

# SPACEFLIGHT Sherpa OTV Program Update

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### Our Mission

Get anyone into space.

Exactly where they want to go.

Exactly when they want to go.



# New Office and Integration Facility - Bellevue

- Combined design, production, integration, mission operations facilities
- Doubled the office and clean room square footage to accommodate increased production
- On-site customer offices for joint programs



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### Spaceflight Heritage – Real Hardware, Real Missions

#### 2011-2022: 45+ Rideshare Missions, >450 Satellites Launched

- Spaceflight's legacy business is providing rideshare accommodations, mission management, and launch vehicle integration for small satellite missions
- Spaceflight designs and builds adapter structures, deployment avionics
- This heritage has created a culture geared toward integrating low cost, high reliability COTS systems into mission

#### 2019: 1<sup>st</sup> Commercial Rideshare Mission to GEO/Lunar

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- On the GTO-1 mission, Spaceflight provided rideshare accommodations and mission management for the first private and first Israeli mission (Beresheet-1) to the Moon's surface on a GTO launch in 2019
- Also carried AFRL experimental small satellite to GEO

#### 2021: First Sherpa Spacecraft Missions

- Spaceflight grows from smallsat launch provider to spacecraft design and operations with its Sherpa Orbital Transfer Vehicles
- January 2021: Launched Sherpa-FX, a basic Sherpa variant with deployment capabilities for small satellites
- June 2021: Launched Sherpa-LTE, equipped with Hall Effect electric thruster and full avionics suite

#### 2023: First Cislunar Sherpa Mission

- Announced in 2021, GEO Pathfinder will be the first Sherpa to operate in cislunar space
- Deploying from Intuitive Machines' IM2 launch at TLI, the Sherpa-ES vehicle will fly around the moon and circularize in a super-GEO orbit using bipropellant chemical propulsion system before deploying customer payloads











# The Spaceflight Toolbox

- Flexible, end-to-end launch services
  - All launch options available to U.S. customers via single contract
  - Dedicated launch and rideshare services
  - Full engineering, integration, and mission management services
  - January 2022 Awarded NASA KSC Venture-Class Acquisition of Dedicated and Rideshare Launch Services (VADR) contract. IDIQ task order to provide FAA licensed commercial launch services for NASA and NASA-sponsored payloads to a variety of orbits.
- In-space Orbital Transfer Vehicles (OTVs)
  - Spaceflight's Sherpa OTVs with either chemical or electric propulsion
  - All small spacecraft sizes supported (CubeSat to 500 kg microsats)

### The Sherpa Program

A mothership for small spacecraft

Best-in-class chemical and electric propulsion

Hosted payload capabilities



### Sherpa Is a Rideshare-Sized Small Spacecraft



- Most Sherpas act as Orbital Transfer Vehicles (OTVs) for moving small satellites (3U to micros) to destination orbits
- Sherpa can also be configured as a shared or dedicated bus for hosted payloads
- Designed to minimize cost per-mission by combining common core systems (structure, EPS, avionics) with modular missionspecific systems (propulsion, comms, and separation systems)
- Sized to take advantage of the growing number of rideshare opportunities for LEO, GEO, and lunar destinations by mating to a 24" port on an ESPA ring
- Modular payload accommodations enable a variety of deployed satellites or hosted payloads

Sherpa mounted on the 24" port on an ESPA ring

### Launch Vehicle Diversity Means More Options for Launch

### Same Sherpa for all launch vehicles

- Launch vehicle and orientation agnostic design
- If it fits, it can fly

If your launch is delayed, Sherpa standardization enables the opportunity to move between missions!

Sherpa as a prime on a dedicated small launch vehicle

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Sherpa as a prime on a medium launch vehicle Rideshare

# Sherpa Spacecraft Family / Flight Status

#### Sherpa-FX

Basic deployment of multiple smallsats from one ESPA port



On orbit (1st launch Jan 2021)

- "Port expander" for small satellites on LEO launch
- Includes a deployment sequencer, 1-way comm system, but no propulsion or attitude control
- Deploys up to 16 spacecraft

#### Sherpa-AC

Spacecraft bus with power, data, and attitude control for hosted payloads



#### On orbit (1st launch May 2022)

- Full avionics suite, ADCS, EPS (solar panels, batteries, etc) and 2-way up/downlink
- Can be hosted payload platform and deploy small satellites



Sherpa-LTE

Fully featured "space tug"

utilizing electric propulsion

#### On orbit (1st launch June 2021)

- Same capabilities as AC with high specific impulse, low thrust electric propulsion using Hall Effect thrusters
- Over 1000 m/s delta-V for 50kg of payload

#### Sherpa-LTC

Faster transfers using high thrust chemical propulsion



#### On orbit (1<sup>st</sup> launch Sept 2022)

- Same capabilities as AC with bipropellant chemical propulsion system from Benchmark Space Systems
- Over 500 m/s delta-V for 50kg of payload

#### Sherpa-ES

SPACEFLIGHT,

High total impulse small satellite sized spacecraft for GEO and cislunar mission



#### First Launch: 2023

- Utilizing heritage from Sherpa AC, LTE, LTC, with upgrades for GEO/cislunar environment
- Same propulsion system as LTC, with larger tanks
- Over 2200 m/s delta-V with 50kg payload

### SPACEFLIGHT/

# Sherpa-AC1

Hosted payload mission to take advantage of Sherpa's capabilities Commissioning still underway.



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# Sherpa-LTC2

Propulsive

Launched September 4 as part of the STARLINK-3 mission.

Undergoing commissioning at this time – everything nominal so far.

Carries Boeing's Varuna Technology Demonstration Mission, or Varuna-TDM as sole hosted payload.

Plan to use Sherpa on-board propulsion to orbit raise Varuna-TDM to its intended orbit.



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## Sherpa-ES Overview

Improved structure to be lighter and carry more mass

Avionics upgrades

- Adding ranging
- Payload electrical interface
- **Propulsion upgrades** 
  - Adding RCS
  - More propellant

# Building on the existing Sherpa modularity





# Getting to GEO with Spaceflight

### A new way: slingshot around the moon

- Launch vehicle places customer spacecraft on "free return" trajectory to moon
- Spacecraft uses Lunar gravity assist to adjust inclination and return altitude
- Customer spacecraft or Sherpa uses propulsion for GEO circularization
- Delta-V = 1200 m/s
  - Approximately 25% reduction in delta-V and only one Van Allen radiation belt passage (unpowered)
  - 15-day transfer

### First demonstration will be GEO Pathfinder



# Introducing GEO Pathfinder

### **Demonstrating path to GEO**

- Secondary payload on Intuitive Machines' IM-2 South Pole mission
- Launching no earlier than 1 June 2023



View during lunar flyby



Sherpa-ES



# Summary

- Sherpa program has 3 active vehicles currently on-orbit all operating nominally.
- Sherpa-AC1 first flight (2 hosted payloads and 3 smallsats) launched on May 25<sup>th</sup> – undergoing commissioning at this time.
- Sherpa-LTC2 first flight w/ onboard propulsion (Boeing hosted payload) launched on September 4<sup>th</sup> – undergoing commissioning at this time
- Spaceflight's family of launch options and Sherpa-based services are opening cis-Lunar space to customers
- Innovative techniques for accessing GEO to be demonstrated in 2Q23 on IM2 lunar south pole launch



### Thank you for attending!

Contact me with any questions, or reach out on social media:

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To learn more about Sherpa and to download the Sherpa payload users guide visit our website at: https://spaceflight.com/sherpa/