Wave Motion Launch Corporation

Non-Rocket Space Launch

Customers

Sales | Discovery | Discovery

$0 RAISED USD

0% of minimum target: $100,000

0% of maximum goal raised: $1,235,000

0 Investors

$100 min for US investors.

PITCH DISCUSSION UPDATES 1

HIGHLIGHTS

> $1.3MM OTA Contract

Contract with U.S. Navy for Jet-Gun prototype

U.S. Patent granted

Wave Motion received utility patent for Jet-gun technology.

NSF I-Corps Awardee

I-Corps 2020 participants & invited to apply for NSF SBIR

SUMMARY

PROBLEM The enormous economic potential of space is locked up by the high cost of current propulsion methods.

SOLUTION A widely affordable, safer, and faster method of getting payloads to orbital speeds without requiring significant onboard propellant.

PRODUCT A patented launcher named the Jet-Gun, which uses a hypervelocity stream of propellant to thrust vehicles from the ground up to supersonic speeds.

TRACTION $1.35MM OTA contract with U.S. NAVY (2022), Expanded team and operations to a new facility (2022), U.S. Utility patent for Jet-Gun technology (2021), Received NSF I-Corps award for customer discovery (2020)

CUSTOMERS U.S. Navy, Northrop Grumman, Lockheed Martin

BUSINESS MODEL Transactional

MARKET Approx. Market Size: $27.6 B

COMPETITION Non-rocket launch schemes with major infrastructure requirements (Spinlaunch); large reusable rockets (Starship) may be competitive or complementary.

TEAM Top aerospace program graduates who brought the Jet-Gun from concept to prototype in 2 years; advisors with 30 years of experience in space & defense.

VISION To become a space economy cornerstone by enabling the transport of vehicles, energy, and commodities to destinations throughout the solar system.

USE OF FUNDS Acquire tools and talent to support our team's efforts to build a proof-of-concept for orbital velocity launch.

MEDIA MENTIONS

The Mission Acceleration Center's Impact on Northwest Innovation

WComotion

$1.3M contract award for barrel-less launcher tech
GeekWire

DEAL TERMS

How it works

Deal type	**Convertible debt**
Valuation cap	**$12,000,000.00** USD
Discount	**20.0%**
Maturity date	**April 29, 2025**
Type of security	**Convertible debt**
Interest rate	**5.0%**
Investment range	**$100-$100,000** USD
Funding goal	**$100,000-$1,235,000** USD
Closing date	**April 30, 2023, 11:00 PM ET**
Carry	**0%**
Investor Fees	**$0**
FORM C	**FORM C**

PROBLEM

The enormous economic potential of space is locked up by the high cost of current propulsion methods.

For decades, people have imagined living and working in space as an extension of our evolutionary journey and often looked toward big, powerful rockets—like NASA's Saturn V, as a means to accomplish that dream. But to travel and live amongst the stars, the Moon, Mars, and beyond will require innovative launch technology that drives launch costs substantially below any rocket's current capabilities.

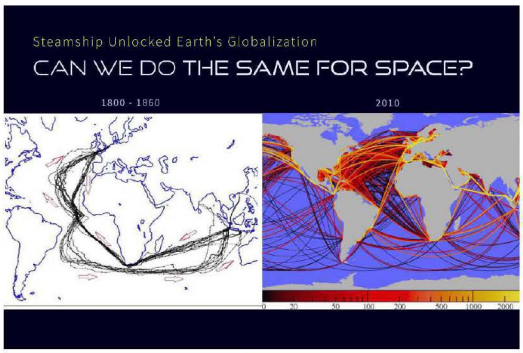
While in 2021 we saw a hype for space tourism, with both Virgin Galactic and Blue Origin making successful trips with paying customers, tickets to space are wildly inaccessible for all but the 1% of the 1% [1], and getting a single pound to orbit can cost thousands of dollars [2]. Some critical differences between launch vehicles, like total lift capability and component reusability, may lead to drastically different launch costs. The bottom line is that getting a single pound to orbit via rockets still costs thousands of dollars, preventing activities like space tourism from becoming widely accessible.

While rocket technology has improved, rockets still have fundamental limitations that drive high launch prices and prevent them from becoming truly "low-cost." All current space launch vehicles are limited by the rocket equation, which dictates that propellant mass must increase exponentially as the final velocity of the rocket increases. In practice, this imposes a requirement that over 90% of the mass of modern rockets must be propellant in order to get the 3-4% of payload mass to orbital velocity.

Lugging around additional mass for fuel brings extra complexity to the engineering and requires more stringent mission planning, already extremely capricious because of weather conditions. And we're not just talking about extreme conditions [3]. A single mechanical issue can threaten the safety of the entire rocket launch and prevent a mission from making it into space.

Undeniably, these technology-driven restrictions on launch have restricted the

growth of the space economy in the same way that global trade was limited by wind-powered ships prior to the development of steam-powered vessels. In the late 1860s through the 1870s, the world underwent a rapid transition as steam power revolutionized trade. Because steamships could travel at consistent speeds regardless of wind and since their routes were not dependent on the weather patterns they could take advantage of more efficient trade routes than traditional ships [4].



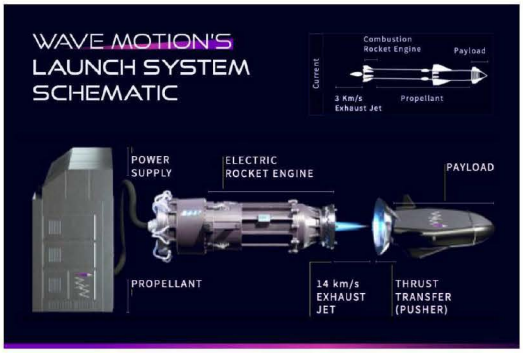
Before steamship, sea routes were shaped by winds. The left image shows fifteen journeys made by British ships between 1800 and 1860 [5]. The right image shows a year of global shipping routes mapped by GPS in 2010 [6].

Imagine a similar revolution unlocking when space transportation becomes safe, accessible, and affordable. Whether it's living and working in space, readily providing emergency provisions to astronauts, or just inexpensively refueling a spacecraft while in orbit, the opportunities on the space frontier are endless. However, they require a safe and cost-effective method for orbital launch.

SOLUTION

A widely affordable, safer, and faster method of getting payloads to orbital speeds without requiring significant onboard propellant.

Expanding the space economy will require envisioning new ways of getting payloads into Earth's orbit and beyond without the need for massive and complex rocket boosters bound by the physical restrictions of the rocket equation. Wave Motion is developing a launch system that can transmit kinetic energy from the ground to vehicles, launching them at orbital speeds. Our technology seeks to ignite a paradigm shift from launch systems that depend on rockets charging thousands of dollars per pound and long booking schedules to a reusable, low-maintenance method of launch.



Wave Motion's current patented technology will allow for orbit-bound vehicles to work around the rocket equation and substantially reduce the amount of onboard propellant needed for a payload to reach its destination. In addition to breaking the propellant dependence, the high-speed launcher will allow for on-demand launches independent of strong weather conditions, a shift from current launch systems. Our team seeks to take advantage of the emerging space market verticals, companies that hope to operate in space which will need a more affordable and recurring method of getting payloads (especially robust "cargo" like bulk construction material or fuel) into Earth's orbit and beyond.

PRODUCT

A patented launcher named the

Jet-Gun, which uses a hypervelocity stream of propellant to thrust vehicles from the ground up to supersonic speeds.

Jet-Gun prototype demo.

The Jet-Gun is a new type of impulsive launcher named for the jet that transmits kinetic energy through the atmosphere to the vehicle.

The Jet-Gun system consists of an energy source, propellant, and an emanator that in current embodiments is a specially-designed nozzle that produces elongated, underexpanded supersonic jets. The Jet-Gun fires a jet of supersonic gas that pushes a projectile to very high speeds, reflecting the thrust on a pusher plate and accelerating it forward. Current versions of the jet-gun accelerate payloads at nearly 10,000 gees, or ten-thousand times the Earth's gravitational acceleration of 9.8 m/s2. Advanced computational fluid dynamic (CFD) modeling validates our launcher's ability to accelerate payloads to nearly orbital speeds with the ability to control the jet stream length.

The launcher's ability to accelerate payloads to nearly orbital speeds makes the Jet-Gun uniquely suited for cost-efficient space launch. Since there is no physical structure or barrel surrounding the projectile, it has the potential to be up to 50x-100x more compact than a rocket or regular cannon of equivalent power.

An added benefit is that the high structural mass and low propellant requirements of a vehicle launched by the Jet-Gun reduce the influence of wind on the launch system, providing the added benefit of being able to launch in more variable weather conditions than those required for large rockets. We envision our system being able to launch multi-ton payloads into low Earth orbit (LEO) for internal costs of less than $20 per kg, with only hours between launches. This cost and frequency are necessary to support the expansion of the space economy to its multi-trillion-dollar projected value [7]. Adjustments will also allow this system to work in the vacuum of space, making it capable of launching payload vehicles from the surface of the Moon, Mars, and beyond.

Different launch systems will be needed for payloads that can tolerate rougher launch conditions such as fuel and raw materials. As we further develop the Jet-Gun, one of our R&D goals is to bring the acceleration of payloads down to the same level as rockets, using a smaller force to come up to speed on a longer path gradually. This aspirational target would allow us to send delicate payloads, and perhaps even human passengers, into orbit while enjoying the same reduction in launch costs we currently project.

Other forms of non-rocket launch have been invented, however, the compact form factor of the Jet-Gun makes it a dual-use technology that can easily be employed in defense applications. A Jet-Gun with equivalent power to a barreled projectile launcher has only 10-20% of the length and mass. These benefits allow Wave Motion to have a viable business in munitions launch without ever needing to send a payload to orbit, especially compared to other proposed non-rocket launch methods (Spinlaunch, Greenlaunch).

For future versions of the Jet-Gun, this pure gas jet will be replaced with a stream of microparticles accelerated to 15 km/sec (hypervelocity) using proprietary electromagnetic means currently in development by our team. These microparticles carry significantly more momentum than gas molecules and are self-focusing rather than dissipating like an expanding gas jet. This modification will extend the duration from seconds to minutes, enabling more force-averse payloads such as humans while still being capable of penetrating the atmosphere and propelling vehicles to orbital velocity. This new Jet-Gun system would increase the payload mass of orbital vehicles from 3-4% to over 50% of the overall vehicle mass. This means that more launch resources can be devoted to what matters - the materials and resources needed to build humanity's presence in orbit.

TRACTION

$1.35MM OTA contract with U.S. NAVY (2022)

Expanded team and operations to a new facility (2022)

U.S. Utility patent for Jet-Gun technology (2021)

Received NSF I-Corps award for customer discovery (2020)

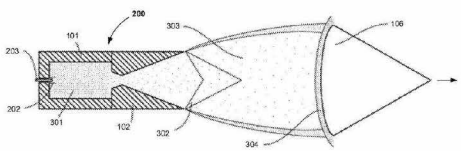
In the two years since its founding, Wave Motion has operated as a lean startup focused on fulfilling every strategic milestone on the way to space launch. Through ingenuity and persistence, our founding team has been able to move quickly to build a myriad of connections both in the Pacific Northwest (PNW) region and nationally. We have established relationships built with local PNW defense ecosystem (advisor from Karman/Systima, members of Pacific Northwest Defense Coalition, Naval Surface Technology and Innovation Consortium, National Security Technology Accelerator).

Through our personal funds and our friends and family raise (~$25K) our young startup has rapidly (with a healthy dash of high-risk tolerance) acquired the following milestones:

- Secured non-dilutive funding from a contract with the Office of Naval Research (ONR) worth $1.35MM.
- Obtained IP, U.S. Patent No: US 10,928,146 B2
- Built & tested small and large sabot designs at supersonic velocities (see some test videos here).
- Constructed and tested a flight computer system from off-the-shelf components capable of withstanding launch accelerations.
- Completed the NSF I-Corps program winning a $2,500 award.

Additionally, the Wave Motion team has secured a dedicated workshop space in Everett, Washington after years of working in our carports and basements.

WAVE MOTION'S PATENT



Apparatus and method for accelerating an object via an external free jet

You can also take a look at some of our scientific papers presented at the American Institute of Aeronautics and Astronautics conferences:

- Velocity Measurement of Projectiles Propelled by Underexpanded Supersonic Jets
- Preliminary Experimental Investigations of an Electrothermal Hypervelocity Accelerator

CUSTOMERS

U.S. Navy
SALES

Northrop Grumman
DISCOVERY

Lockheed Martin
DISCOVERY

Our first customer is the U.S. Navy, which has issued an agreement in the form of an Other Transaction Authority (OTA) contract to manufacture and test a prototype of the Jet-Gun for munitions-launch purposes. The first phase of this contract is expected to be completed by the end of 2023. Successful completion of OTA's milestones will allow for Wave Motion to be selected for follow-on OTAs without competitively bidding for them.

Wave Motion is part of organizations like the Pacific Northwest Defense Coalition (PDNC) and National Security Innovation Network (NSIN), which connect small businesses to end-users in the U.S. Government via contracting organizations like the Naval Surface Technology and Innovation Consortium (NSTIC) and National Security Technology Accelerator (NSTXL). We are expanding our customer outreach pipeline and are getting ready to acquire more contracts within branches of the U.S. Department of Defense (DoD), including the U.S. Army, Air Force, Strategic Command, and Space Force.

We hope to expand our customer base outside of the defense market and into space launch once we are able to successfully replicate projectile launches at orbital velocity. Launch vehicles propelled by the Jet-Gun would act as the eighteen-wheelers of the space economy, hauling "gas" and "freight" from the Earth's surface into orbit. Our beachhead market in the space industry would be Fixed Satellite Servicing, with government customers such as the U.S. Space Force, NASA, and private customers building and operating systems in space such as Lockheed Martin, Northrop Grumman, and IntelSat. Customers attempting on-orbit manufacturing, such as RedWire or Varda, may also request our launch services when the capability is built out. Our customer research and meetings with companies in the space industry such as Spaceflight, Masten Space Systems, and others have shown us that once we are capable of putting a payload into orbit, customer acquisition will rapidly accelerate.

BUSINESS MODEL

Transactional
A one-time sale of goods or services

We pursue a transactional business model, where customers pay directly for launch products and services provided by our team at Wave Motion.

We are leveraging the dual-use of the Jet-Gun technology and its cross-industry applications to pursue defense contracts in the short term. Until we are able to conduct orbital velocity launches, the sale of Jet-Gun munitions launchers– likely in partnership with an established defense contractor like Lockheed, Northrop or Raytheon– will be our main source of revenue. Contracts such as Small Business Innovation Research (SBIR) and Other Transactional Authority (OTA) vehicles will not only provide the revenue needed to keep the lights on and expand our team but will also serve as non-dilutive funding for research in different technical areas that will be needed for successful space launch.

Successful prototypes will be spun-off as a line of independent products, available to be acquired by the U.S. Government through contract vehicles such as Defense Federal Acquisition Regulations (DFARS) or even directly through follow-on OTAs. Wave Motion is already ITAR-registered and familiar with the procurement and contracting policies of the U.S. Government, and we have confidence in our ability to navigate these processes successfully.

Wave Motion plans to build up to enable "space as a service" offerings, fulfilling customer needs for certain launch services and deliveries to orbit. We are waiting to build our traction and testing of space launches before aggressively offering our services to satellite operators and commercial space stations. The team has been forging the relationships and foundations to approach those connections when the technology is ready for application in the space sector. When the time comes, we will seek those customers in Fixed Satellite Servicing, space operations, and On-Orbit manufacturing. The missions by SpaceLogistics (a subsidiary of Northrop Grumman) for IntelSat and their subsequent growth show there is a real demand for this service that Wave Motion can start exploiting.

MARKET

$27.6 B
Approximate Total Market Size

Beachhead: Military munitions launcher and artillery market
Wave Motion's technology is ready for deployment in its current state. The changing nature of national security challenges and the growing demand for high-precision ammunition to support troops while minimizing collateral damage have increased the demand in the artillery systems market. In the breakdown, the global artillery systems market was valued at USD $3.91B in FY2021, with an expected compound annual growth rate (CAGR) of over 4% over the next decade [8].

The U.S. Department of Defense FY 2023 Budget alone request for weapons procurement allocated $12.6B for ground-based weapons systems, $24.7B for Missile Defeat and Defense programs, and $27.6B for Space and Space-Based Systems. In that same budget, $7.2B funds have been allocated to procure highly survivable, precision-strike, and long-range fires—from hypersonic to subsonic – across the joint force [9]. Hypersonic development budgets have increased over the past decade and are expected to see further growth with the development of these systems by Russia and China.

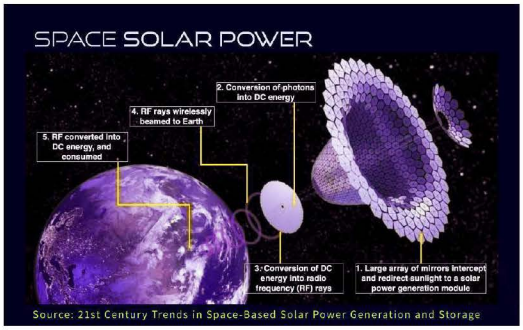
Artillery, hypersonic weapons, and missile defense all represent defense markets where Wave Motion can provide an advantage.

Near Future: Launch and On-Orbit Services
In addition to providing launch for appropriate payloads, Wave Motion's focus will be leveraging the Jet-Gun's low cost of launch to enter markets for in-space activities such as On-Orbit Servicing And Manufacturing. The space launch services market is at $12.67B in 2021, with an expected CAGR of 16.3% over the next five years reaching $31.9B in 2029 [10].

The most immediate target for on-orbit servicing missions such as refueling or supporting mission's lifetime extensions would be the Satellite Service Market, expected to grow to $27.15 billion by 2026, which provides services such as telecommunications and national security missions. An example of a servicing mission was the deployment of Mission Extension Vehicle MEV-1 to Intelsat 901 in order to maintain its orbit. For this mission, Northrop Grumman charged $13 million dollars a year for five years [11]. With 168 operational communications satellites in GEO, that translates to a potential $10.9 billion dollar opportunity available today. As space development expands into cislunar space and beyond, this addressable market will only grow; more spacecraft and even space stations will require servicing, and the Jet-Gun is the most cost-effective manner of delivering resources such as fuel, batteries, or commodities for astronauts.

Growth Opportunities
The core kinetic energy beaming technology Wave Motion is developing can be utilized for more than just space launch systems. Streams of particles at high velocity can be used for both additive and subtractive manufacturing, wireless power transmission, and mining.

Space-based solar power (SBSP) is a lucrative, unaddressed market that our technology could help realize. Not only can we deploy SBSP arrays for low costs compared to rockets [12], kinetic-energy beaming offers huge efficiency advantages over currently available methods like microwaves. The existing market is at $425.7 million and it is expected to reach 9.2B by 2030 [13]. Wave motion estimates a capture of some of that market to provide power SBSP to locations on earth, with particular relevance for remote locations on Earth that currently rely on diesel generators, such as mines and research outposts.



COMPETITION

Non-rocket launch schemes with major infrastructure requirements (Spinlaunch); large reusable rockets (Starship) may be competitive or complementary.

Space
Our direct competitors include several large lift rockets such as SpaceX's Starship, United Launch Alliance's SLS, and Blue Origin's New Glenn, which are expected to come online and reach orbit in the next decade. These technologies are expected to drop the cost per pound into orbit, competitive with our Jet-Gun pricing but we see the market niche for us. As previously illustrated, we want to pursue the emerging space market verticals, companies that hope to operate in space which will need a more affordable and recurring method of getting payloads (especially robust "cargo" like bulk construction material or fuel) into Earth's orbit and beyond.

The democratization of space has increased the demand for space launches because companies that once had to pay hundreds of thousands of dollars to put their satellites into orbit can now do the same for a fraction of that price. This also includes demand for different capabilities of launch. Market reports indicate that the increase in the number of satellite and testing probe launches are drivers in the market and SpaceX's Starship will have to accommodate for the additional costs associated with having human passengers and delicate payloads in their launches, whereas the Jet-Gun can be used to deliver "bulk cargo."

In this case, our technology offers the shift from rockets that take weeks to schedule and cost thousands of dollars per pound to be sent into orbit, to a ground-based, repeatable, low-maintenance method of launch that results in a cost of around $20 per kg or less to orbit.

The Jet-Gun concept addresses the problems of kinetic and beamed launch schemes while retaining their inherent cost advantage over conventional rocket launch systems. As a "beamed" propulsion device, the Jet-Gun accelerates projectiles without needing them to be enclosed by a pressure-retaining barrel or contacting any sort of structure. This makes the maintenance costs of a Jet-Gun facility practically negligible compared to concepts such as a light gas gun (Green Launch) or the Spinlaunch accelerator which must transmit energy to the payload vehicle via a physical structure.

Eliminating the accelerating structure also makes the Jet-Gun many times smaller for the same payload mass to orbit, allowing for multi-ton payloads without enormous capital cost. This differentiates Wave Motion from all other impulsive launch competition, which by virtue of using a structure that must enclose the projectile also have inherently limited payload sizes.

When it comes to costs, though SpinLaunch touts a launch cost of $500,000 per launch, this is for a payload estimated to be approximately 200 kilograms, equating to a cost of $2500 per kilogram or about $1140 per pound. This is directly comparable to the cost per pound of a Falcon 9 expendable booster fully booked and a mere half the cost of rideshare for 200kg, priced at $1MM. SpaceX recently announced an increase in its launch prices going for a small satellite rideshare program and their flights are now starting at $1.1 million for a payload weighing around 200 kilograms. SpaceX increased the cost of additional payload mass by 10% as well and will now charge $5,500 per extra kilogram, up from a previous $5,000 per kilogram [13]. For satellite, cargo operators and perhaps testing probes, the cost savings will be a motivator to utilize Wave Motion's niche market offering.

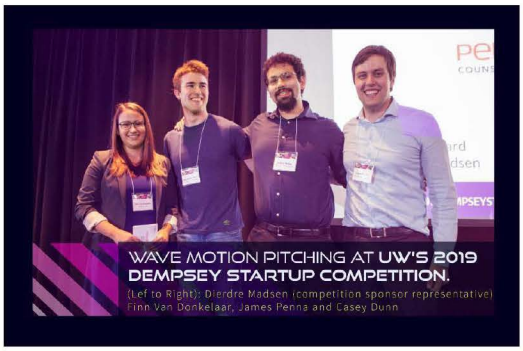
Defense
In the national security sector, Wave Motion faces competition from prime contractors that manufacture munitions launchers such as BAE Systems, Lockheed Martin, Northrop Grumman, Raytheon, and General Dynamics. Our strategy has been to carve our own niche in the very large and well-funded

defense ecosystem, as well as partner with a prime defense contractor for projects. We have gained access to their resources to fend off competition by pushing the protection of our intellectual property. Wave Motion has already started talks with Lockheed Martin and Northrop Grumman.

TEAM

Top aerospace program graduates who brought the Jet-Gun from concept to prototype in 2 years; advisors with 30 years of experience in space & defense.

Founding Story:
After meeting in graduate school at the University of Washington, the team decided to compete in the UW's 2019 Dempsey Startup Competition by the Buerk Center for Entrepreneurship and won the Perkins-Coie Best Technology/Innovation for the Wave Motion Cannon (now Jet-Gun). Since then, we have been working together to leverage our complementary skills and experiences to make Wave Motion successful. We have brought the Jet-Gun technology from a concept to a patented prototype within 2 years. We are excited about what we can accomplish as we continue to grow our team.

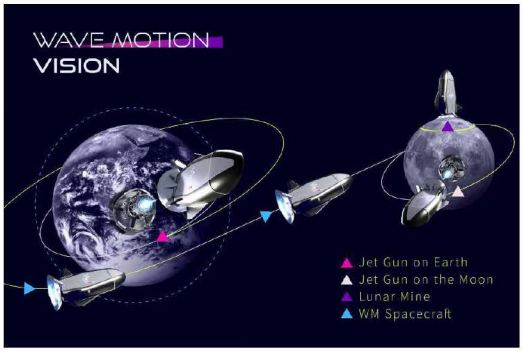


VISION

To become a space economy cornerstone by enabling the transport of vehicles, energy, and commodities to destinations throughout the solar system.

Imagine if a spacecraft could be inexpensively refueled while in orbit, if emergency provisions could be provided to astronauts in a matter of hours, and if raw materials to build a base on the Moon could be delivered at one-tenth of the price. Wave Motion can leverage its highly affordable and fast launch system to unlock access across space industry verticals.

Our long-term vision is to not only launch resources from the surface of the Earth and into orbit but to become the go-to company for space resource extraction and delivery throughout the entire solar system.



USE OF FUNDS

Acquire tools and talent to support our team's efforts to build a proof-of-concept for orbital velocity launch.

The company is raising capital to meet and accelerate the capabilities of Wave Motion to handle contracts for public and private customers and for the development of new technology for orbital launch.
The rough percentage breakdown by accounting category is displayed below.

These funds will enable us to support the next phase of high-growth as well as enable us to secure long-term agreements/contracts with customers. Furthermore, this raise will provide Wave Motion with the working capital needed to promote adoption from larger customers who perceive a lack of capital as a risk. A new facility buildout, along with equipment and an expanded team will reduce execution risk and allow for growth in sales and opportunities.

COMPANY

Wave Motion Launch Corporation

Transportation/Launch Services

The space economy needs a high-volume, low-cost way of sending supplies into space to sustain industry and exploration. Wave Motion Launch Corporation is bringing down the cost of getting into orbit by bringing the boom with our patented hypervelocity launcher, the Jet-Gun. While currently being adopted in the defense industry, we envision that the Jet-Gun can be used to launch payloads into Earth orbit and beyond every day for less than $100 per pound, enabling billions in spaced-based industrial activity.

Website	**wavemotionlaunch.space/**
Employeee Count	**3 People**
Founding yeax	**2020**
Company type	**Pxivate**

View Company Profile

RISKS & DISCLOSURES

Risks and disclosures that are specific to our business and its financial condition.

[Needs to be extracted from Form C]

DOCUMENTS

Form C

Security Document