Proposal Summary: Ampaire Inc

Proposal Information

Topic Title:	**Electric and Hybrid Electric Systems for Unmanned Aerial Vehicle (UAV) and Aircraft in the 1500 to 5000 lbs size class**
Proposal Title:	**High Efficiency Powertrain for Hybrid Aircraft (HEPHA)**

Small Business Concern

Firm:	**Ampaire Inc**
Address:	**3507 Jack Northrop Ave, Hawthorne, CA 90250**
Phone:	**(310) 507-9329**

Principal Investigator:

Name:	**Dr. Edward Lovelace**
E-mail:	**ed@ampaire.com**
Address:	**3507 Jack Northrop Ave, Hawthorne, CA 90250**
Phone:	**(617) 335-8162**

Business Official:

Name:	**Alison Matthews**
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Phone:	**(310) 853-0974**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 4

End: 4

Technical Abstract (Limit 2000 characters, approximately 200 words):

Ampaire proposes to develop hybrid electric powertrain technology consisting of a modern JetA/SAF engine plus electric machine in a hybrid electric configuration to enable flexible implementation in a number of aircraft applications. The JetA/SAF engine is a modern, high efficiency compression ignition (CI) engine from subcontractor DeltaHawk (Racine, WI) that will be coupled to Ampaire's custom electric machine and mechanical integration to provide several key features: enabling multi-mode hybrid electric operation, significant reduction in fuel use, and the potential to integrate the technology onto Ampaire's flying testbed in Phase 2.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

Hybrid electric manned and unmanned aircraft applications including the NASA SUSAN roadmap.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

Ampaire's roadmap of commercial certified hybrid electric aircraft.

Duration: **6**

Proposal Summary: Canopy Aerospace Inc.

Proposal Information

Topic Title:	**Enabling technologies for the development of a robust Low-Earth Orbit Economy**
Proposal Title:	**Reusable Heatshields through Additive Manufacturing (RHAM)**

Small Business Concern

Firm:	**Canopy Aerospace Inc.**
Address:	**520 S State St APT 1624, Chicago, IL 60605**
Phone:	**(859) 333-3696**

Principal Investigator:

Name:	**Mr. Matt Shieh**
E-mail:	**matt@canopyaerospace.com**
Address:	**520 S State St APT 1624, Chicago, IL 60605**
Phone:	**(859) 333-3696**

Business Official:

Name: **Dr. John Howard**
E-mail: **john@canopyaerospace.com**
Address: **203 Yoakum Parkway Apt 705, Alexandria, VA 22304**
Phone: **(301) 602-0456**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 4
End: 6

Technical Abstract (Limit 2000 characters, approximately 200 words):

NASA has a stated strategic goal to promote a commercial presence in LEO, as formalized in their Commercial LEO Destinations (CLDs) program. Given the emphasis on transitioning to CLDs, highly available thermal protection system (TPS) manufacturing has become an even more critical capability. Unfortunately, the reusable TPS materials such Alumina-Enhanced Thermal Barrier (AETB or "Shuttle Tile") developed for the Shuttle program are still the state-of-the-art option despite long lead times and incredible amounts of manual labor (~2 tiles/week/technician).

To fill this gap, Canopy Aerospace Inc. (Canopy) proposes to develop a new Reusable Heatshields Additive Manufacturing (RHAM) platform, that allows rapid production of reusable TPS tiles with digitally defined tailorability. The proposed development of RHAM will leverage Canopy's experience in advanced manufacturing of thermal protection system materials. RHAM advantages are made possible by the unique Canopy innovations that include: 1) New TPS material formulations that open up the space of usable precursors and manufacturing routes; 2) Unique implementation of a state-of-art binder jetting process to produce highly insulative ceramics; and 3) New heat treatment processes for forming mechanically resilient porous ceramics.

Canopy's Phase I RHAM project will evaluate the technical feasibility of using an innovative additive manufacturing approach for producing TPS ceramic materials that exceed NASA standards, establishing the foundation for a new suite of high-quality tailorable TPS products.

In Phase II, the RHAM will reach technology readiness level (TRL) 6 and be ready for initial testing for potential transition to both NASA and commercial space companies.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

The proposed RHAM addresses the major NASA strategic goal of enabling the commercial LEO economy. The RHAM production system will reduce or fully remove the need for the costly machining of reusable TPS materials and promote the commercial LEO economy, directly in support of NASA's CLD strategic vision. This will support many of NASA's missions that now utilize spacecraft manufactured by commercial companies, providing faster development and manufacturing which will lead to lower overall costs for the administration.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

The RHAM platform has attracted serious interest from commercial space companies and has significant potential for near-term insertion into commercial missions. This spans across a variety of space verticals that include reusable rockets, downmass logistics, orbital spacecraft, and hypersonics. Some specific applications include Sierra's Dreamchaser, SpaceX's Starship, and NASA's Orion capsule contracted to Lockheed. Furthermore, there is strong alignment with military defense systems in development today that can utilize reusable TPS. Most rec

Duration: **6**

Proposal Summary: Cecilia Energy

Proposal Information

Topic Title:	**Point-of-use Recycling for Optimized Space-Age Logistics**
Proposal Title:	**Catalytic Conversion of Waste Plastic to Hydrogen**

Small Business Concern

Firm:	**Cecilia Energy**
Address:	**60 Broadway 11A, Brooklyn, NY 11249**
Phone:	**(973) 348-6736**

Principal Investigator:

Name:	**Kathryn Carpenter**
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Address:	**60 Broadway 11A, Brooklyn, NY 11249**
Phone:	**(973) 348-6736**

Business Official:

Name:	**Kathryn Carpenter**
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Address:	**60 Broadway 11A, Brooklyn, NY 11249**
Phone:	**(973) 348-6736**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 3

End: 4

Technical Abstract (Limit 2000 characters, approximately 200 words):

Here we propose to develop methods for the microwave-assisted thermocatalytic decomposition of the non-biodegradable portion of ersatz crew mission waste to produce primarily H2 and carbon. The H2 can be used for atmosphere regeneration in the Sabatier reactor or proposed Bosch reactor, or could be used directly as fuel. The carbon produced could be used in In Situ Resource Utilization to produce activated carbon for water treatment, char for plant growth, or higher-value carbon products for manufacturing purposes. This Phase I work encompasses three Technical Objectives (TOs). TO1 will determine the optimal catalyst form, microwave energy, and reaction time to convert the ersatz waste stream. TO2 will determine the catalyst regeneration and life cycle. TO3 will characterize the carbon and other products formed and determine appropriate separation strategies and uses for each. This work supports current ECLSS systems by providing a secondary form of H2 other than electrolysis of water. Additionally, this recycling strategy could be applied to terrestrial waste streams to produce H2 from waste plastic with concomitant sequestration of the carbon, adding to the drawdown of atmospheric CO2.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

Trash-to-gas conversion of non-biodegradable crew waste stream to H2 and solid carbon in support of ECLSS. Reformation of methane to produce H2 and solid carbon in support of ECLSS.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

Production of H2 from waste plastic with concomitant carbon sequestration.

Duration: **6**

Proposal Summary: Crystal Sonic, Inc.

Proposal Information

Topic Title:	**Low-Cost Photovoltaic Arrays for Space**
Proposal Title:	**Reducing Cost of Space Photovoltaics via Sound-Assisted Substrate Reuse**

Small Business Concern

Firm:	**Crystal Sonic, Inc.**

Address: **311 W. Virginia Ave, Phoenix, AZ 85003**
Phone: **(617) 515-5031**

Principal Investigator:

Name: **Dr. Arno Merkle**
E-mail: **arno@xtalsonic.com**
Address: **311 W. Virginia Ave, Phoenix, AZ 85003**
Phone: **(617) 515-5031**

Business Official:

Name: **Dr. Arno Merkle**
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Address: **311 W. Virginia Ave, Phoenix, AZ 85003**
Phone: **(617) 515-5031**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 4
End: 5

Technical Abstract (Limit 2000 characters, approximately 200 words):

High substrate costs limit the proliferation of many next-generation semiconductor device applications, such as high-efficiency GaAs-based photovoltaics for space applications, often consuming 50% of the cell manufacturing cost. We propose a novel substrate re-use technology, known as Sonic Lift-off (SLO) to drive down the costs of space photovoltaic manufacturing. SLO utilizes sound to separate thin devices from their host substrate, leaving the remaining substrate available for multiple reuses. A key milestone in the march towards commercialization is the ability to demonstrate the technology at industrially relevant wafer diameters. In this proposal we plan to build upon our successes to date demonstrating 2" diameter wafer SLO and extend this to 4" wafer diameters with improvements to our SLO instrumentation and process control.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

Substrate re-use of GaAs photovoltaic devices for space.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

A wide range of emerging next-generation semiconductor device technologies based on 'wide bandgap' semiconductors, including SiC, GaN, AlN and others. Applications include: power electronics for electric vehicles, electric motors, photovoltaic inverters and more; RF communication devices; UVC-LED devices for disinfection; Laser diodes and sensor applications and more.

Duration: **6**

Proposal Summary: H3X Technologies Inc.

Proposal Information

Topic Title:	**Electric and Hybrid Electric Systems for Unmanned Aerial Vehicle (UAV) and Aircraft in the 1500 to 5000 lbs size class**
Proposal Title:	**HPDM-30 – A 10 kW/kg Integrated Motor Drive for UAV and Aircraft Electric Propulsion**

Small Business Concern

Firm:	**H3X Technologies Inc.**
Address:	**9197 W 6th Ave, STE 1100, Lakewood, CO 80215**
Phone:	**(952) 913-7232**

Principal Investigator:

Name:	**Mr. Max Liben**
E-mail:	**max@h3x.tech**
Address:	**9197 W 6th Ave, STE 1100, Lakewood, CO 80215**
Phone:	**(917) 608-1164**

Business Official:

Name:	**Mr. Jason Sylvestre**
E-mail:	**jason@h3x.tech**
Address:	**9197 W 6th Ave, STE 1100, Lakewood, CO 80215**
Phone:	**(952) 913-7232**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 1

End: 3

Technical Abstract (Limit 2000 characters, approximately 200 words):

The HPDM-30 is a ultra high power density 30kW integrated motor drive for Unmanned Aerial Vehicle (UAV) and Small Aircraft Electric Propulsion. It combines the motor and inverter into a single unit and utilizes the same advanced core technology developed for H3X's flagship product, the HPDM-250. H3X is targeting a combined motor/inverter efficiency of 93% and a continuous specific power of 10 kW/kg, making it 3X more power dense than anything else commercially available. The goal of this Phase I proposal is to complete the design, analysis and simulation for the HPDM-30 and a manufacturing plan to build prototypes that could later be tested on the H3X dynamometer in a Phase II effort.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

25% SUSAN Flight Research Vehicle

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

Commercial drones, Military UAVs and ROVs, special purpose ground vehicles, Gensets, Downhole industrial

Duration: **6**

Proposal Summary: Outpost Technologies Corporation

Proposal Information

Topic Title:	**Enabling technologies for the development of a robust Low-Earth Orbit Economy**
Proposal Title:	**Outpost Cargo Ferry: A Rapid Cargo Downmass Vehicle**

Small Business Concern

Firm:	**Outpost Technologies Corporation**
Address:	**1601 Colorado Ave, Santa Monica, CA 90404**
Phone:	**(714) 876-7102**

Principal Investigator:

Name:	**Vanessa Kuroda**

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Phone: **(650) 336-8659**

Business Official:

Name: **Jason Dunn**
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Phone: **(650) 336-8659**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 1
End: 3

Technical Abstract (Limit 2000 characters, approximately 200 words):

Today's cost to go to ISS and back represents a high barrier to entry for the Low Earth Orbit (LEO) economy. Commercial LEO Destinations (CLDs) as well as the International Space Station (ISS) are in need of the ability to have rapid cargo downmass capabilities in order to iterate quicker and accelerate their business. In this effort, Outpost Technologies Corporation (Outpost) will address this need and develop the Cargo Ferry which is a rapid cargo downmass vehicle that will be used for both returning cargo from commercial space stations as well as the ISS. Beneficial applications of our innovation include Earth return of non-human cargo, scientific samples, small payloads, and important research. Driving down the cost of Earth return would open the door to more throughput on the ISS National Lab while also enabling the broader Low-Earth orbit economy to flourish.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

The ISS is at stowage capacity, requiring tough decisions by the ISS program office each time a new payload is manifested. By downmassing stowed cargo, more room is made for new science and R&D on station. On-demand availability of the Cargo Ferry as a backup trunk payload ensures there will be no empty trunk space on future missions.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

Dedicated payload and cargo return is one of the few remaining items left unsolved for CLD business models to close. Companies and institutions looking to iterate quickly in the space environment need fast Earth return. A human rated version of the Cargo Ferry may one day provide a solution for CLDs necessitating an emergency Earth return solution.

Duration: **6**

Proposal Summary: re:3D, Inc.

Proposal Information

Topic Title:	**Point-of-use Recycling for Optimized Space-Age Logistics**
Proposal Title:	**On-Orbit Additive Manufacturing Using Recycled Waste**

Small Business Concern

Firm:	**re:3D, Inc.**
Address:	**1100 Hercules Ave Ste 220, Houston, TX 77058**
Phone:	**(512) 730-0033 EXT 22**

Principal Investigator:

Name:	**Patrick Ferrell**
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Address:	**1100 Hercules Ave Ste 220, Houston, TX 77058**
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Business Official:

Name:	**Samantha Snabes**
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Address:	**1100 Hercules Ave Ste 220, Houston, TX 77058**
Phone:	**(832) 746-0922**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 2

End: 4

Technical Abstract (Limit 2000 characters, approximately 200 words):

re:3D Inc. proposes developing a recycling system centered on a 3D printer capable of turning thermoplastic waste generated on orbit into functional and useful objects through the use of material extrusion additive manufacturing (AM). Guided by the analysis of available on-orbit waste streams and their potential printability, a low size, weight and power (SWaP) engineering prototype printer, based on re:3D's Gigabot X (GBX) technology, will be designed and demonstrated. The GBX is a commercial printer capable of printing directly from ground plastic flakes. Printing from flake eliminates the need for the extra space, resources and energy required for an intermediate step of producing filament - the most common approach to recycling plastics for 3D printing.

In addition to the prototype printer demonstration, re:3D will deliver the engineering specifications for a low-SWaP integrated recycling system to include waste granulation and other required steps in the waste-to-print AM process.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

NASA has specifically identified packaging material as an upmass of significant logistical overhead. This material is placed in orbit at appreciable cost, and its reuse through recycling must be considered - particularly for lunar and deep space missions which have limited opportunities for resupply and waste disposal.

Off-planet human habitation will require point-of-use recycling/upcycling solutions which can be provided by additive manufacturing technologies.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

A waste-to-print system integrated in a small form factor would be of use to US Navy submarines on active deployment which can be away from supply and repair opportunities for months at a time.

Such a system could also be of interest to individuals and families looking for a personal recycling solution, reducing the carbon footprint of recycled goods by removing the need for transporting waste materials between multiple processing plants.

Duration: **6**

Proposal Summary: Solestial, Inc.

Proposal Information

Topic Title:	**Low-Cost Photovoltaic Arrays for Space**
Proposal Title:	**Next Generation Silicon Based Solar Arrays for Space Stations and Other Permanent Space Infrastructure**

Small Business Concern

Firm: **Solestial, Inc.**
Address: **7700 South River Parkway, Tempe, AZ 85284**
Phone: **(520) 838-9404**

Principal Investigator:

Name: **Dr. Stanislau Herasimenka**
E-mail: **sh@solestial.com**
Address: **7700 South River Parkway, Tempe, AZ 85284**
Phone: **(520) 838-9404**

Business Official:

Name: **Dr. Stanislau Herasimenka**
E-mail: **sh@solestial.com**
Address: **7700 South River Parkway, Tempe, AZ 85284**
Phone: **(520) 838-9404**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 2
End: 4

Technical Abstract (Limit 2000 characters, approximately 200 words):

Solestial, Inc. (formerly Regher Solar) in collaboration with Opterus Research and Development, Inc. (Opterus) propose this SBIR Ignite project to develop a novel photovoltaic solar array technology for large-scale spacecraft and planetary surface infrastructure that can overcome size, cost and weight limitations of the existing solar array technologies, achieve >50 kWe scale, 200 W/kg specific power and 50 kW/m3 stowed volume efficiency while simultaneously having $40/W cost and >1,000 MW manufacturing potential.

The proposed innovation is based on integrating the next generation radiation hard and ultra-light silicon Solar Power Modules (SPMs) developed by Solestial with R-ROMA deployment system developed by Opterus. The proposed SBIR Ignite project will develop critical technologies required to integrate thin silicon SPMs with R-ROMA deployment system to achieve TRL 6 on a 1-5 kW solar array followed by transitioning to TRL 7,8 and injection into commercial and NASA missions. Using the follow-on funding Solestial will be looking to build a full size 50 kWe solar array demonstrator and space test a 5 kW scaled model.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

The proposed technology will meet NASA goal of bringing to TRL 6 by 2030 50 kW-scale photovoltaic solar arrays, deployed vertically or horizontally, providing power at >200 V at 200 W/kg BOL and exhibiting no more than 10% degradation over ten years in the Lunar polar environment. Large scale arrays can also be used to power future science missions using solar electric propulsion as well as non-nuclear deep space missions.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

50 kW-scale solar arrays are needed for commercial space stations and solar electric propulsion tugs. In addition to meeting 200 W/kg and 50 kW/m3 goals commercial customers are looking for at least 10X cost reduction compared to the state of practice. The proposed technology can deliver $40/W manufacturing cost making it the most cost effective solution on the market.

Duration: **6**

Proposal Summary: StormImpact Inc.

Proposal Information

Topic Title:	**Technologies Using NASA Data to Foster Climate Resilience**
Proposal Title:	**Optimizing vegetation management to improve the resilience of the electrical power system to extreme weather**

Small Business Concern

Firm:	**StormImpact Inc.**
Address:	**7510 Heatherwood Lane, Dublin, OH 43017**
Phone:	**(415) 839-6903**

Principal Investigator:

Name:	**Dr. Brent McRoberts**
E-mail:	**brent@stormimpact.net**
Address:	**7510 Heatherwood Lane, Dublin, OH 43017**
Phone:	**(317) 847-2003**

Business Official:

Name: **Mr. Jamie McKee**
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Address: **7510 Heatherwood Lane, Dublin, OH 43017**
Phone: **(614) 935-2835**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 2
End: 4

Technical Abstract (Limit 2000 characters, approximately 200 words):

The reliability and resilience of the national electrical grid is a matter of both national security and quality of life. However, the grid is highly vulnerable to damage and outages due to extreme weather; a problem that is expected to worsen in the face of climate change. Storm restoration is a major expense for utility companies, with U.S. power companies alone spending on average $55 billion annually on storm response and restoration of infrastructure, a number that could be decreased significantly with better information on the threat of vegetation near vulnerable infrastructure. StormImpact Inc. will use NASA Earth Science data to build machine learning (ML) vegetation growth and vegetation risk models that will allow electrical utilities to proactively prepare for storms and improve the resilience of the electrical infrastructure to climate change. In addition, the NASA remote sensing data and vegetation ML model outputs will be ingested into our current suite of storm outage ML models. We anticipate cost savings of 10% to 20% for our utility customers due to improved vegetation management efficiency and greater power system reliability based on improved damage and outage predictions in advance of storms.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

This Phase I R/R&D project is responsive to the SBIR Ignite solicitation request for "Technologies Using NASA Data to Foster Climate Resilience." The vegetation growth and vegetation risk products that we are developing have applications for assessing infrastructure damage and wildfire risk.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

Vegetation management products will address a gap in the market by providing electrical utilities with accurate and cost-effective guidance so that they can identify when and where there are vegetation management issues. In addition, there are markets and applications for these products such as wildfire risk management, insurance, and forestry.

Duration: **6**

Proposal Summary: Terrafuse, Inc.

Proposal Information

Topic Title:	**Technologies Using NASA Data to Foster Climate Resilience**
Proposal Title:	**Wildfire Mitigation through Explainable Risk Predictions**

Small Business Concern

Firm:	**Terrafuse, Inc.**
Address:	**C/O ENGINE ROOM 4725 FIRST STREET, SUITE 250, PLEASANTON, CA 94566**
Phone:	**(707) 570-5450**

Principal Investigator:

Name:	**Mr. Stephen Marshall**
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Address:	**8 Putnam Ave, Chelmsford, MA 11824**
Phone:	**(617) 797-2172**

Business Official:

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Phone:	**(707) 570-5450**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 3

End: 4

Technical Abstract (Limit 2000 characters, approximately 200 words):

The proposed innovation is to add explanations into Terrafuse's existing wildfire risk prediction model to provide localized, actionable guidance on the effectiveness of different wildfire mitigation efforts. Mitigations are actions like clearing defensible space around buildings or installing fire-resistant vents. Explanations describe the relative importance of each input to the wildfire prediction model, or feature, to the overall wildfire risk. We refer to these explanations as feature contributions. We will implement them by building on our prior work with the Shapley Additive Explanations (SHAP) technique from game

theory. Feature contributions will provide guidance on which mitigation actions will be most efficacious. For example, where wildfire risk is driven primarily by the amount of fuel, clearing defensible space around structures will be more effective. However, for locales where wildfire risk is strongly influenced by wind, structural improvements that protect against wind-blown embers, like enclosed eaves and fire-resistant vents, may be more efficacious. This localized mitigation guidance will support more optimal resource allocation and better decision-making during pre-wildfire planning for the insurance industry and the public.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

This innovation makes extensive use of NASA data sets, such as the Moderate Resolution Imaging Spectroradiometer (MODIS), the Shuttle Radar Topography Mission (SRTM), and the NASA Global Fire Atlas. As such, it is a show case for how NASA's space-based observing programs make a difference on Earth.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

This innovation is targeted at the insurance industry: society's first line of defense for coping with wildfire damage. The insurance industry does not know how community and property-level mitigation affects wildfire risk. This innovation will provide location-specific guidance on which mitigating actions will be most effective.

Duration: **6**

Proposal Summary: Trans Astronautica Corporation (TransAstra)

Proposal Information

Topic Title:	**Commercial Development of Active Debris Remediation (ADR) Services**
Proposal Title:	**Mini Bee Capture Bag for Active Debris Remediation**

Small Business Concern

Firm:	**Trans Astronautica Corporation (TransAstra)**
Address:	**13539 Desmond Street, Los Angeles, CA 91331**
Phone:	**(818) 422-0514**

Principal Investigator:

Name:	**Dr. Joel Sercel**
E-mail:	**joel@transastra.com**

Address: **13539 Desmond Street, Los Angeles, CA 91331**
Phone: **(818) 422-0514**

Business Official:

Name: **Mr. Alex Pilmer**
E-mail: **alexp@transastra.com**
Address: **13539 Desmond Street, Los Angeles, CA 91331**
Phone: **(626) 533-7233**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 2
End: 3

Technical Abstract (Limit 2000 characters, approximately 200 words):

The exponential growth of the number of satellites and debris in orbit drives an urgent need for orbital debris removal for both the public and the private sector. TransAstra is developing a breakthrough inflatable capture bag technology, the Mini Bee™ Capture Bag (MBCB), which provides a solution to the Active Debris Removal problem. MBCB will enable object capture and deorbit missions with lower complexity and cost than any alternative and fills the commercial need of protecting the burgeoning space economy from the rapid proliferation of dangerous orbital debris. MBCB is superior because it can capture non-cooperative spacecraft or debris of arbitrary shape without hardware accommodations such magnetic components or grapple fixtures. For these reasons, satellite manufacturers and constellation developers are turning to TransAstra's MBCB as a solution. TransAstra has begun collaboration on the MBCB with various private companies based on its potential to solve the orbital debris problem for multiple types of objects. MBCB's flexibility makes it widely applicable to a broad range of debris removal and hazardous objects capture scenarios. Initially suitable for flight on a ride-share class, in-space logistics vehicle launched into LEO, the MCBC system provides a deployable inflatable capture bag that is capable of fully enclosing small spacecraft for repositioning and de-orbiting. MBCB technology can later scale to much larger sizes and can thus serve growing commercial and defense needs with no technical changes to the architecture. This SBIR proposal matures the inflatable capture bag and proximity operations technology of MBCB.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

Active debris removal for large debris - greater than 10 cm in diameter

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

End of life disposal for satellites larger than 10cm in diameter

Duration: **6**

Proposal Summary: Turion Space Corp.

Proposal Information

Topic Title:	**Commercial Development of Active Debris Remediation (ADR) Services**
Proposal Title:	**Low-Cost CubeSat for Active Removal of Sizable Space Debris Utilizing a Mothership Architecture**

Small Business Concern

Firm:	**Turion Space Corp.**
Address:	**9272 Jeronimo Rd, Suite 107c, Irvine, CA 92618**
Phone:	**(678) 689-4592**

Principal Investigator:

Name:	**Mr. Jackson Parker**
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Phone:	**(678) 689-4592**

Business Official:

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Phone:	**(425) 205-7022**

Summary Details:

Estimated Technology Readiness Level (TRL) :

Begin: 2

End: 3

Technical Abstract (Limit 2000 characters, approximately 200 words):

Turion Space Corp. proposes developing a CubeSat-based debris remediation strategy, whereby several "Deorbiter" CubeSats are deployed from a carrier spacecraft to remove multiple debris objects from LEO (600-1500km) in a single mission. The system's mothership will be a scaled adaptation of Turion's DROID platform, currently undergoing development for Space Situational Awareness (SSA) and Rendezvous and Proximity Operations (RPO) applications. The DROID mothership will be equipped with a gridded ion thrust to ensure maximum ∆V, an RPO computer vision system and CubeSat deployer. The Deorbiters will be designed based on an 8-12U form factor and emphasize commercial-off-the-shelf components with flight heritage to accelerate development timelines, scale production, and lower the Deorbiter unit costs with economies of scale. If a Deorbiter does not have sufficient ∆V to deorbit a debris object, multiple can be deployed and used on the same object, enabling the architecture to scale to larger debris, higher energy orbits, and reduced deorbit timeframes. In addition, each Deorbiter will operate independently of the mothership and, if issues arise, can deorbit itself to avoid creating additional debris. The architecture does not require additional hardware on the target object, such as docking adapters or communication systems. In addition, alternative state-of-the-art ADR methods such as throw nets, space-based lasers, the ion-beam shepherd, electrodynamic tethers, and robotic arms have drawbacks due to highly complex system dynamics and increased risk of further debris generation. The proposed mission architecture maximizes commercial utility because the mothership will collect SSA data when not performing the debris removal missions, and the Deorbiter system can be used for multiple commercial applications such as life extension.

Potential NASA Applications (Limit 1500 characters, approximately 150 words):

The proposed Low-Cost CubeSat for Active Removal of Sizable Debris Utilizing a Mothership Architecture will address critical ADR needs for NASA by deorbiting non-operational US government owned space objects. The proposed employment of the multi-use capabilities of the mothership and Deorbiter CubeSats have the potential to enable ADR to become a viable and sustainable part of the growing space economy, reducing the fiscal burden on NASA for development and deploying this technology.

Potential Non-NASA Applications (Limit 1500 characters, approximately 150 words):

The proposed Low-Cost CubeSat for Active Removal of Sizable Debris Utilizing a Mothership Architecture maximizes commercial utility because the mothership will collect SSA data when not performing debris removal missions, and the Deorbiter can be used for multiple applications such as life extension and orbit relocation, eventually ranging beyond LEO to MEO and GEO. However, if Deorbiter CubeSats are not utilizing mothership deployer slots, last-mile orbit delivery for commercial CubeSat customers can be performed.

Duration: **6**