are particularly encouraged to participate. The mission will carry experiments, payloads, or satellites provided by institutions in the participating countries.

The purpose of this Call for Interest (CFI) is to provide a summary of the proposed mission and to solicit information from Member States interested in providing experiments, payloads, or satellites that could be flown on this mission. The CFI also has the objective of gathering information on the interested countries so that UNOOSA may better understand the demand for this type of mission.

This mission will be the first space mission devoted to addressing the Sustainable Development Goals.