Briefing for UN/Dream Chaser Mission Payload Providers
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

Missions

- SOHO (L1)
- WIND
- Genesis
- Parker Solar Probe
- Messenger
- Venus Express
- Lunar Prospector
- Lunar Reconnaissance Orbiter
- Clementine
- SMART-1
- Over 300 missions
- Mars Observer
- Mars Odyssey
- Mars Pathfinder
- Mars Polar Lander
- Mars Phoenix Lander
- Mars Surveyor
- Mars Exploration Rovers (Spirit & Opportunity)
- Mars Science Lab (Curiosity)
- Mars 94
- Mars 2001
- Juno
- Europa
- Cassini
- New Horizons
- Dawn
- OSIRIS-REx
Space Systems Product Lines

Spacecraft Systems

Space Technologies

Space Exploration Systems

Propulsion & Environmental Systems
Full Range of Spacecraft Subsystems

Launch Adapters & Separation Systems
Docking & Berthing Systems
Deployable Structures
Electrical Power
Pointing & Motion Control Mechanisms
Flight & Thrust Vector Control Mechanisms
Thermal Control Devices

Credit: NASA
Space Exploration Systems

Crewed & Uncrewed Dream Chaser Space Vehicle

- Cargo Services to ISS
- Science
- Servicing
- Observation
- Exploration Support

Space Transportation & Space Missions

Habitats & Landing Systems

Credit: NASA
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
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

Credit: NASA
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
Dream Chaser Cargo System Features

Uncrewed Dream Chaser
Pressurized Cargo

Pressurized Cargo Storage
Powered Payload Capabilities

Pressurized and Unpressurized Cargo

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

Cargo Module
Pressurized and Unpressurized Cargo

Unpressurized Cargo Storage (FRAM / Direct Mount)
Pressurized Cargo Storage
Extensive Testing on Prototypes

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

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
Dream Chaser Flight Test
November 11, 2017

• **Conducted at Edwards AFB, California**
  o Supported by NASA Armstrong Flight Research Center
  o Carried to altitude by a Columbia Helicopters Model 234-UT Chinook

• **Drop Parameters**
  o Release altitude: 12,324 ft
  o Release equivalent air speed: 66 mph
  o Max Speed attained: 330 mph
  o Flight Duration: ~60 seconds

• **Landing Parameters**
  o Landing speed: 191 mph
  o Touchdown point: 1,250 ft down runway
  o Rollout distance: 4,200 ft

• **Results**
  o Validated the aerodynamic performance of the spacecraft in the final approach and landing phase of flight
  o 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

- Mach ~2
- Mach ~1
- Subsonic Flight Region
- Mach ~0.7
- Landing Speed ~200 kts
- 3-4 minutes in NAS
- 12-20 nm
- 60,000 ft MSL
- 34,000 ft MSL
- 18,000 ft MSL
- Mean Sea Level (MSL) = 0 ft

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

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